Online knowledge sharing in Vietnamese tele-communication companies: An integration of social psychology models
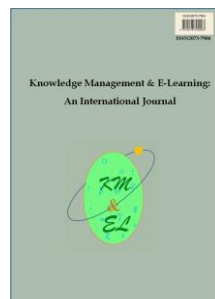
Tuyet-Mai Nguyen
Griffith University, Australia
Thuongmai University, Vietnam
Van Toan Dinh
Phong Tuan Nham
Vietnam National University, Vietnam

Online knowledge sharing in Vietnamese tele-communication companies: An integration of social psychology models

Tuyet-Mai Nguyen* ⓘ

Department of Marketing
Griffith University, Australia
Department of Information and E-commerce
Thuongmai University, Vietnam
E-mail: mai.nguyenthituyet@griffithuni.edu.au

Van Toan Dinh* ⓘ

University of Economics and Business
Vietnam National University, Vietnam
E-mail: dinhvantoan@vnu.edu.vn

Phong Tuan Nham ⓘ

University of Economics and Business
Vietnam National University, Vietnam
E-mail: tuannp@vnu.edu.vn

*Corresponding author

Abstract: Organizational knowledge is regarded as a key source of sustainable competitive advantages for organizations. Along with the development of information technology, organizations often find many ways to facilitate the online knowledge sharing process. However, the establishment of successful online knowledge sharing initiatives seems to be challenging to accomplish. This study aims to enhance the understanding of the factors that affect employees' knowledge-sharing behavior in organizations by examining the integration of two social psychology models—the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB). A total of 501 complete responses, from full-time employees in Vietnamese tele-communication companies, were collected and used for data analysis using structural equation modelling. The overall findings of this study appear to coincide with the propositions of the TAM and the TPB, which this research model was built on. Perceived ease of use and perceived usefulness significantly affect employees' attitudes toward knowledge sharing. In turn, attitudes, along with subjective norms and perceived behavior control (PBC), have a positive influence on knowledge sharing intentions (KSI). Consequently, KSI can be used to predict knowledge donating and knowledge collecting.

Keywords: Online knowledge sharing; Sustainable development; Technology acceptance model; Theory of planned behavior

Biographical notes: Tuyet-Mai Nguyen is a PhD Candidate at Griffith

Business School, Griffith University, Australia. Her research interests include e-commerce, knowledge sharing, and e-marketing. She is a senior lecturer and marketing specialist at Department of Information and E-commerce, Thuongmai University, Vietnam. Her research has been published in the journals Journal of Knowledge Management and VINE: The Journal of Information and Knowledge Management Systems.

Dr. Dinh Van Toan is working for VNU University of Economics and Business, Vietnam. His research interests include strategic management, corporate governance and knowledge management.

Nham Phong Tuan is an associate professor of strategic management at VNU, University of Economics and Business, Vietnam. His research interests include strategic management, innovation management, entrepreneurship, and knowledge management. He has published over 20 articles in a variety of journals such as Singapore Management Review, Market journal, Economics Annals XXI, Asian Academy of Management Journal.

1. Introduction

Knowledge sharing has been highlighted as a key factor in sustaining organizational competitive advantage (Grant, 1996; Ullah et al., 2016; Han, 2017; Kim & Park, 2017; Zheng et al., 2017; Castaneda & Durán, 2018; Najam et al., 2018). Along with the rapid growth of information technology, online knowledge sharing has been flourishing. Some companies, such as IBM, Intel, SAP, and Exxon, have used weblogs to facilitate internal knowledge sharing among employees (Wang & Lin, 2011). An increasing number of online communities have been created to facilitate knowledge sharing; therefore, researchers have paid more attention to online knowledge sharing (Levy, 2009; Paroutis & Al Saleh, 2009; Islam & Ashif, 2014). However, there are few studies that have examined online knowledge sharing in organizations (Krasnova et al., 2010; Papadopoulos et al., 2012).

While online knowledge sharing provides many advantages (Schau, & Gilly, 2003), employees may refuse to use information technology to share knowledge online because of fear of losing individual competitive advantage (Akhavan et al., 2005). Therefore, there is a need to understand employees' psychological motives and factors that affect online knowledge sharing behavior, which managers could then use to formulate strategies to ensure sustainable organizational competitive advantage (Othman & Sohaib, 2016; Kim & Park, 2017).

The TAM and TPB are appropriate tools for understanding online knowledge sharing, because they have been used in a number of studies (Gefen & Straub, 2003; Hsu & Lin, 2008; Aulawi et al., 2009; Jeon et al., 2011) to predict and understand knowledge sharing behavior and information technology usage and acceptance. However, neither the TAM nor the TPB has been found to be sufficient to explain or predict both information technology usage and knowledge sharing behavior (Venkatesh et al., 2003). Prior scholars have conducted a number of studies integrating these two models. For example, Lee (2009) combined the TAM and TPB to study the adoption of online trading; Wu et al. (2011) proposed an integrative model of the TAM and TPB to investigate the adoption of mobile healthcare; and Shiau and Chau (2016) unified the TAM and TPB together with another four well-known theories and developed a more advance model. However, in the online knowledge sharing literature, these models have often been examined

separately. Furthermore, few studies have investigated the TAM to understand the acceptance of information technology in online knowledge sharing (Hsu & Lin, 2008). Therefore, this study draws on two schools of thought from the TAM and TPB to examine the adoption of information technology in online knowledge sharing in organizations.

Online knowledge sharing behavior often refers to both knowledge donating and knowledge collecting (Ardichvili et al., 2003). These two dimensions of knowledge sharing behavior need to be investigated separately because they are different. In the online knowledge sharing literature, a lack of studies exists that have examined these two dimensions in a single study context.

The main objectives of this study were to integrate and empirically test the two models for online knowledge sharing in the organizational context, and to measure online knowledge sharing behavior through knowledge donating and knowledge collecting. The findings of this study will contribute a theoretical background by setting a solid theoretical integration of the TAM and TPB to predict and explain employees' online knowledge sharing behavior. Regarding the practical perspective, the research may give practitioners an increased understanding of online knowledge sharing in organizations, which can then be used to encourage employees to share knowledge online.

This paper proceeds as follows: Section 2 introduces the theoretical background, Section 3 outlines the research model and hypotheses, Section 4 details the methodology and research design, and Section 5 presents the data analysis and hypotheses testing results. Section 6 discusses our research findings and implications for theory and practice, Section 7 provides limitations and potential topics for future research, and Section 8 presents the conclusion.

2. Theoretical background

2.1. Technology acceptance model (TAM)

Hsu and Lin (2008) emphasized that the successful adoption of information technology mainly depends on the importance of internal technology resource infrastructure; therefore, the TAM should be considered in examining online knowledge sharing in organizations. The TAM is the theory widely used to explain and predict the acceptance of information technology by individuals. The TAM, first introduced by Davis et al. (1989), was derived from the Theory of Reasoned Action (TRA) model, developed by Ajzen and Fishbein (1980) to explain and predict the acceptance of information technology by users. The TAM provides a basis for understanding the influence of external determinants, beliefs, attitudes, and intentions regarding adoption decisions (Awa et al., 2015).

The TAM focused on two salient factors—perceived ease of use and perceived usefulness. Perceived ease of use refers to the degree to which individuals believe that using a technology system is free of effort (Davis, 1989; Hsu & Lin, 2008). Perceived usefulness refers to the degree to which individuals believe that using a technology system enhances their performance (Davis, 1989; Hsu & Lin, 2008). According to the TAM, the actual use of an online technology system is determined by individual intentions, which are impacted by attitudes toward use and perceived usefulness; then individual attitudes toward the use of a technology system are determined by perceived

ease of use and perceived usefulness; and the perceived ease of use influences perceived usefulness (Davis, 1989) (see Fig. 1).
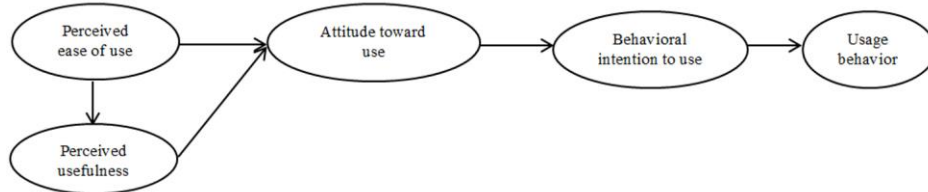

Fig. 1. Technology acceptance model, Adapted from Davis (1989)

In organizations, the TAM has been applied in empirical studies, including the examination of email (Davis, 1989), voice mail (Chin & Todd, 1995), television commercials (Yu et al., 2005), mobile learning technology, and personal digital assistants (Igbaria et al., 1995; Chau, 1996; Gefen & Straub, 1997). Hung and Cheng (2013) succeeded in empirically proving the positive effect of perceived ease of use and perceived usefulness on KSI in online communities.

2.2. Theory of planned behavior (TPB)

The TPB, a social psychological model developed by Ajzen (1991), is one of the most frequently used models to predict individual behavior (Chen et al., 2009; Chen, 2011). According to TPB, individual intention refers to the degree of individual belief that they will perform a behavior (Hutchings & Michailova, 2004). Behavioral intention is a product of three factors: attitude, subjective norms, and PBC. Attitudes refer to the degree of individual favorable feelings about knowledge sharing behavior (Hutchings & Michailova, 2004). Subjective norms refer to the perceived social pressure to perform a behavior in accordance with expectations (Ajzen, 1991). Perceived behavior control refers to perceived ease or difficulty in performing a behavior and is assumed to reflect experience and expected impediments (Ajzen, 1991). The TPB further postulates behavioral intention as the main determinant of actual behavior (Ajzen, 1991) (see Fig. 2).
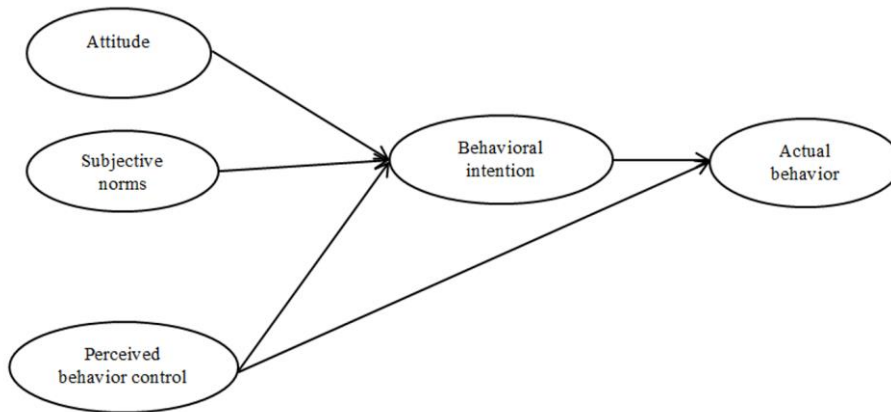

Fig. 2. Theory of planned behaviour, Adapted from Ajzen (1991)

2.3. Rationale for the integration of TAM and TPB

In the organizational context, online knowledge sharing plays a crucial role in maintaining organizational competitive advantage through facilitating the flow of information and wide distribution of knowledge. Thus, it is imperative for organizations to understand the driving force of employees' online knowledge sharing behavior. During the past decade, TAM and TPB have been widely applied to examine information technology usage and acceptance to perform a specific behavior (Davis, 1989; Hsu & Lin, 2008); however, few studies examined the application of TAM and TPB in online knowledge sharing in organizations (see Table 1). Furthermore, neither TAM nor TPB alone has been found to be sufficient to superiorly explain behavior (Venkatesh et al., 2003). Since online knowledge sharing involves the acceptance of information technology to perform knowledge sharing behavior, TAM and TPB need to be integrated to examine information usage and acceptance in online knowledge sharing. A greater explanatory power regarding individual behavior can be found in an integrated approach of TAM and TPB (Bosnjak et al., 2006; Arora & Sahney, 2018). The TAM and TPB can complement each other to facilitate understanding employees' online knowledge sharing behavior. Thus, the integrated approach, on the one hand through TAM, helps to explain how employees decide to use information technology to share knowledge, and on the other through TPB, helps to understand employees' psychological motives underlying knowledge sharing behavior. Therefore, this study uses an integrated TAM–TPB framework to understand employees' online knowledge sharing behavior in organizations.

Online knowledge sharing behavior refers to the transfer or dissemination of knowledge online to help other employees and to collaborate with other employees in solving problems (De Vries et al., 2006; Lin, 2007b; Van den Hooff et al., 2012). Researchers often pay attention to knowledge sharing in organizations because it transforms individual knowledge into organizational knowledge (Suppiah & Sandhu, 2011). By definition, online knowledge sharing involves the supply of knowledge and the demand for knowledge (Ardichvili et al., 2003). Therefore, knowledge sharing behavior contains two distinctive dimensions of knowledge sharing: knowledge donating and knowledge collecting (Van den Hooff & de Ridder, 2004; De Vries et al., 2006; Ali et al., 2018). These two dimensions are different in nature and need to be examined independently in the online knowledge sharing process in organizations (Van den Hooff & de Leeuw van Weenen, 2004). Knowledge donating refers to the process whereby employees donate their intellectual capital. On the other hand, knowledge collecting refers to the process whereby employees consult colleagues to encourage or ask them to share their intellectual capital (Van den Hooff & de Ridder, 2004). As there is a lack of studies that examine these two dimensions at the same time, this study examines the two dimensions to further understand knowledge sharing behavior.

Table 1
Summary of empirical studies examining TAM and TPB in online knowledge sharing in organizations

Author	TPB	TAM	Country	Sample size	Sample characteristics	Main findings
Akhavan et al. (2015)	✓		Iran	257	Employees from 22 high-tech companies including companies in the pharmaceutical, nano technological, biotechnological, aviation, and aerospace industries in Iran	The effects of three motivational factors (perceived loss of knowledge power, perceived reputation enhancement, and perceived enjoyment in helping others) and two social capital factors (social interaction ties and trust) on employees' attitudes toward KS were supported. Employees' knowledge sharing behaviors increase their innovative work behaviors.

Aulawi et al. (2009)	✓		Indonesia	125	Employees in an Indonesian telecommunication company	Knowledge sharing behavior has a positive impact on individual innovation capability. Teamwork, trust, senior management support and self-efficacy are found as knowledge enablers of employees' knowledge sharing behavior.
Casimir et al. (2012)	✓		Malaysia	483	Full-time employees from 23 organizations	The relationship between the KSI and knowledge sharing behavior is partly mediated and not moderated by information technology usage to share knowledge.
Chatzoglou and Vraimaki (2009)	✓		Greece	276	Bank employees in Greece	KSI knowledge is mainly influenced by employees' attitudes toward knowledge sharing, followed by subjective norms.
Chen et al. (2009)	✓		Taiwan	396	Full-time senior college students and MBA students who enrolled in two courses (enterprise resource planning and electronic business)	Attitudes, subjective norm, web-specific self-efficacy and social network ties are shown to be determinants of KSI. KSI, in turn, is significantly associated with knowledge sharing behavior. Knowledge creation self-efficacy does not significantly affect KSI.
Chuang et al. (2015)	✓		Taiwan	395	Middle management employees in 50 Taiwanese ISO 9001:2000-certified firms in the information technology industry	Perceived ethics and self-efficacy have significant direct influences on attitudes towards knowledge sharing. Subjective norms are significantly associated with KSI in the context of total quality management implementations. However, subjective norms alone do not significantly affect attitudes towards knowledge sharing.
Hsu and Lin (2008)	✓	✓	Taiwan	212	Blog users in organizations	Ease of use and enjoyment, and knowledge sharing (altruism and reputation) positively affect attitudes toward blogging. Social factors (community identification) and attitudes toward blogging significantly affect a blog participant's intention to continue to use blogs.
Ibragimova et al. (2012)	✓		USA	220	Information technology professionals	Attitudes toward knowledge sharing, subjective norms, and procedural justice positively affect KSI, while distributive and interactional justice affect it indirectly through attitudes toward knowledge sharing.
Jeon et al. (2011)	✓		Korea	282	Employees of four large Korean high-tech production companies	Both extrinsic motivational and intrinsic motivational factors positively influenced attitudes toward knowledge sharing, in which intrinsic motivational factors have more influential impact. There are some differences in knowledge sharing mechanisms between formally managed communities of practice and informally nurtured communities of practice.
Kahlor et al. (2016)	✓		USA	216	Nanoscientists in the United States	The ethics-to-practice gap can be fixed by providing ethics information more available for scientists and redoubling social pressure to improve seeking and sharing of ethics information.
Mahmood et al. (2011)	✓		Pakistan	209	Information technology professionals from more than 70 information technology companies located in five major cities of Pakistan	Intent towards sharing tacit knowledge is mostly affected by the subjective norms and less by their personal attitudes.
Papadopoulos et al. (2012)	✓		\Thailand	175	employees in Thai organizations which have used or have the potential for knowledge sharing through employee weblogs from a directory of Thailand organizations registered on the Thai stock exchange	Self-efficacy, perceived enjoyment, certain personal outcome expectations, and individual attitudes towards knowledge sharing positively affect KSI.

Safa and Von Solms (2016)	✓	\\\\Malaysia	482	employees of several Malaysian organizations whose main activities were in the domain of banking, insurance, e-commerce and education.	Extrinsic motivation (reputation and promotion) and intrinsic motivation (curiosity satisfaction) have positive effects on employees' attitudes toward knowledge sharing. Self-worth satisfaction does not affect attitudes. Attitudes, PBC, and subjective norms have a positive influence on intentions, and intentions affect knowledge sharing behavior. Organizational support affects knowledge sharing behavior more than trust.
So and Bolloju (2005)	✓	Hong Kong	40	Working information technology professionals who were studying a part-time master's degree program at a large university	Attitudes and PBC significantly affect KSI. Attitudes, subjective norms, and PBC significantly affect intentions to reuse knowledge.
Teh and Yong (2011)	✓	Malaysia	116	Information systems personnel	The sense of self-worth and in-role behavior positively affect attitudes toward knowledge sharing. Both subjective norms and organizational citizenship behavior positively affect KSI, while the attitudes toward knowledge sharing are negatively related to KSI. Individual knowledge sharing behavior is affected by KSI.
Tohidinia and Mosakhani (2010)	✓	Iran	502	Employees were randomly selected from ten companies	Perceived self-efficacy and anticipated reciprocal relationships affect attitudes toward knowledge sharing. Organizational climate significantly affects subjective norms. The level of information and communication technology usage has a positive influence on knowledge sharing behavior.
Wu and Zhu (2012)	✓	China	180	Responses from ten companies in China	Significant statistical support was found for the extended TPB research model, accounting for about 60 percent of the variance in KSI and 41 percent variance in the actual knowledge sharing behavior.

3. Research model and hypothesis

The proposed model is grounded in TAM (Davis, 1989) and TPB (Ajzen, 1991) (see Fig. 3). A number of studies have identified perceived ease of use as an attitudinal determinant (Davis, 1989; Hung et al., 2015). If an organization's online knowledge sharing system requires extra time to learn or is difficult to learn, employees will display a natural tendency to avoid using it (Malhotra & Galletta, 2004). Perceived ease of use has been theoretically and empirically proven to be one of the key determinants of information technology system usage (Ndubisi et al., 2003; Guriting & Oly Ndubisi, 2006; McKechnie et al., 2006). Furthermore, Venkatesh and Davis (2000) empirically found that ease of use has a positive influence on attitudes toward online knowledge sharing and is a proven key factor of employees' KSI. The importance of perceived ease of use has been well documented in explaining information technology system adoption and usage, for example mobile banking and internet banking (Ramayah & Suki, 2006).

Employees' attitudes toward online knowledge sharing are explained and predicted by perceptions of usefulness (Awa et al., 2015). Accordingly, the more useful employees perceive online knowledge sharing to be, the more favorable their attitudes toward online knowledge sharing will be. Indeed, from a potential knowledge donator perspective, if they find online knowledge sharing useful, they tend to share knowledge online with their colleagues (Kankanhalli et al., 2005). Taylor and Todd (1995) confirmed that perceived usefulness has a direct effect on attitudes toward online

knowledge sharing, because of expectations about productivity, performance, and effectiveness.
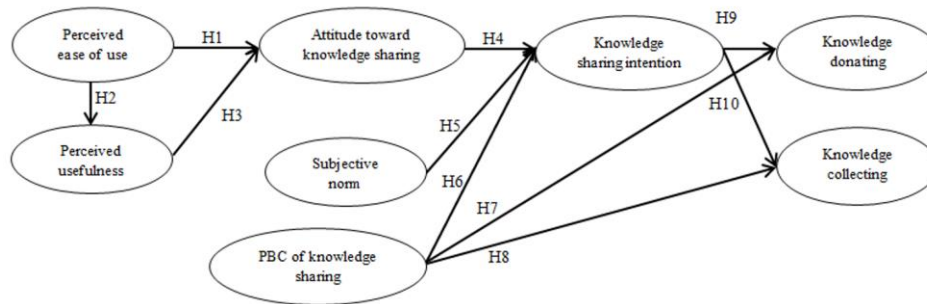

Fig. 3. Conceptual framework

According to TAM, other things being equal, improvements in ease of use have a direct influence on perceived usefulness (Davis, 1989). Previous research has consistently argued that there is a positive relationship between perceived usefulness and perceived ease of use in online knowledge sharing (Davis, 1989; Pavlou, 2003). The general premise is that perceived usefulness directly affects attitudes toward online knowledge sharing, but perceived ease of use acts indirectly through perceived usefulness (Davis, 1989; Pavlou, 2003). Gefen and Straub (2000) extensively examined this relationship and suggested that, in most cases, perceived ease of use affects attitudes toward online knowledge sharing through perceived usefulness. The indirect effect of perceived ease of use on attitudes to using information technology through perceived usefulness has been validated in a variety of technologies, applications, and information systems (Gefen & Straub, 2000; Devaraj et al., 2002; Pavlou & Fygenson, 2006; Pavlou et al., 2007; Chiu et al., 2009). Therefore, we propose the following hypotheses:

H1. *Perceived ease of use is positively related to attitudes toward knowledge sharing.*

H2. *Perceived ease of use is positively related to perceived usefulness.*

H3. *Perceived usefulness is positively related to attitudes toward knowledge sharing.*

Online KSI has long been reported to be determined by attitudes toward online knowledge sharing (Pavlou & Fygenson, 2006). This implies that the more favorable an employee's attitude toward knowledge sharing, the greater will be their intention to share knowledge online. Bock et al. (2005) found that attitudes toward knowledge sharing positively and significantly influence KSI when they examined employees in thirty organizations. A study by Brown and Venkatesh (2005), whereby they examined factors affecting household technology adoption, showed that attitudes toward information technology usage positively affected technology adoption intentions. The significant effect of attitudes toward knowledge sharing on KSI has been supported by a number of researchers (Bock & Kim, 2002; Ryu et al., 2003; Lin & Lee, 2004; Tohidinia & Mosakhani, 2010; Ho et al., 2011; Fauzi et al., 2018). Thus, we hypothesize:

H4. *Attitudes toward online knowledge sharing are positively related to KSI.*

Sujbective norms have been shown to be an important antecedent of KSI (Bock et al., 2005; Tohidinia & Mosakhani, 2010). This suggests that employees who perceive greater social pressure in an organization will have a stronger KSI. When Ryu et al. (2003) explored physicians' knowledge sharing behavior, they found that subjective

norms had a strong overall effect on behavioral intentions. The relationship between subjective norms and KSI has been found in a number of studies (Ryu et al., 2003; Jeon et al., 2011; Wu & Zhu, 2012; Akhavan et al., 2015; Fauzi et al., 2018). Accordingly, we hypothesize:

H5. *Subjective norms are positively related to KSI.*

According to TPB, the role of PBC is two-fold. First, jointly with attitudes and subjective norms, PBC is a co-determinant of online KSI. Second, collectively with intentions, it acts as a co-determinant of knowledge donating and knowledge collecting. If employees perceive at ease with online knowledge sharing, they are likely to feel that knowledge sharing is under their control. As a result, they are more likely to have KSI and carry out knowledge donating and knowledge collecting activities (Lin & Lee, 2004; Tohidinia & Mosakhani, 2010; Ho et al., 2011). The role of PBC on intentions, knowledge donating, and knowledge collecting has gained substantial empirical support (Ajzen, 1991; Taylor & Todd, 1995; Pavlou & Fygenson, 2006). We thus propose:

H6. *PBC is positively related to online KSI.*

H7. *PBC is positively related to knowledge donating.*

H8. *PBC is positively related to knowledge collecting.*

According to TPB, KSI is the primary determinant of actual behavior for employees to carry out what they intend to do (Ajzen, 1991). In online knowledge sharing, online KSI is a motivational factor that indicates employees' readiness to engage in knowledge donating and knowledge collecting (Ajzen, 1991; Castaneda et al., 2016). Dawkins and Frass (2005) validated that KSI is a major significant antecedent of knowledge donating and knowledge collecting in the online knowledge sharing process. Tang et al. (2010) confirmed that KSI can be transformed to knowledge donating and knowledge collecting when employees want to be involved in organizational online knowledge sharing activities. Consistent with TPB, we hypothesize that:

H9. *KSI is positively related to knowledge donating.*

H10. *KSI is positively related to knowledge collecting.*

4. Research methodology

4.1. Sampling and data collection

The survey method and questionnaire techniques were employed to collect data based on previous studies (Durmusoglu et al., 2014; Cavaliere & Lombardi, 2015; Akhavan & Mahdi Hosseini, 2016). This study aimed to investigate employees who use online knowledge sharing systems in an organization. Regarding the industry selection, following other research (Kim & Lee, 2006; Tohidinia & Mosakhani, 2010), two criteria were considered: the importance of knowledge management practices, and appropriate information technology infrastructures for online knowledge sharing. Based on the suggestion of Akhavan and Mahdi Hosseini (2016) and Aulawi et al. (2009), we chose the tele-communication industry because it satisfied the two criteria under consideration. It is worth noting that the tele-communication industry in Vietnam is growing fast, offering a wide range of new products and services. Along with the change in information technology and the global business environment, the tele-communication

industry has to rationalize its products and services and has examined the use of knowledge management to ensure sustainable competitiveness.

The pilot test was conducted with 30 employees working in tele-communication companies in Vietnam. The results reported accepted reliabilities for the measures. The main survey was then conducted, and 559 responses were collected of which 501 were usable and 58 were invalid. Of the 501 usable respondents, 271 were male and 230 were female. The majority of respondents were under 41 years of age (87.8%) and had at least one university degree (86.1%). Most respondents had more than one year of experience in online knowledge sharing within an organization (99.2%) and had been working for a company with more than 100 employees (94.2%). Table 2 summarizes the demographic information. To ensure the appropriateness of datasets and the representativeness of the participants, the chi-square test and the nonresponse bias were assessed. The results showed there was no significant difference in the characteristics of the respondents.

Table 2
Demographic profile (N = 501)

Characteristics		Frequency	%
Gender	Male	271	54.1
	Female	230	45.9
Age	≤ 30	184	36.7
	31–40	256	51.1
	41–50	57	11.4
	>50	4	0.8
Education	High school and lower	4	0.8
		22	4.4
	Vocational school	44	8.8
	Technical college	352	70.3
	University	79	15.8
	Master's or higher		
Experience with online knowledge sharing in organizations	< 1 year	4	0.8
	1–3 years	145	29.0
	3–5 years	169	33.8
	> 5 years	183	36.4
Organization size	< 100 employees	29	5.8
	101–300 employees	219	43.7
	> 300 employees	253	50.5

4.2. Measurement

The questionnaire was designed to measure research constructs using multiple-item scales, which were adapted from previous studies that reported high statistical reliability and validity. Each item was evaluated on a seven-point Likert scale ranging from (1)

strongly disagree to (7) strongly agree. Perceived ease of use and perceived usefulness were measured using scales adapted from Hsu and Lin (2008). Items for measuring attitudes toward online knowledge sharing were based on Lin (2007a). The measure of subjective norms was based on Chuang et al. (2015), while items to assess PBC were adapted from Akhavan et al. (2015). The items knowledge donating and knowledge collecting were derived from Akhavan and Mahdi Hosseini (2016). All measurement items are present in the Appendix I.

The survey, originally in English, was translated into Vietnamese by two bilingual scholars of Vietnamese and English. Another bilingual scholar of Vietnamese and English translated it back into English to ensure a high degree of accuracy. A web-based questionnaire was developed using SurveyMonkey and a link to the questionnaire was sent to Vietnamese tele-communication companies. The respondents were informed that their participation was completely voluntary and their responses to the survey were anonymous and would be treated confidentially.

5. Data analysis and results

5.1. Measurement model

5.1.1. Content validity

Content validity refers to representativeness and comprehensiveness of the items that are used to create a scale (Bock & Kim, 2002). In this research, content validity was set through rigorous pre-testing. The definition of the constructs was built on TPB and TAM, as well as previous research using similar models.

5.1.2. Construct validity

Construct validity determines whether the chosen measures describe the true constructs (Straub, 1989). Following a similar approach to those of previous studies (Bock & Kim, 2002; Ryu et al., 2003; Lin & Lee, 2004), two aspects of construct validity needed to be tested— convergent and discriminant validity. To test convergent validity, the factor loading of each item of constructs, as well as composite reliability and average variance extracted (AVE) of the latent constructs, were assessed. Table 3 summarized the results of the measurement model fit. In particular, all factor loadings exceeded the recommended cut-off value of 0.5 (Straub, 1989), ranging from 0.69 to 0.97.

The internal consistency of the measurement model was assessed through Cronbach's alpha and composite reliability. The Cronbach's alpha values of measurements ranged from 0.81 to 0.96, exceeding the acceptable threshold of 0.70 (Nunnally, 1994). Regarding composite reliability, some different recommended values for a reliable construct were suggested. While Bagozzi and Yi (1988) recommend that 0.6 should be the cut-off value, Bock et al. (2005) and Ryu et al. (2003) stated that the recommenced values should be 0.7 and 0.8, respectively. In this research, even with the highest of the above recommended cut-off values (0.8), the composite reliability of all latent constructs also yielded higher values. The AVE of all constructs exceeded the threshold value of 0.5 (Fornell & Larcker, 1981), revealing good convergent validity.

Table 3
The results of the measurement model fit

Construct	Item	Mean	SD	Factor loading	Alpha	Composite reliability	AVE
Perceived ease of use (PEU)	PEU1	5.26	1.36	0.92	0.94	0.94	0.85
	PEU2	5.22	1.34	0.92			
	PEU3	5.29	1.31	0.92			
Perceived usefulness (PUS)	PUS1	5.35	1.31	0.94	0.96	0.96	0.86
	PUS2	5.34	1.32	0.94			
	PUS3	5.34	1.26	0.93			
	PUS4	5.32	1.33	0.91			
Attitudes toward knowledge sharing (ATT)	ATT1	5.31	1.39	0.87	0.94	0.94	0.80
	ATT2	5.29	1.41	0.93			
	ATT3	5.24	1.36	0.90			
	ATT4	5.29	1.43	0.88			
Subjective norms (SNO)	SNO1	5.17	1.33	0.92	0.96	0.96	0.84
	SNO2	5.13	1.37	0.92			
	SNO3	5.20	1.28	0.92			
	SNO4	5.19	1.33	0.91			
Perceived behavior control (PBC)	PBC1	4.81	1.45	0.76	0.89	0.89	0.67
	PBC2	4.93	1.45	0.84			
	PBC3	4.78	1.52	0.77			
	PBC4	5.00	1.39	0.89			
Knowledge sharing intentions (KSI)	KSI1	5.27	1.33	0.97	0.96	0.96	0.87
	KSI2	5.22	1.35	0.93			
	KSI3	5.26	1.37	0.93			
	KSI4	5.38	1.32	0.89			
Knowledge donating (KDO)	KDO1	5.32	1.43	0.93	0.94	0.94	0.80
	KDO2	5.30	1.49	0.93			
	KDO3	5.28	1.43	0.89			
Knowledge collecting (KCO)	KCO1	5.11	1.37	0.89	0.81	0.80	0.58
	KCO2	4.95	1.52	0.69			
	KCO3	4.90	1.58	0.69			

For discriminant validity, Table 4 shows that the square root of the AVE values (in bold) were larger than the inter-construct correlations, thus demonstrating acceptable discriminant validity (Fornell & Larcker, 1981). Regarding common method bias, Harman's one-factor test was assessed. All items were entered into an exploratory factor analysis. If a single factor accounts for the majority of the variance in the model, it is concluded that a substantial amount of common method variance is present (Harman, 1976; Mattila & Enz, 2002). The results showed that no single factor accounted for more than 50 per cent of variance; thus, common method bias was not an issue in this study. Regarding the extent of multicollinearity, variance inflation factor scores of all constructs were well below the threshold of 3.3 recommended by Bharati et al. (2015), ranging from 1.98 to 2.74. These results indicated the absence of multicollinearity.

Table 4
Correlation and AVE

	PEU	PUS	ATT	SNO	PBC	KSI	KDO	KCO
PEU	0.92							
PUS	0.80	0.93						
ATT	0.75	0.77	0.90					
SNO	0.69	0.77	0.72	0.92				
PBC	0.68	0.73	0.72	0.65	0.82			
KSI	0.70	0.75	0.76	0.82	0.70	0.93		
KDO	0.74	0.69	0.80	0.70	0.67	0.67	0.92	
KCO	0.73	0.82	0.75	0.73	0.64	0.78	0.59	0.76

Note. PEU = perceived ease of use; PUS = perceived usefulness; ATT = attitudes toward knowledge sharing; SNO = subjective norms; PBC = perceived behavior control; KSI = knowledge sharing intentions; KDO = knowledge donating; and KCO = knowledge collecting. The bold numbers in the diagonal row are the square roots of AVE.

Table 5
The results of the PLS-SEM

	Hypothesized relationship	Estimate of coefficient (standardized)	p-value	Conclusion
H1	PEU → ATT	0.39	***	Supported
H2	PEU → PUS	0.80	***	Supported
H3	PUS → ATT	0.46	***	Supported
H4	ATT → KSI	0.25	***	Supported
H5	SNO → KSI	0.52	***	Supported
H6	PBC → KSI	0.19	***	Supported
H7	PBC → KDO	0.40	***	Supported
H8	PBC → KCO	0.19	**	Supported
H9	KSI → KDO	0.39	***	Supported
H10	KSI → KCO	0.64	***	Supported

Note. **p< 0.01, ***p<0.001; PEU = perceived ease of use; PUS = perceived usefulness; ATT = attitudes toward knowledge sharing; SNO = subjective norms; PBC = perceived behavior control; KSI = knowledge sharing intentions; KDO = knowledge donating; and KCO = knowledge collecting.

5.2. Structural model

In order to examine the causal relationships among the remaining latent variables, the theoretical model was tested using the partial least squares-structural equation modeling method (PLS-SEM) using smartPLS 3.0. The PLS-SEM is an increasingly popular statistical procedure, which is now considered to be more rigorous and appropriate in comparison to traditional structural equation modeling methods (Hair et al., 2014). The PLS-SEM results are summarized in Table 5. The resultant R-squared (R^2) and adjusted R-squared (adjusted R^2) for attitudes toward knowledge sharing, KSI, knowledge

donating, and knowledge collecting were more than 50 percent, suggesting that the integration of TAM and TPB is capable of explaining a relatively high proportion of variation in online knowledge sharing behavior (Hair et al., 2014).

As shown in Fig. 4, Table 5, both perceived ease of use and perceived usefulness were found to have a significant effect on attitudes toward knowledge sharing ($\beta_{\text{elf-perceived ease of use}}$=0.39, p<0.001; $\beta_{\text{perceived usefulness}}$=0.46, p<0.001); thus, H1 and H3 were supported. Perceived ease of use also was found to be significantly influential on perceived usefulness (β=0.80, p<0.001); thus, H2 was supported. Attitudes toward knowledge sharing (β=0.25, p<0.001), subjective norms (β=0.52, p<0.001), and PBC (β=0.19, p<0.001) had significant and positive effect on KSI; therefore, H4, H5, and H6 were supported. PBC positively affected knowledge donating (β=0.40, p<0.001) and knowledge collecting (β=0.19, p<0.01); thus, H7 and H8 were supported. The results also show that there was a significantly positive influence from KSI on knowledge donating (β=0.39, p<0.001) and on knowledge collecting (β=0.64, p<0.001); thus, H9 and H10 were supported.
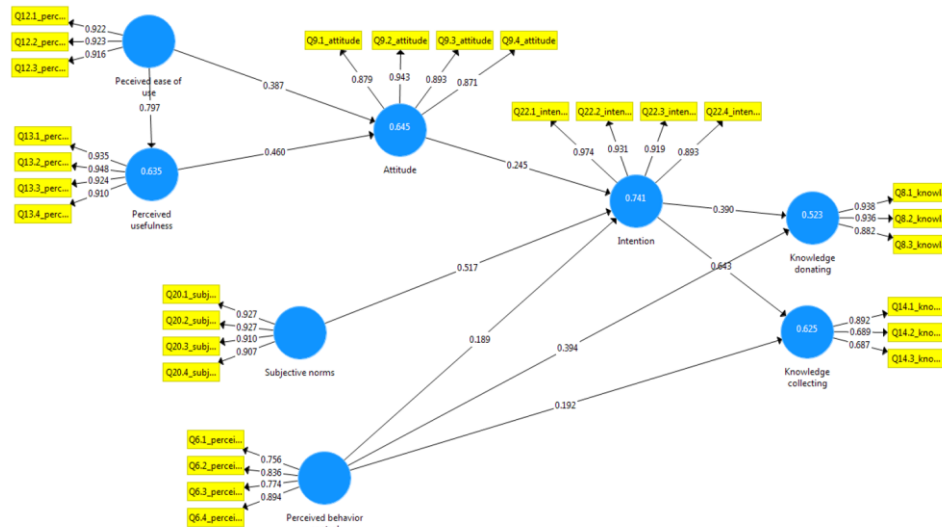

Fig. 4. Results of the structure model

6.   Discussion and implications

6.1. Discussion

This study provides a firm basis of understanding as to what triggers employees to engage in online knowledge sharing in organizations. Online knowledge sharing involves information technology system usage and knowledge sharing behavior. While TAM can explain why employees use an information system, TPB can explain why employees share knowledge online. The Integration of TAM and TPB provides a more comprehensive picture to understand the adoption of online knowledge sharing in organizations. Overall, the results indicate a strong power of the integrated model of TAM and TPB in predicting online knowledge sharing behavior. Specifically, the results suggest that perceived ease of use and perceived usefulness have a significant effect on

attitudes toward online knowledge sharing. Moreover, perceived ease of use has an indirect effect, via perceived usefulness, on attitudes toward online knowledge sharing. This result supports the findings of Davis (1989). The resultant coefficients indicate that attitudes toward knowledge sharing, subjective norms, and PBC have a positive effect on KSI, supporting Ajzen's TPB (Ajzen, 1991). The results show that subjective norms have the strongest effect on KSI, followed by attitudes and then PBC. The results are consistent with prior research results on knowledge sharing using TPB (Lin & Lee, 2004; Safa & Von Solms, 2016). Ryu et al. (2003) and Chatzoglou and Vraimaki (2009) also found positive relationships among these variables. However, the direct effect of subjective norms on KSI is the strongest, followed by attitudes and, then, PBC. These variances do not contradict TPB. As Ajzen (1991) explains, in different situations, the relative importance of the three predictors of KSI is expected to be different. The integration of TAM and TPB is empirically investigated in organizational online knowledge sharing in this study. The results advance the literature by confirming the necessity to integrate TAM and TPB in the context where both information technology system usage and knowledge sharing behavior are concerned. Besides, the findings of the study also indicate that two dimensions of knowledge sharing behavior, knowledge donating and knowledge collecting, should be examined separately, because the impacts of other factors, including KSI and PBC, are different. H9 and H10 examined the relationship between KSI and knowledge donating and between KSI and knowledge collecting. These hypotheses proposed that employees' KSI has a positive effect on knowledge donating and knowledge collecting. The path coefficients (0.39 and 0.64, respectively) indicated a medium positive relationship between KSI and knowledge donating and a strong positive relationship between KSI and knowledge collecting. The results are consistent with the recommendations of Ajzen (1991).

H7 and H8, on the other hand, proposed a positive influence of PBC on knowledge donating and knowledge collecting. The resultant coefficient showed a medium direct effect (0.39) of PBC on knowledge donating and a weak direct effect (0.19) of PBC on knowledge collecting. Furthermore, these results are in line with the findings of Ajzen (1991), because TPB suggests that PBC can be used directly and indirectly through KSI for the prediction of behavioral achievement (Ajzen, 1991).

This study supports the findings of previous studies such as that by Akhavan et al. (2015), which examine knowledge sharing behavior as only one construct, to indicate that both intentions and PBC are very important to knowledge sharing behavior. However, the present study goes beyond that by examining two dimensions of knowledge sharing behavior, knowledge donating and knowledge collecting, in a single study context. The results show that in comparison with the effect of KSI, the effect of PBC on knowledge donating is weaker, whereas the opposite is true for knowledge collecting. Although both PBC and attitudes make a significant contribution to the prediction of knowledge sharing behavior, the weight of their important roles in knowledge donating and knowledge collecting is different. Thus, when examining online knowledge sharing behavior, it is also necessary to investigate the two dimensions, knowledge donating and knowledge collecting.

6.2. Implications

6.2.1. Implications for theory

In terms of theory building, this study attempts to integrate two grounding theories, TPB and TAM, and apply them into a new context, online knowledge sharing in organizations. This approach makes an important contribution to the emerging literature about online knowledge sharing, in particular in organizational online knowledge sharing. The present study has many implications for future online knowledge sharing in organizations. First, this is the first time that the integration of TAM and TPB is empirically examined in online knowledge sharing in organizations and has a good explanatory power. A more comprehensive picture was provided to bring new insights into understanding knowledge sharing behavior. This result lays the basis for the integration of other theories, such as the social cognitive theory into TAM or TPB.

Second, although knowledge sharing behavior in online knowledge sharing has been studied by a number of researchers (Jeon et al., 2011; Wu & Zhu, 2012; Akhavan et al., 2015), the knowledge sharing behaivor variable has only been modeled as a single construct, which fails to reflect the true characteristics of knowledge sharing. This study examines the two distinctive online knowledge sharing behaviors, knowledge donating and knowledge collecting, consequently providing a more in-depth understanding of online knowledge sharing in organizations. The results of this study also show significantly different effects of PBC and KSI on knowledge donating and knowledge collecting. Thus, this study provides additional insight into the importance of examining knowledge donating and knowledge collecting in a single study context and recommends further investigation of these two dimensions of knowledge sharing behavior in future research.

Third, TAM and TPB have been examined in knowledge sharing but few studies have examined them in organizational online knowledge sharing, in particular TAM. Empirically examining the integration of TAM and TPB in organizational online knowledge sharing, in particular in an emerging economy such as Vietnam, significantly contributes to the literature because it shows the power of both TAM and TPB in explaining individual psychology underlying knowledge sharing behavior.

6.2.2. Implications for practice

Based on the research findings, the following suggestion could be considered by organizations that hope to maintain a competitive advantage through improving online knowledge sharing. First, a positive attitude toward online knowledge sharing is formed by perceived ease of use and perceived usefulness. This finding is particularly important for managers when making decisions about how to allocate resources to encourage employees to engage in online knowledge sharing in organizations, through improving perceived ease of use and perceived usefulness. Regarding perceived ease of use, in the planning and development of online knowledge sharing, software developers should focus on user-friendly display and functions and extend key features that are frequently required (Chen et al., 2007). Managers should also consider organizing training courses to improve competency in using online knowledge sharing systems.

Regarding perceived usefulness, managers could organize meetings to share the benefits of online knowledge sharing to improve employees' job performance and productivity. Hsu and Lin (2008) argued that if employees understand the usefulness of

online knowledge sharing, and believe that online knowledge sharing can help their personal development and career progression and improve job performance, they will have a positive attitude toward online knowledge sharing. Changing employees' recognition of online knowledge sharing is more effective than incorporating sophisticated incentive and evaluation systems into knowledge management initiatives (Bock & Kim, 2002; Bock et al., 2005). Managers should remind employees that sharing their knowledge online is a form of contribution to the organization. It needs to be stressed that organizations should include their knowledge sharing strategies in corporate strategies (Lin & Lee, 2004) to increase awareness of the importance of knowledge sharing behavior. Since attitudes, subjective norms, and PBC were found to affect employees' KSI, organizational efforts should encourage the creation of a favourable environment that can positively influence those factors. To establish such an environment, several cultural factors, including professional autonomy, cohesiveness, and communication structure should be promoted (Ryu et al., 2003). Consequently, mutual social relationships among employees can be cultivated. Furthermore, managers should provide appropriate feedback to employees because these actions are closely related to social pressure to encourage employees to share knowledge online (Bock et al., 2005). In addition, managers should make employees feel that online knowledge sharing is under their control. Valuable knowledge often resides in employees' brain and online knowledge sharing is voluntary. Online knowledge sharing is effective only when employees engage in the knowledge sharing process.

7. Limitations and suggestions for further research

7.1. Limitations

First, the present study is solely concerned with a particular sector, tele-communications; thus, the results may not be generalizable to other sectors. Second, the data collection was conducted in Vietnam; consequently, due to the influence of cultural factors, which may characterize the sample under investigation, similar results cannot be guaranteed when examining the same sector in other counties. For further validity, the research should be conducted in different industries and in different countries (Bock et al., 2005). Third, the present study does not take into account other factors that may impede knowledge sharing, such as time availability, cognitive barriers, and status hierarchies (Bock et al., 2005). Moreover, the present model does not examine the possible moderating role of education and work experience (Constant et al., 1994) or gender (Connelly & Kelloway, 2003) on online knowledge sharing. Finally, all variables were measured using self-report scales. Previous researchers (Bock & Kim, 2002) recommended that more direct and objective measures should be developed to gain higher accuracy and validity of the conceptual model.

7.2. Suggestions for further research

Based on the limitations of the study, future researchers should examine the conceptual model in other industries and other countries with different national cultures. The potential differences of online knowledge sharing between employees in the private and public sectors, or in the different hierarchical levels of organizations, should also be examined. Additionally, to improve the exploratory power of the research model, more factors should be examined such as leadership style and task structure (Ryu et al., 2003) or barriers (Akhavan et al., 2015). At the same time, the role of intrinsic and extrinsic

motivation should be further explored, because contradictory results exist in previous studies (Chatzoglou & Vraimaki, 2009). Finally, since this is a cross-sectional study, future scholars should consider conducting a longitudinal research to deepen understanding of online knowledge sharing in organizations.

8.   Conclusion

One of the main contributions of this study is that it is the first to explore online knowledge sharing behavior in organizations using a research model underpinned by two widely accepted social psychology theories, namely TAM and TPB. Since previous studies (Bock et al., 2005; Chow & Chan, 2008; Cho et al., 2010; Tohidinia & Mosakhani, 2010; Huang et al., 2011; Lai & Chen, 2014) focused more on the investigation of KSI, this research is also among a limited number of studies to examine employees' two types of knowledge sharing behavior; knowledge donating and knowledge collecting. This research also contributes to the literature by testing the direct effect of PBC on online knowledge sharing behavior, which although suggested by theory, was often not investigated in other research models (Chatzoglou & Vraimaki, 2009). Furthermore, this study has brought new insights in knowledge sharing behavior in a specific professional group, telecommunication employees in Vietnam.

ORCID

Tuyet-Mai Nguyen https://orcid.org/0000-0002-4889-589X

Van Toan Dinh https://orcid.org/0000-0001-5586-471X

Phong Tuan Nham https://orcid.org/0000-0002-0973-3943

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, New Jersey: Prentice-Hall.

Akhavan, P., Hosseini, S. M., Abbasi, M., & Manteghi, M. (2015). Knowledge-sharing determinants, behaviors, and innovative work behaviors: An integrated theoretical view and empirical examination. *Aslib Journal of Information Management, 67*(5), 562–591.

Akhavan, P., Jafari, M., & Fathian, M. (2005). Exploring the failure factors of implementing knowledge management system in the organizations. *Journal of Knowledge Management Practice, 6*.

Akhavan, P., & Mahdi Hosseini, S. (2016). Social capital, knowledge sharing, and innovation capability: An empirical study of R&D teams in Iran. *Technology Analysis & Strategic Management, 28*(1), 96–113.

Ali, I., Ali, M., Badghish, S., & Baazeem, T. A. S. (2018). Examining the role of childhood experiences in developing altruistic and knowledge sharing behaviors among children in their later life: A partial least squares (PLS) path modeling approach. *Sustainability, 10*(2). doi: 10.3390/su10020292

Ardichvili, A., Page, V., & Wentling, T. (2003). Motivation and barriers to participation in virtual knowledge-sharing communities of practice. *Journal of Knowledge*

Management, 7(1), 64–77.

Arora, S., & Sahney, S. (2018). Antecedents to consumer's showrooming behavior: An integrated TAM-TPB framework. *Journal of Consumer Marketing, 35*(4), 438–450.

Aulawi, H., Sudirman, I., Suryadi, K., & Govindaraju, R. (2009). Knowledge sharing behavior, antecedent and their impact on the individual innovation capability. *Journal of Applied Sciences Research, 5*(12), 2238–2246.

Awa, H. O., Ojiabo, O. U., & Emecheta, B. C. (2015). Integrating TAM, TPB and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs. *Journal of Science and Technology Policy Management, 6*(1), 76–94.

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science, 16*(1), 74–94.

Bharati, P., Zhang, W., & Chaudhury, A. (2015). Better knowledge with social media? Exploring the roles of social capital and organizational knowledge management. *Journal of Knowledge Management, 19*(3), 456–475.

Bock, G. W., & Kim, Y. G. (2002). Breaking the myths of rewards: An exploratory study of attitudes about knowledge sharing. *Information Resources Management Journal, 15*(2), 14–21.

Bock, G. W., Zmud, R. W., Kim, Y. G., & Lee, J. N. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS Quarterly, 9*(1), 87–111.

Bosnjak, M., Obermeier, D., & Tuten, T. L. (2006). Predicting and explaining the propensity to bid in online auctions: A comparison of two action-theoretical models. *Journal of Consumer Behavior, 5*(2), 102–116.

Brown, S. A., & Venkatesh, V. (2005). Model of adoption of technology in households: A baseline model test and extension incorporating household life cycle. *MIS Quarterly, 29*(3), 399–426.

Casimir, G., Ng, Y. N. Y., & Cheng, C. L. P. (2012). Using IT to share knowledge and the TRA. *Journal of Knowledge Management, 16*(3), 461–479.

Castaneda, D. I., & Durán, W. F. (2018). Knowledge sharing in organizations: Roles of beliefs, training, and perceived organizational support. *Knowledge Management & E-Learning, 10*(2), 148–162.

Castaneda, D. I., Ríos, M. F., & Durán, W. F. (2016). Determinants of knowledge-sharing intention and knowledge-sharing behavior in a public organization. *Knowledge Management & E-Learning, 8*(2), 372–386.

Cavaliere, V., & Lombardi, S. (2015). Exploring different cultural configurations: How do they affect subsidiaries' knowledge sharing behaviors? *Journal of Knowledge Management, 19*(2), 141–163.

Chatzoglou, P. D., & Vraimaki, E. (2009). Knowledge-sharing behavior of bank employees in Greece. *Business Process Management Journal, 15*(2), 245–266.

Chau, P. Y. K. (1996). An empirical assessment of a modified technology acceptance model. *Journal of Management Information Systems, 13*(2), 185–204.

Chen, C. C. (2011). Factors affecting high school teachers' knowledge-sharing behaviors. *Social Behavior and Personality, 39*(7), 993–1008.

Chen, C.-D., Fan, Y.-W., & Farn, C.-K. (2007). Predicting electronic toll collection service adoption: An integration of the technology acceptance model and the theory of planned behavior. *Transportation Research Part C, 15*(5), 300–311.

Chen, I. Y. L., Chen, N. S., & Kinshuk. (2009). Examining the factors influencing participants' knowledge sharing behavior in virtual learning communities. *Educational Technology & Society, 12*(1), 134–148.

Chin, W. W., & Todd, P. A. (1995). On the use, usefulness, and ease of use of structural equation modeling in MIS research: a note of caution. *MIS Quarterly, 19*(2), 237–246.

Chiu, C. M., Lin, H. Y., Sun, S. Y., & Hsu, M. H. (2009). Understanding customers' loyalty intentions towards online shopping: An integration of technology acceptance model and fairness theory. *Behavior & Information Technology, 28*(4), 347–360.

Cho, H., Chen, M. H., & Chung, S. (2010). Testing an integrative theoretical model of knowledge-sharing behavior in the context of Wikipedia. *Journal of the American Society for Information Science and Technology, 61*(6), 1198–1212.

Chow, W. S., & Chan, L. S. (2008). Social network, social trust and shared goals in organizational knowledge sharing. *Information & Management, 45*(7), 458–465.

Chuang, S. S., Chen, K. S., & Tsai, M. T. (2015). Exploring the antecedents that influence middle management employees' knowledge-sharing intentions in the context of total quality management implementations. *Total Quality Management & Business Excellence, 26*(1/2), 108–122.

Connelly, C. E., & Kelloway, E. K. (2003). Predictors of employees' perceptions of knowledge sharing cultures. *Leadership & Organization Development Journal, 24*(5), 294–301.

Constant, D., Kiesler, S., & Sproull, L. (1994). What's mine is ours, or is it? A study of attitudes about information sharing. *Information Systems Research, 5*(4), 400–421.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982–1003.

Dawkins, C. E., & Frass, J. W. (2005). Decision of union workers to participate in employee involvement: An application of the theory of planned behavior. *Employee Relations, 27*(5), 511–531.

De Vries, R. E., Van den Hooff, B., & de Ridder, J. A. (2006). Explaining knowledge sharing the role of team communication styles, job satisfaction, and performance beliefs. *Communication Research, 33*(2), 115–135.

Devaraj, S., Fan, M., & Kohli, R. (2002). Antecedents of B2C channel satisfaction and preference: Validating e-commerce metrics. *Information Systems Research, 13*(3), 316–333.

Durmusoglu, S., Jacobs, M., Zamantili Nayir, D., Khilji, S., & Wang, X. (2014). The quasi-moderating role of organizational culture in the relationship between rewards and knowledge shared and gained. *Journal of Knowledge Management, 18*(1), 19–37.

Fauzi, M. A., Tan, C. N.-L., & Ramayah, T. (2018). Knowledge sharing intention at Malaysian higher learning institutions: The academics' viewpoint. *Knowledge Management & E-Learning, 10*(2), 163–176.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50.

Gefen, D., & Straub, D. (2003). Managing user trust in B2C e-services. *E-service Journal, 2*(2), 7–24.

Gefen, D., & Straub, D. W. (1997). Gender differences in the perception and use of e-mail: An extension to the technology acceptance model. *MIS Quarterly, 21*(4), 389–400.

Gefen, D., & Straub, D. W. (2000). The relative importance of perceived ease of use in IS adoption: A study of e-commerce adoption. *Journal of the Association for Information Systems, 1*: 8.

Grant, R. M. (1996). Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. *Organization Science, 7*(4), 375–387.

Guriting, P., & Oly Ndubisi, N. (2006). Borneo online banking: Evaluating customer

perceptions and behavioral intention. *Management Research News, 29*(1/2), 6–15.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis* (7th ed.). Harlow, Essex: Pearson Education Limited.

Han, J. (2017). Technology commercialization through sustainable knowledge sharing from university-industry collaborations, with a focus on patent propensity. *Sustainability, 9*(10). doi: 10.3390/su9101808

Harman, H. H. (1976). *Modern factor analysis* (3rd ed.). Chicago, IL: University of Chicago Press.

Ho, S. C., Ting, P. H., Bau, D. Y., & Wei, C. C. (2011). Knowledge-sharing intention in a virtual community: A study of participants in the chinese wikipedia. *Cyberpsychology, Behavior, and Social Networking, 14*(9), 541–545.

Hsu, C. L., & Lin, J. C. C. (2008). Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. *Information & Management, 45*(1), 65–74.

Huang, Q., Davison, R. M., & Gu, J. (2011). The impact of trust, guanxi orientation and face on the intention of Chinese employees and managers to engage in peer-to-peer tacit and explicit knowledge sharing. *Information Systems Journal, 21*(6), 557–577.

Hung, S. W., & Cheng, M. J. (2013). Are you ready for knowledge sharing? An empirical study of virtual communities. *Computers & Education, 62*, 8–17.

Hung, S. Y., Lai, H. M., & Chou, Y. C. (2015). Knowledge-sharing intention in professional virtual communities: A comparison between posters and lurkers. *Journal of the Association for Information Science and Technology, 66*(12), 2494–2510.

Hutchings, K., & Michailova, S. (2004). Facilitating knowledge sharing in Russian and Chinese subsidiaries: The role of personal networks and group membership. *Journal of Knowledge Management, 8*(2), 84–94.

Ibragimova, B., Ryan, S. D., Windsor, J. C., & Prybutok, V. R. (2012). Understanding the antecedents of knowledge sharing: An organizational justice perspective. *Informing Science: The International Journal of an Emerging Transdiscipline, 15*, 183–205.

Igbaria, M., Guimaraes, T., & Davis, G. B. (1995). Testing the determinants of microcomputer usage via a structural equation model. *Journal of Management Information Systems, 11*(4), 87–114.

Islam, M. S., & Ashif, S. M. (2014). An exploratory study on knowledge sharing practices among professionals in Bangladesh. *Knowledge Management & E-Learning, 6*(3), 332–343.

Jeon, S., Kim, Y. G., & Koh, J. (2011). An integrative model for knowledge sharing in communities-of-practice. *Journal of Knowledge Management, 15*(2), 251–269.

Kahlor, L. A., Dudo, A., Liang, M.-C., Lazard, A. J., & AbiGhannam, N. (2016). Ethics information seeking and sharing among scientists: The case of nanotechnology. *Science Communication, 38*(1), 74–98.

Kankanhalli, A., Bernard, C. Y. T., & Wei, K.-K. (2005). Contributing knowledge to electronic knowledge repositories: An empirical investigation. *MIS Quarterly, 29*(1), 113–143.

Kim, S., & Lee, H. (2006). The impact of organizational context and information technology on employee knowledge-sharing capabilities. *Public Administration Review, 66*(3), 370–385.

Kim, W., & Park, J. (2017). Examining structural relationships between work engagement, organizational procedural justice, knowledge sharing, and innovative work behavior for sustainable organizations. *Sustainability, 9*(2). doi: 10.3390/su9020205

Krasnova, H., Spiekermann, S., Koroleva, K., & Hildebrand, T. (2010). Online social

networks: Why we disclose. *Journal of Information Technology, 25*(2), 109–125.

Lai, H. M., & Chen, T. T. (2014). Knowledge sharing in interest online communities: A comparison of posters and lurkers. *Computers in Human Behavior, 35*, 295–306.

Lee, M. C. (2009). Predicting and explaining the adoption of online trading: An empirical study in Taiwan. *Decision Support Systems, 47*(2), 133–142.

Levy, M. (2009). WEB 2.0 implications on knowledge management. *Journal of Knowledge Management, 13*(1), 120–134.

Lin, H. F. (2007a). Effects of extrinsic and intrinsic motivation on employee knowledge sharing intentions. *Journal of Information Science, 33*(2), 135–149.

Lin, H. F. (2007b). Knowledge sharing and firm innovation capability: An empirical study. *International Journal of Manpower, 28*(3/4), 315–332.

Lin, H. F., & Lee, G. G. (2004). Perceptions of senior managers toward knowledge-sharing behavior. *Management Decision, 42*(1), 108–125.

Mahmood, A., Qureshi, M. A., & Shahbaz, Q. (2011). An examination of the quality of tacit knowledge sharing through the theory of reasoned action. *Journal of Quality and Technology Management, 7*(1), 39–55.

Malhotra, Y., & Galletta, D. F. (2004). Building systems that users want to use. *Communications of the ACM, 47*(12), 89–94.

Mattila, A. S., & Enz, C. A. (2002). The role of emotions in service encounters. *Journal of Service Research, 4*(4), 268–277.

McKechnie, S., Winklhofer, H., & Ennew, C. (2006). Applying the technology acceptance model to the online retailing of financial services. *International Journal of Retail & Distribution Management, 34*(4/5), 388–410.

Najam, U., Inam, A., Awan, H. M., & Abbas, M. (2018). The interactive role of temporal team leadership in the telecom sector of Pakistan: Utilizing temporal diversity for sustainable knowledge sharing. *Sustainability, 10*(5). doi: 10.3390/su10051309

Ndubisi, N. O., Gupta, O. K., & Massoud, S. (2003). Organizational learning and vendor support quality by the usage of application software packages: A study of Asian entrepreneurs. *Journal of Systems Science and Systems Engineering, 12*(3), 314–331.

Nunnally, J. C. (1994). *Psychometric theory* (3rd ed.). New York, NY: McGraw-Hill.

Othman, F. A. A., & Sohaib, O. (2016). Enhancing innovative capability and sustainability of Saudi firms. *Sustainability, 8*(12). doi: 10.3390/su8121229

Papadopoulos, T., Stamati, T., & Nopparuch, P. (2012). Exploring the determinants of knowledge sharing via employee weblogs. *International Journal of Information Management, 33*(1), 133–146.

Paroutis, S., & Al Saleh, A. (2009). Determinants of knowledge sharing using Web 2.0 technologies. *Journal of Knowledge Management, 13*(4), 52–63.

Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce, 7*(3), 101–134.

Pavlou, P. A., & Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior. *MIS Quarterly, 30*(1), 115–143.

Pavlou, P. A., Liang, H., & Xue, Y. (2007). Understanding and mitigating uncertainty in online exchange relationships: A principal-agent perspective. *MIS Quarterly, 31*(1), 105–136.

Ramayah, T., & Suki, N. M. (2006). Intention to use mobile PC among MBA students: Implications for technology integration in the learning curriculum. *UNITAR e-Journal, 2*(2), 30–39.

Ryu, S., Ho, S. H., & Han, I. (2003). Knowledge sharing behavior of physicians in hospitals. *Expert Systems with Applications, 25*(1), 113–122.

Safa, N. S., & Von Solms, R. (2016). An information security knowledge sharing model

in organizations. *Computers in Human Behavior, 57*, 442–451.

Schau, H. J., & Gilly, M. C. (2003). We are what we post? Self-presentation in personal web space. *Journal of Consumer Research, 30*(3), 385–404.

Shiau, W. L., & Chau, P. Y. K. (2016). Understanding behavioral intention to use a cloud computing classroom: A multiple model comparison approach. *Information & Management, 53*(3), 355–365.

So, J. C. F., & Bolloju, N. (2005). Explaining the intentions to share and reuse knowledge in the context of IT service operations. *Journal of Knowledge Management, 9*(6), 30–41.

Straub, D. W. (1989). Validating instruments in MIS research. *MIS Quarterly, 13*(2), 147–169.

Suppiah, V., & Sandhu, M. S. (2011). Organizational culture's influence on tacit knowledge-sharing behavior. *Journal of Knowledge Management, 15*(3), 462–477.

Tang, Z., Chen, X., & Wu, Z. (2010). Using behavior theory to investigate individual-level determinants of employee involvement in TQM. *Total Quality Management & Business Excellence, 21*(12), 1231–1260.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research, 6*(2), 144–176.

Teh, P.-L., & Yong, C.-C. (2011). Knowledge sharing in IS personnel: Organizational behavior's perspective. *Journal of Computer Information Systems, 51*(4), 11–21.

Tohidinia, Z., & Mosakhani, M. (2010). Knowledge sharing behavior and its predictors. *Industrial Management & Data Systems, 110*(4), 611–631.

Ullah, I., Akhtar, K. M., Shahzadi, I., Farooq, M., & Yasmin, R. (2016). Encouraging knowledge sharing behavior through team innovation climate, altruistic intention and organizational culture. *Knowledge Management & E-Learning, 8*(4), 628–645.

Van den Hooff, B., & de Leeuw van Weenen, F. (2004). Committed to share: Commitment and CMC use as antecedents of knowledge sharing. *Knowledge and Process Management, 11*(1), 13–24.

Van den Hooff, B., & de Ridder, J. A. (2004). Knowledge sharing in context: The influence of organizational commitment, communication climate and CMC use on knowledge sharing. *Journal of Knowledge Management, 8*(6), 117–130.

Van den Hooff, B., Schouten, A. P., & Simonovski, S. (2012). What one feels and what one knows: The influence of emotions on attitudes and intentions towards knowledge sharing. *Journal of Knowledge Management, 16*(1), 148–158.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186–204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478.

Wang, S. M., & Lin, J. C.-C. (2011). The effect of social influence on bloggers' usage intention. *Online Information Review, 35*(1), 50–65.

Wu, L., Li, J. Y., & Fu, C. Y. (2011). The adoption of mobile healthcare by hospital's professionals: An integrative perspective. *Decision Support Systems, 51*(3), 587–596.

Wu, Y., & Zhu, W. (2012). An integrated theoretical model for determinants of knowledge sharing behaviors. *Kybernetes, 41*(10), 1462–1482.

Yu, J., Ha, I., Choi, M., & Rho, J. (2005). Extending the TAM for a t-commerce. *Information & Management, 42*(7), 965–976.

Zheng, J., Wu, G., & Xie, H. (2017). Impacts of leadership on project-based organizational innovation performance: The mediator of knowledge sharing and moderator of social capital. *Sustainability, 9*(10). doi: 10.3390/su9101893

Appendix I

Questionnaire items and measurement analysis

Measurement scales

Perceived ease of use, Source: Hsu and Lin (2008)

PEU1	I find online knowledge sharing systems in organizations to be flexible to interact with.
PEU2	Learning to operate online knowledge sharing systems in organizations is easy.
PEU3	Online knowledge sharing systems in organizations is easy to use.

Perceived usefulness, Source: Hsu and Lin (2008)

Using the online systems in organizations to share knowledge enables me to…

PUS1	accomplish my work more quickly
PUS2	improve my work performance
PUS3	enhance my work effectiveness
PUS4	increase my productivity when performing my work

Attitudes toward knowledge sharing, Source: Lin (2007a)

My online knowledge sharing with other colleagues is…

ATT1	very pleasant
ATT2	very good
ATT3	very valuable
ATT4	very beneficial

Subjective norms, Source: Chuang et al. (2015)

SNO1	My CEO thinks that I should share my knowledge online with other colleagues in the organization.
SNO2	My boss thinks that I should share my knowledge online with other colleagues in the organization.
SNO3	My colleagues think that I should share my knowledge online with other colleagues in the organization.
SNO4	Generally speaking, I try to follow the CEO's policy and intentions.

Perceived behavior control, Source: Akhavan et al. (2015)

PBC1	I have enough time available to share knowledge online with my colleagues.
PBC2	I have the necessary tools to share knowledge online with my colleagues.
PBC3	I have the ability to share knowledge with my colleagues.
PBC4	Sharing knowledge online with my colleagues is within my control.

Knowledge sharing intentions, Source: Lin (2007a)

KSI1	I intend to share knowledge online with my colleagues more frequently in the future.
KSI2	I will try to share knowledge online with my colleagues.
KSI3	I will always make an effort to share knowledge online with my colleagues.
KSI4	I intend to share knowledge online with colleagues who ask.

Knowledge donating, Source: Akhavan and Mahdi Hosseini (2016)

KDO1	I share my information, skills, and experiences with my colleagues.

KDO2	When I have learned something new, I tell my colleagues about it.
KDO3	Knowledge sharing among my colleagues is considered normal.

Knowledge collecting, Source: Akhavan and Mahdi Hosseini (2016)

KCO1	I only share knowledge when my colleagues ask for it.
KCO2	When I need new information or skills, I will ask my colleagues.
KCO3	When one of my colleagues is good at something, I ask him/her to teach me how to do that thing.