International Journal of Management, Knowledge and Learning, 2(2), 227–242

The Mediating Role of Knowledge Sharing on Information Technology and Innovation

Onwika Kaewchur
Kasetsart University, Thailand

Pornthep Anussornnitisarn
Kasetsart University, Thailand

Zbigniew Pastuszak
Maria Curie-Skłodowska University, Poland

This study aims to investigate the relationship between information technology, knowledge sharing, and a firm's innovation. Knowledge sharing as a mediating effect is also simultaneously investigated with regard to the relationship between information technology and a firm's innovation. In this research, the quantitative method was mainly employed. The data was collected with a survey. A total of 224 respondents from herbal manufacturing companies were included in the research. The results presented in this paper demonstrate that knowledge sharing and information technology can critically influence the organization's innovation and can play a vital role as a significant success factor in this process.

Keywords: knowledge sharing; innovation; information technology; knowledge management

Introduction

Knowledge is the basic competitive advantage of a firm. Knowledge can be created, recognized, archived, accessed, and applied by people within a company (Nonaka, 1995). This organizational knowledge usually flows and is distributed within the firm. Moreover, multiple types of knowledge are required in order to improve products or services of an organization (Lee, 2001).

In particular, organization knowledge can be created from past learning, experience, and the acquisition of new information and knowledge by each individual. As a result, sharing knowledge of individuals with others will increase the ability to solve problems (Nonaka, Von Krogh & Voelpel, 2006) and enhance the innovation capability of the firm (Lee, 2001; Sáenz, Aramburu, & Rivera, 2009). Moreover, the firm cannot survive without explicit or tacit knowledge; both types of knowledge should be integrated and simultaneously performed. As Hiroshi Okuda, the chairman of Toyota, mentioned,

'The strength of Japanese manufacturing industries is in the technology (based on) tacit knowledge. With the progress in Information Technology (IT), tacit knowledge is converted into explicit knowledge. Still, we need tacit knowledge. To build a car, we have to educate people.' This statement also indicates the need for IT to support the organizational knowledge creation process within a firm, as information technology is a supporting factor of the organizational structure and enhances organizational performance.

In this research, we focused on the herbal industry, since Thailand is rich in a variety of herbs, as can be seen from the increasing number of new herbal products entering the market, and the increasing trend of herbal consumption. The herbal industry in Thailand has shown rapid growth and is becoming popular. According to the report of the Ministry of Industry, Thailand, the number of herbal manufacturers has increased by approximately 23 percent between 2004 and 2012. The creation of innovative products is an important part of the herbal industry. The main focus of the herbal industry is to reduce time-to-market, as well as launch unique products. Moreover, the herbal industry has unique characteristics such as high cost of R&D investment in developing products, and a highly regulatory environment.

Currently, most herbal manufacturers develop product formulations by themselves and keep them as a trade secret; so, in regards to the organization knowledge, the knowledge and experience of personnel is of highest value to the firm. In addition, almost all herb products in Thailand have been developed by incremental innovation.

The organizational aspect, which may be able to support increasing innovation performance, is knowledge sharing amongst individuals within the company. Knowledge sharing can bring a lot of benefits to the firm, such as faster creation of new innovative products or services. Therefore, the purpose of this research aims to:

- investigate the relationship among knowledge sharing, information technology, and innovation,
- identify the mediating effect of knowledge sharing on these relationships.

The next sections of this paper are organized as follows: the second section describes the relevant literature review; the third section develops the research model and launches the hypotheses for testing; the fourth section presents the research methodology and data collection procedure; the fifth section reports the data analysis and results; and the last section discusses the results, presents the conclusion, the limitations of this study, and further research directions.

Literature Review

Knowledge Sharing

In an era of competition, one of the most important intangible assets of an organization is knowledge rather than capital and labor. Nonaka et al. (2006) mentioned that knowledge is the key success factor of an organization. Organizations must adapt in order to gain the competitive advantage and survive in a fiercely competitive global economy.

Many earlier scholars defined knowledge in a variety of ways; however, there is no consensus about its characteristics (King, 2009). Two common types of knowledge in the field of knowledge management consist of explicit and tacit knowledge. Firstly, explicit knowledge refers to knowledge that can be easily articulated, expressed in words and numbers, and can be stored in repositories, communicated, and reproduced. Secondly, tacit knowledge refers to knowledge that is difficult to articulate, hard to transfer to others, and is based on experiences and commitments of people (Nonaka, 1994; Polanyi, 1966).

In order to gain and sustain a competitive advantage, managing the knowledge resource becomes an essential issue in the development of an organization (Davenport, De Long, & Beers, 1998). Organizational knowledge is usually accrued and distributed within an organization. Moreover, to improve products, services, or organizational performance, multiple knowledge sources are required. The integration of knowledge can be accrued based on the sharing of individual knowledge.

Knowledge sharing is defined as 'activities of transferring or disseminating knowledge from one person, group or organization to another' (Lee, 2001, p. 324). Moreover, knowledge sharing can benefit an organization if individuals are willing to share (Nonaka, 1995). One benefit of knowledge constitutes the direct effect on organizational performance, namely innovation. In other words, knowledge sharing is an ingredient of the innovation process. Moreover, it provides other benefits to the organization, such as increased intellectual capital, interchange between individual competitiveness and organizational competiveness, and reduced organizational costs of employees' knowledge gathering (Zhang, Li, & Shi, 2005).

Information Technology

During the past decade, much literature in the field of information technology demonstrated the importance of information technology in the improvement of an organization's performance. Information technology is a supporting factor of an organization that increases organizational innovation and performance. Yang and Chen (2007) suggest four main factors on the organizational level, which have an effect on knowledge sharing. These consist

of culture, structure, people, and technology. In regards to the technological aspects, they identified IT infrastructure as the most important factor, followed by IT know-how, and IT-support. In addition, Hsu (2006) suggested three approaches that are used to enhance employees' knowledge sharing within organizations: 1) technology-based approach 2) incentive-based approach and 3) organizational-based approach. A technology-based approach requires information technology to support individuals in sharing their knowledge within the organization.

Furthermore, there are two basic approaches to knowledge management for which IT can provide support: codification and personalization (Hansen, Nohria, & Tierney, 1999). In the case of the codification approach, explicit and structured knowledge is codified and stored in knowledge bases. The main role of IT is to help people to share knowledge through common storage so as to achieve economic reuse of knowledge, e.g. IT tools are electronic knowledge repositories. In the case of the personalization approach tacit and unstructured knowledge is shared largely through direct personal communication. The main role of IT is to help people locate each other and communicate so as to achieve complex knowledge transfer, e.g. IT tools are knowledge expert directories and video conferencing tools. Both are fundamental for the understanding of the role of information technology in knowledge management.

Innovation

Innovation can be defined as simply the introduction of something new (Davenport, 1993). A more extensive explanation can be found in the *Oslo Manual* (OECD, 2005), which identifies that 'innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations.' Most innovation definitions are focused on improvement within an organization in order to meet its business goals. Innovation can be categorized into various types. For instance, Tidd, Bessant, and Pavitt (2005) focused on the pathway to be examined when creating an innovation. Innovation is categorized in four types, which can be called the 4Ps of innovation. These consist of 1) Product innovation: changes in the things (products/services) that an organization offers; 2) Process innovation: changes in the ways in which they are created and delivered; 3) Position innovation: changes in the context in which the products/services are introduced; 4) Paradigm innovation: changes in the underlying mental models, which frame what the organization does. Moreover, the *Oslo Manual* (OECD, 2005) categorized innovation into four types – product innovation, process innovation, market innovation, and organization innovation.

Information Technology and Knowledge Sharing

Information technology is an essential administrative support function and can increase the competitive advantage of the firm. Information technologies can not only improve a firm performance, but also support knowledge sharing among individuals within the firm. Ng, Lee, Foo, and Gan (2012) proposed a research model which postulates that knowledge management implementation can improve the technological innovation of firms. Ismail and Yusof (2010) investigated the influence of technological factors, which included information technology infrastructure, know-how, and tools on the knowledge sharing quality of government officers in Malaysia. The results showed that information technology know-how, such as IT training of employees, is the most important variable in increasing knowledge sharing quality, followed by infrastructure, and tools. Moreover, much literature argues that IT can support employee knowledge sharing. Aulawi, Sudirman, Suryadi, and Govindaraju (2008) described IT as an important factor that has a direct effect on the knowledge sharing behavior of employees. IT can also support the sharing behavior of the informal knowledge of employees (Davison, Ou, & Martinsons, 2013).

Information Technology and Innovation

Huang, Li, and Chen (2009) stated that the level of a firm's innovation can be improved by information synergy and IT capability. Furthermore, an appropriate information technology system could improve the efficiency of knowledge management in an innovative organization (Norek, 2013). Moreover, Bartel, Ichniowski, and Shaw (2007) explained that investment in new information technology in a manufacturing firm will have a valuable effect, such as increasing productivity growth and product innovation performance. As a result, worker skills in IT should improve simultaneously.

Knowledge Sharing and Innovation

Most early literature agreed that knowledge sharing has an influence on innovation. Wang and Wang (2012) pointed out that explicit and tacit knowledge sharing both have direct influence on a firm's innovation and performance. Explicit knowledge sharing has greater influence on innovation speed, while tacit knowledge has more influence on innovation quality. Furthermore, Saenz, Aramburu, and Blanco (2012) focused on the effect of knowledge sharing mechanism on innovation capability. The results indicated that personal-interaction based knowledge sharing initiatives were the most influential, while ICT-based knowledge sharing initiatives and knowledge sharing embedded in management processes were respectively significant. Moreover, Liao, Fei, and Chen (2007) argued that knowledge sharing plays an important role in developing a firm's innovation. In addition,

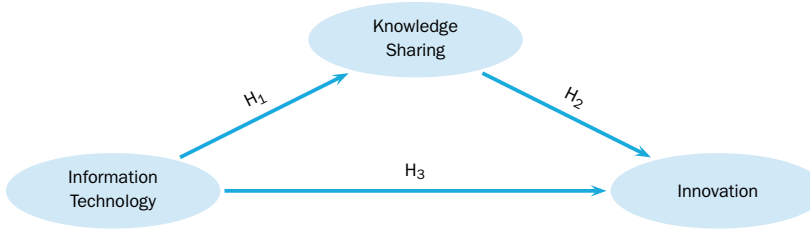

Figure 1 The Research Model

knowledge must be absorbed and then shared between employees with the purpose of increasing a firm's innovative capability, thus benefiting the company.

The Research Model and Hypotheses

The research model was constructed following earlier relevant literature as shown in Figure 1. It shows the research model with all variables. It also illustrates the relationship between knowledge sharing, information technology, and innovation. Three research hypotheses of this study were generated in order to test the relationship among knowledge sharing, information technology, and innovation. Moreover, the mediating effect of knowledge sharing on the relationship between information technology and a firm's innovation was also tested in the final step.

To establish the mediating role of knowledge sharing, three hypotheses were proposed according to Baron and Kenny (1986, p. 1177):

> First, the independent variable must affect the mediator in the first equation; second, the independent variable must affect the dependent variable in the second equation; and third, the mediator must affect the dependent variable in the third equation. If these conditions all hold in the predicted direction, then the effect of the independent variable on the dependent variable must be less in the third equation than in the second. Perfect mediation holds if the independent variable has no effect when the mediator is controlled.

The hypotheses were established following Baron and Kenny (1986) and earlier relevant literature:

- H_1 *Information technology has a positive influence on employee knowledge sharing.*
- H_2 *Information technology has a positive influence on a firm's innovation.*
- H_3 *Knowledge sharing has a positive influence on a firm's innovation.*

Research Method and Data Collection

Research Methodology

First, the hypotheses of this study were established based on the approach of Baron and Kenney (1986). Then, to analyze the mediation hypotheses, the bootstrapping method developed by Preacher and Hayes (2008) was employed. Moreover, Preacher and Hayes (2008) argued that this mediation testing procedure has more advantages than other techniques, such as the causal steps approach (Baron & Kenny, 1986). For example, the multiple mediators can be tested either simultaneously or separately. Secondly, this method can also be applied to small samples. Due to the fact that the bootstrapping method, which is based on 5,000 bootstrap samples, is mainly used to test the mediation hypotheses, there is no need to test multivariate normality. Thirdly, this method employs only one single analysis to test the multiple mediator models; therefore, the risk of making type I error is reduced. Moreover, the bootstrapping method is a non-parametric resampling procedure; the data set is repeatedly sampled and then indirect effect is estimated in each resampling data set.

Therefore, in this study, SPSS was mainly used to analyze the data, while the macro developed by Preacher and Hayes (2008), also known as the indirect macro, was used to analyze the mediator effect. Moreover, this study was based on 5,000 bootstrap samples and a 95 percent confidence interval.

Measurement Development

In this study, the measured items of all variables in the research model were primarily adopted from relevant former literature. These included three major variables – information technology, knowledge sharing, and a firm's innovation as shown in Table 1. Firstly, information technology contained six measured items, which were adopted from Yang and Chen (2007); Wang and Wang (2012); Ismail and Yusof (2010). All items focused on IT infrastructure and employees' IT knowledge. Secondly, knowledge sharing consisted of six measured items, which were adopted form Lin and Lee (2006); Baharim (2008); Wang and Wang (2012). The measured items emphasized explicit and tacit knowledge sharing of the employees. Lastly, innovation contained eight measured items, which were adopted from Liao et al. (2007), Aulawi et al. (2008), and Norek, 2013. The measured items focused on product and process innovation within the firm.

Data Collection Procedure

The quantitative method was employed in this study. Questionnaires were used as the data collection tool. The questionnaires were distributed to

Table 1 Variables Development

Variables	No. of items	Sources
Information technology	6	Yang and Chen (2007), Wang and Wang (2012), Ismail and Yusof (2010)
Knowledge sharing	6	Lin and Lee (2006), Baharim (2008), Wang and Wang (2012)
Innovation	8	Liao et al. (2007), Aulawi et al. (2008), Norek (2013)

Table 2 Profile of Herbal Manufacturers and Number of Respondents

Category		No. of respondents	Percent
Main Products	Herb medicine	92	40.9
	Herb cosmetics	45	20.1
	Herb food and supplement	67	29.9
	Herb spa products	4	1.8
	Others	16	7.3
Age of business	Less than 1 year	6	2.7
	1–5	20	8.9
	6–10	138	61.6
	11–15	30	13.4
	16–20	28	12.5
	More than 20 years	2	0.9
Number of employees	Less than 50	48	21.2
	50–199	28	12.4
	200–499	69	31.0
	More than 500	79	35.4

Table 3 Scale Reliability

Dimension	No. of items	Cronbach's alpha coefficient
Information technology (IT)	6	0.762
Knowledge sharing (KS)	6	0.739
Innovation (IN)	8	0.716

42 herbal manufacturers from November, 2012 to January, 2013 by mail and walk-in. There were a total of 224 usable questionnaires. The profile of herbal manufacturers and number of respondents is shown in Table 2.

Reliability Test

The questionnaire design was primarily based on the literature review. The questionnaires were measured by internal consistence reliability based on the Cronbach's alpha coefficient technique. The results indicating the Cronbach's alpha coefficient of knowledge sharing, information technology, and a firm's innovation are shown in Table 3. As displayed, overall the results are above the acceptable level 0.7. This indicates that each measured item

Table 4 Descriptive Statistics and Inter-Correlation Matrix

Dimension	Mean	St. dev.	IT	KS	IN
IT	3.2210	0.7190	1.000		
KS	3.5499	0.5481	0.356	1.000	
IN	3.2355	0.8185	0.252	0.278	1.000

of the questionnaire has a high internal consistency. Moreover, the mean and standard deviation of each variable and the inter-correlation among variables are displayed in Table 4.

Measurement

In this study, all of the measured items were adopted from earlier research. These consisted of the following three constructs – knowledge sharing, information technology, and innovation. Moreover, a five-point Likert scale, which ranged from '1 = strongly disagree' to '5 = strongly agree,' was employed to measure all items.

Data Analysis and Results

The questionnaires from 224 respondents from 42 manufacturers of herbal industry were used in the data analysis. Table 5 displays the respondent's characteristics according to demographics.

The results of this research display that the relationship between the independent variable, information technology, and the mediating variable, knowledge sharing, is positive and significant. Moreover, the relationship between the dependent variable, innovation, and the mediating variable, knowledge sharing, is also positive and significant. Therefore, the results of hypotheses testing are as follows:

- H_1 presents the relationship between information technology and knowledge sharing. The results display that information technology is positively and significantly ($\beta = 0.2711$, $t = 5.6689$, $p < 0.001$) related to knowledge sharing.
- H_2 presents the relationship between information technology and a firm's innovation. The results display that information technology is positively and significantly ($\beta = 0.1990$, $t = 2.5663$, $p < 0.001$) related to a firm's innovation.
- H_3 presents the relationship between knowledge sharing and a firm's innovation. The results display that information technology is significantly ($\beta = 0.3226$, $t = 3.1709$, $p < 0.001$) related to a firm's innovation.

Moreover, H_1, H_2 and H_3 are significant, and mediation analysis was tested with the use of the bootstrapping method with bias corrected con-

Table 5 Respondent's Demographic Profiles

Respondent's profile	Classification	Frequency	Percentage
Gender	Male	81	36.0
	Female	143	64.0
Age	20–29	117	52.2
	30–39	65	29.2
	40–49	20	8.8
	50 and above	22	9.8
Educational level	High school	20	8.9
	Bachelor	163	72.8
	Master	41	18.3
	PhD	0	0.0
Year of experience	Less than 1 year	28	12.5
	1–5 years	83	37.1
	6–10 years	56	25.0
	11–15 years	16	7.1
	More than 15 years	41	18.3
Department	Production	65	29.0
	R&D	54	24.1
	Engineering/maintenance	20	8.9
	Quality Control	65	29.0
	Others	20	9.0

fidence estimates from Preacher and Hayes in SPPS macro. In this study, a 95% confidence interval of the indirect effects was obtained with 5,000 bootstrap resamples (Preacher & Hayes, 2008). The mediated hypothesis was tested and the results of the mediation analysis confirm the mediation role of knowledge sharing in the relationship between information technology and a firm's innovation ($\beta = 0.0874$, $CI = 0.0344$ to 0.1611). In addition, it indicates that knowledge sharing providesa partial mediation effect between information technology and a firm's innovation. Moreover, the overall model is significant, $R^2 = 0.1265$, $F = 32.1361$, $p < 0.001$.

Discussion

This goal of this study is to develop a framework for examining knowledge sharing, information technology, and innovation. The research samples were obtained from employees of herbal manufacturers in Thailand.

Firstly, the results display that information technology has a positive influence on knowledge sharing. The results of this study are consistent with earlier relevant researches (Aulawi et al., 2008; Davison et al., 2013; Ismail & Yusof, 2010). Information technology also has a positive influence on a firm's innovation. The results of this study are consistent with earlier

relevant researches by Huang et al. (2009) and Bartel et al. (2007). Much earlier research also showed a strong relationship between knowledge sharing and a firm's innovation (Liao et al., 2007; Saenz et al., 2012; Wang and Wang, 2012). The results of this study also indicate that knowledge sharing has a significantly positive influence on a firm's innovation. Furthermore, the results indicate that knowledge sharing is a partial mediator between information technology and a firm's innovation. This means that it is not only an indirect predictor of a firm's innovation, but could also support information technology's influence on a firm's innovation.

In the field of herbal manufacturing in Thailand, innovation is the key driver of business and competitiveness. Both public and private organizations, such as The National Innovation Agency, Thailand, provided support to herbal manufacturers in order to develop their innovation. The results indicate that most herbal manufacturers focus more on their product innovation rather than on process innovation. Moreover, due to certain constraints, such as high cost of R&D investment and inadequate expertise, most of herbal manufacturers developed their products as an incremental innovation. Multiple sources of knowledge are required to develop organization innovation – not only explicit knowledge, but also tacit knowledge, such as employee experience, which becomes an essential aspect of the organizational knowledge. The ability to change tacit knowledge to explicit knowledge and share this knowledge with others is most valuable to an organization. This indicates that knowledge sharing of employees plays an important role in an organization. In this study, it also emerged that employees in herbal manufacturing shared their explicit knowledge rather than tacit knowledge. Their tacit knowledge, however, could mostly be shared through training programs.

In addition, information technology becomes an organizational factor in increasing knowledge sharing and firm's innovation. In this study, we found that many herbal manufacturers emphasize the information technology issue; however, they focus on the information technology infrastructure rather than employee information knowledge. For example, some manufacturers provided LAN system and intranet to share their information and knowledge within the organization. Moreover, some of them invested in the video conference system to communicate within the organization. Furthermore, some of them preferred to communicate with their employees and customers via social network. However, there were not many organizations which provided training courses in information technology to their employees.

Essentially, the results of this study display that knowledge sharing is a partial mediator between information technology and organization innovation. It indicates that knowledge sharing is not only directly related to organization innovation, but also leverages information technology influence

on an organization's innovation. It can be said that sharing knowledge is proportional to utilizing information technology in order to enhance the organization's innovation. In other words, information technology can support the knowledge sharing of employees with functionalities such as communication among individuals, sharing information and knowledge via the organizational network, storing data, and supporting decision making. Moreover, organizations facilitate the effectiveness of information technology infrastructures and the knowledge of employees in the field of information technology by providing training courses to increase knowledge sharing of employees, which can also drive innovation and competitiveness of the organization.

Research Implications

This study emphasizes the importance of knowledge sharing, information technology, and organizational innovation. The results of this study have both theoretical and practical implications that can be described as follows:

- *Theoretical implications.* This study discusses the theoretical development in the field of information technology, knowledge sharing, and organizational innovation. The theoretical contribution of this study is the development of a research model, which enhances the essential variable, knowledge sharing, as the mediator between the relationship between information technology and organizational innovation. The contribution of this study is valuable because, when reviewing the earlier relevant literature, we found that although much of it addressed the relationships between knowledge sharing, information technology, and organizational innovation, there is no research on knowledge sharing as the mediating variable between information technology and innovation. As displayed by the results, the implementation of knowledge sharing among employees within an organization and providing an appropriate information technology system could leverage the level of organizational innovation, for example through the creation of new ideas. Therefore, it can be concluded that knowledge sharing and information technology are the critical factors, which can increase the innovation performance of an organization.
- *Practical implications.* The results of this study also suggest some useful managerial insights. Firstly, from the managerial perspective, managers should emphasize both information technology and knowledge sharing among employees in order to increase their organizational innovation performance. With regard to knowledge sharing among employees within an organization, encouraging employees to share both their explicit and tacit knowledge represents an essential approach to increasing organizational innovation. Nevertheless,

tacit knowledge sharing is difficult to perform in the framework of routine work. Utilizing information technology is one possible approach to assisting in sharing tacit knowledge; however, it does not provide an exact method of increasing organizational innovation. Managers should also pay attention to other factors, such as improving organizational culture, providing a reward system and encouraging interaction among employees. Moreover, external knowledge sharing should also encourage employees, especially in the R&D department, to improve the product and process innovation of the organization.

Secondly, this study indicates the influence of information technology on knowledge sharing and organizational innovation. Therefore, organizations should provide an appropriate information technology infrastructure in order to support knowledge sharing and increase organizational innovation performance. Furthermore, organizations should also recognize the knowledge and skills of employees in information technology with the purpose of taking full advantage of the benefits provided by the information technology. For example, organizational managers could provide appropriate IT training programs for employees within an organization.

Significance of Research Findings

In the current fiercely competitive marketplace, an essential way for survival of an organization is effective innovation. The ability to create and continuously develop employees' own innovation should also be emphasized. There are both internal and external factors that can drive the innovation of an organization. In recent years, an increasing amount of literature addresses the issue of organizational innovation development. This study mainly focuses on the technological perspective and knowledge management within organizations in order to increase organizational innovation performance.

The relationship between information technology and organizational innovation has been widely investigated. However, this study aims to investigate the relationship between information technology and organizational innovation, and then add knowledge sharing as the mediator. Then we can hypothesize that information technology and knowledge sharing positively influence organizational innovation, while knowledge sharing as a mediating effect is also simultaneously investigated with regard to the relationship between information technology and a firm's innovation.

The results of this study confirm previous research results showing that information technology and knowledge sharing positively influence organizational innovation and provide additional evidence that knowledge sharing can play a mediating role in leveraging information technology to increase organization innovation performance.

Given the importance of information technology, knowledge sharing and

innovation in today's world, the results of this study will serve as the base for further studies in several areas, such as innovation improvement, organizational development, knowledge management, organizational planning and management, and human resource management. Moreover, it could act as a guide for developing organizational innovation through utilizing information technology in order to share knowledge among employees. In addition, the results of this study could also provide a better understanding of knowledge sharing, information technology, and innovation within organizations.

Limitations and Future Research

In this research, there are some unavoidable limitations. Firstly, it is based on a small number of organizations; therefore, the results may not be generalized to all other organizations. Consequently, future research should focus on a larger number of organizations in order to obtain a broad view of results. Secondly, this study only focused on the perspectives of staff level employees. Therefore, future research should focus on the perspectives of top level management and may compare the perspectives of managers and employees in order to examine the gap and establish appropriate strategies for increasing organization innovation performance. In addition, research of different sample backgrounds, such as other countries, other industries, or comparison between different industries could also be performed. Finally, some other relevant variables may also be added to the research model and their relationships could be investigated in further studies to better understand the critical success factors in firm's innovation improvement.

Acknowledgements

This research was supported by the Ministry of Science and Technology, Thailand.

References

Aulawi, H., Sudirman, I., Suryadi, K., & Govindaraju, R. (2008, December). Knowledge sharing behavior, antecedent and its influence towards the company's innovation capability. Paper presented at the IEEE International Conference on Industrial Engineering and Engineering Management, Singapore.

Baharim, S. B. (2008). *The influence of knowledge sharing on motivation to transfer training: A Malaysian public sector context* (Unpublished doctoral thesis), Victoria University, Melbourne, Australia.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173–1182.

Bartel, A., Ichniowski, C., & Shaw, K. (2007). How does information technology affect productivity? Plant-level comparisons of product innovation, pro-

cess improvement, and worker skills. *The Quarterly Journal of Economics, 122*(4), 1721–1758.

Davenport, T. H. (1993). *Process innovation: Reengineering work through information technology.* Boston, MA: Harvard Business School Press.

Davenport, T. H., DeLong, D. W., & Beers, M. C. (1998). Successful knowledge management projects. *Sloan Management Review, 39*(2): 43–57.

Davison, R. M., Ou, C. X. J., & Martinsons, M. G. (2013). Information technology to support informal knowledge sharing. *Information Systems Journal, 23*(1), 89–109.

Hansen, M. T., Nohria, N., & Tierney, T. (1999). What's your strategy for managing knowledge? *Harvard Business Review, 77*(2), 106–116.

Hsu, I.-C. (2006). Enhancing employee tendencies to share knowledge: Case studies of nine companies in Taiwan. *International Journal of Information Management, 26*(4), 326–338.

Huang, Y.-H., Li, E. Y., & Chen, J. S. (2009). Information synergy as the catalyst between information technology capability and innovativeness: Empirical evidence from the financial service sector. Retrieved from http://informationr.net/ir/14-1/paper394.html

Ismail, B. M., & Yusof, Z. M. (2010). The Contribution of technological factors on knowledge sharing quality among government officers in Malaysia. In P. Virtanen & N. Helander (Eds.), *Knowledge management* (Chapter 15). Retrieved from http://www.intechopen.com/download/pdf/11014

King, W. R. (2009). *Knowledge management and organizational learning.* Berlin, Germany: Springer.

Lee, J.-N. (2001). The impact of knowledge sharing, organizational capability and partnership quality on IS outsourcing success. *Information & Management, 38*(5), 323–335.

Liao, S. H., Fei, W. C., & Chen, C. C. (2007). Knowledge sharing, absorptive capacity, and innovation capability: An empirical study of Taiwan's knowledge-intensive industries. *Journal of Information Science, 33*(3), 340–359.

Lin, H.-F., & Lee, G.-G. (2006). Effects of socio-technical factors on organizational intention to encourage knowledge sharing. *Management Decision, 44*(1), 74–88.

Ng, Y.-K., Lee, V.-H., Foo, A. T.-L., & Gan, P.-L. (2012). The relationship between knowledge management practices and technological innovation: A conceptual framework. *International Journal of Management, Knowledge and Learning, 1*(1), 71–89.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science, 5*(1), 14–37.

Nonaka, I. (1995). *The knowledge-creating company.* Cambridge, MA: Harvard Business Press.

Nonaka, I., Von Krogh, G., & Voelpel, S. (2006). Organizational knowledge creation theory: Evolutionary paths and future advances. *Organization Studies, 27,* 1179–1208.

Norek, T. (2013). The knowledge management for innovation processes for SME sector companies. *International Journal of Management, Knowledge and Learning, 2*(1), 83–99.

OECD. (2005). *Oslo manual: Guidelines for collecting and interpreting innovation data.* Paris, France: OECD Publishing.

Polanyi, M. (1966). *The tacit dimension.* Garden City, NY: Doubleday.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40,* 879–891.

Saenz, J., Aramburu, N., & Blanco, C. (2012). Knowledge sharing and innovation in Spanish and Colombian high-tech firms. *Journal of Knowledge Management, 16*(6), 5–5.

Sáenz, J., Aramburu, N., & Rivera, O. (2009). Knowledge sharing and innovation performance: A comparison between high-tech and low-tech companies. *Journal of Intellectual Capital, 10*(1), 22–36.

Tidd, J., Bessant, J. R., & Pavitt, K. (2005). *Managing innovation: Integrating technological, market and organizational change.* Hoboken, NJ: Wiley.

Wang, Z., & Wang, N. (2012). Knowledge sharing, innovation and firm performance. *Expert Systems with Applications, 39*(10), 8899–8908.

Yang, C., & Chen, L.-C. (2007). Can organizational knowledge capabilities affect knowledge sharing behavior? *Journal of Information Science, 33*(1), 95–109.

Zhang, L., Li, J., & Shi, Y. (2005, December). Study on improving efficiency of knowledge sharing in knowledge-intensive organization. Paper presented at the First International Conference on Internet and Network Economics, Hong Kong, China.

Onwika Kaewchur is pursuing her Doctoral degree in Industrial Engineering at Kasetsart University. She has focused her research on knowledge management, innovation and learning of an organization on long-term competitiveness. *onwika@gmail.com*

Pornthep Anussornnitisarn is a Lecturer and the Deputy Director of International Graduate Program in Industrial Engineering, Department of Industrial Engineering at Kasetsart University. He received his Doctoral degree in Industrial Engineering from Purdue University in 2003. His research includes logistics, supply-chain management, and applied ICT to improve organizational learning and development. *fengpta@ku.ac.th*

Zbigniew Pastuszak is the Dean of the Faculty of Economics, and is currently teaching at Maria Curie-Skłodowska University in Poland. He has worked in the area of information technology application to improve communication and information flows within and across organizations. He is also conducting several research projects in e-commerce and organizational development. *z.pastuszak@umcs.lublin.pl*