Knowledge sharing and innovation capability at both individual and organizational levels: An empirical study from Vietnam's telecommunication companies

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Abstract. *This paper aims at investigating the relationship between knowledge sharing activities and innovation capability at both individual and organizational levels. By reviewing extensive literature, a conceptual framework is built with integrating three factors: knowledge sharing, individual innovation capability and firm innovation capability. This study applies structural equation modeling (SEM) to analyze the data collected from 392 employees working at major Vietnam's telecommunication companies. Empirical results show that knowledge sharing including knowledge donating, knowledge collecting play an important role in improving individual innovation capability. There is no direct link between knowledge collecting and organizational innovation capability, while knowledge donating has direct positive impact on product and managerial innovation. Furthermore, the individual innovation capability acts as a mediating variable between knowledge sharing practices and firm innovation capability. Implications for academics and practitioners are provided in this study.*

Keywords: *knowledge sharing, knowledge donating, knowledge collecting, firm innovation capability, individual innovation capability.*

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Introduction

In the global and competitive market today, organizations always try to utilize their resources to be productive, effective and gaining competitive advantage over rivals. Besides, due to the unpredictable technology change every day that leads to unexpected demand of customers, organizations regardless of which industry they are operating in need to be responsive to the change in order to meet customers' requirement. To do that, innovation plays an important role that brings organization strategic advantages through quality improvement, new product and services development, cost reduction as well as differentiation (Yeşil et al., 2013). Applying effective innovation in organization allow the firm to achieve sustainable growth (Göğüş et al., 2013). Furthermore, firms all over the world are converging into same level of many aspects such as operations, marketing, human resources management, organizations are trying to build strong innovation capability because it is difficult for competitors to imitate and it is one of key factors that drive firm performance (Harrison & Samaon, 2002). Therefore, many researchers have paid attention to find out which factors to enable innovation capability of employees as well as organization as a whole.

Telecommunication industry in Vietnam has been experiencing a long time of saturation. Over the past ten years, revenue of telecom industry is still growing because number of subscribers increase. However, higher number of emerging local telecom businesses are driving market competition. The competition among telecoms companies is no longer over tariffs matter but it is about creativity to meet customers' changing requirements. Several Vietnamese telecom providers are acting to tackle this issue. Most recently, Viettel Group – one of Vietnam's top telecom revealed that the company is investing on 5G chip and compatible devices using that chip, so that customers can enjoy better high-speed mobile services (Onishi, 2019). This project is a big challenge since it requires huge cost and time of development, as well as in-depth technical knowledge that Vietnamese companies are lacking. As a result,, Vietnamese telecom companies are seeking collaboration with foreign companies, to acquire necessary knowledge and technology, for example cooperation between Vinaphone and Nokia, MobiFone and Samsung Electronics recently (Onishi, 2019).

Knowledge management and innovation were found to be closely related (Plessis, 2007). Knowledge management includes various aspects such as knowledge life cycle, knowledge capture, knowledge development, knowledge sharing, and knowledge utilization (Liao et al., 2007). Among these aspects, knowledge sharing is considered major focus by organization to foster knowledge exchange and creation among employees within an organization. Many studies (Rahab et al., 2011; Lin, 2007; Tassabehji et al., 2019) showed that firm innovation capability can be improved through knowledge sharing process. Practically, recognizing the need of providing innovative products to customers, VNPT - a key telecommunication and IT enterprise have opened R&D center where everyone including employees, external partners can come, connect and share their ideas to develop new products and services (VNPT, 2017). This example shows the importance of knowledge sharing on innovation, emphasizing that innovation of a company significantly relies on knowledge sources from its employees, partners or customers.

Many existing literatures focused on finding out knowledge sharing enablers including individual, organizational and technological factors, and how knowledge sharing affects firm innovation capability. However, there are limited studies that pay attention on innovation capability at both individual and organizational level, while employees' innovation capability should be original source of organizational innovation

capability. “How individual innovation capability mediates the relationship between knowledge sharing and organizational innovation capability?” Addressing that research question would shed a light on the mechanism of how knowledge management lead to creativity in organizations, as well as provide implications to practitioners for better innovation management, raising the importance of individual creativity in contribution to organizational success, especially in telecommunication industry that is in need of innovation. Therefore, the purpose of this study is investigating relationship between knowledge sharing and innovation capabilities at individual as well as organizational levels from Vietnam’s telecommunication companies.

Literature review and hypothesis development

Knowledge sharing

At present, organizations focus more on knowledge sharing, which is an essential part of knowledge management (Liao et al., 2007). Knowledge sharing refers to the exchange of information among people, family or communities. In organizations, knowledge sharing occurs between individuals regarding ideas, suggestions, experience, expertise as well as skills (Bartol & Srivastava, 2002). Knowledge sharing in an organization simply is the way organization make knowledge is available for employees (Ipe, 2003). Knowledge sharing as a process where individuals commonly exchange their implicit (tacit) and explicit knowledge to create new knowledge (Van Den Hooff & De Ridder, 2004). According to Lin (2007), knowledge sharing behavior is divided into two sub-behaviors namely knowledge collecting and knowledge donating, which is utilized in this paper. These two “knowledge sharing” practices were derived from the idea that there are two parties involving in knowledge sharing process, namely “knowledge carrier” (or knowledge source) and “knowledge receiver” (Hendriks, 1999). Knowledge collecting refers to process of communicating and encouraging others to share their knowledge or intellectual capital, while knowledge donating is the behavior of transferring personal intellectual capital to others (Van Den Hooff & De Ridder, 2004). In more details, both knowledge collecting and knowledge donating are practices implemented by employees, urging them to gain and transfer new information to make everyone’s knowledge become more comprehensively. Knowledge sharing is more considered as voluntary act, making knowledge possessed by an individual are available for others to understand, absorb and utilize, finally lead to joint ownership of knowledge between senders and recipients (Ipe, 2003).

The importance of knowledge sharing has been emphasized in existing literature. Nowadays, companies are focusing on human capital and knowledgeable workforce to enhance organizational performance (Kuo et al., 2014). Knowledge sharing enables innovative behavior, which is employee’s action to realize, promote and create new knowledge that are useful for organization (Akram et al., 2018). Externally, knowledge sharing with customers and suppliers can improve customer or supplier relationships, enhance new product development process, facilitate decision making, provide employees various types of knowledge that support employee’s learning as well as organizational learning (Alavi et al., 2005; Andrews & Delahaye, 2000). While knowledge donating helps to build organizational knowledge, generate ideas based on recognition of new business opportunities; knowledge collecting is important for project completion, as it involves internalization and socialization of knowledge (Lin, 2007; Hansen, 1999). Kamasak & Bulutlar (2010) explored the relationship between knowledge collecting and knowledge donating on innovation, pointing out that knowledge collecting influence significantly to exploratory and exploitative innovation, whereas knowledge donating

has effect only on exploitative innovation. Generally, collecting and integrating new knowledge will lead to innovativeness, but there is the need for further empirical studies that investigate the impact of knowledge sharing practices on employees' innovation and skills (Raykov, 2014). Existing literature that show the relationship between knowledge sharing and innovation are shown in Table 1.

Innovation capability at individual and organizational level

Innovation capability

Innovation is defined as process of creating new ideas, solutions that can meet new requirements or existing needs (Maryville, 1992). There are many ways to classify innovation: product/process, radical/incremental, technological/managerial or market pull/technology push (Verde et al., 2011). Innovation capabilities describe the firm's ability to accomplish high innovation performance on routine basis. According to Burgelman et al. (2004), innovation capabilities are comprehensive set of characteristics of an organization that support organizational innovation strategies. Using dynamic capabilities approach, Lawson & Samson (2001) defines innovation capability as the capacity of transforming knowledge into new product, process to provide more benefit for organization and stakeholders (Lawson & Samson, 2001). It shares the same view with Kogut & Zander (1992), conceptualizing innovation capability as organizational ability to utilize and activate knowledge into the forms of products, services, processes and systems. In today's business environment, individual firms are distinguished with each other by building innovation capabilities that are difficult for others to imitate. It can be viewed as the way organization reconfigure its resources and capabilities to innovate (Aryanto et al., 2015). Recently, Wang & Hu (2017) brought out the concept of collaborative innovation capability, which is known as the ability of involving key supply chain partners in innovation process. They pointed out that this type of innovation capability can affect positively to innovation performance, also significantly moderate the relationship between knowledge sharing and innovation (Wang & Hu, 2017). Innovation capability is viewed as one of the most important capabilities a firm can have, and it should be considered within an organization at both individual and organizational levels.

Individual innovation capability

Employee innovation capability refers to the ability as well as the tendency of employees to create new ideas and perform those ideas in order to obtain organizational objectives (Huhtala & Parzefall, 2007). Innovativeness of employees was conceptualized as the degree an employee adopts or is willing to adopt something new (Hurt et al., 1977). It can also be viewed as employees' new perspectives about issues that arise, willingness to take risk and tolerance for ambiguity (Saunila & Ukko, 2014). The importance of employee's initiatives in knowledge creation was early highlighted by Nonaka & Takeuchi (1995), arguing that knowledge is created through multi-level employee interactions. Therefore, organizations cannot gain new knowledge, or at least, knowledge will have little impact on organizational effectiveness unless the knowledge are shared and understood among individuals and groups. Furthermore, since employees are critical sources of knowledge for organization, the organization is likely to lose the knowledge if there is no knowledge sharing, or when employees leave (Ipe, 2003). Davenport & Prusak (1999) defined knowledge as personal, so that organization will only effectively manage knowledge resources when employees contribute knowledge to the firm. Literature have emphasized the importance of organizational support (ex. providing guidelines, set of practices to support continual improvement) to

trigger individual innovation (Lotz, 2018). Hiltunen & Henttonen (2016) argued that innovation can come from every employee in the company, even when it comes to shop-floor worker. However, employee's innovation ability is somewhat hidden, and their results indicated the importance of leadership support to improve employee-driven innovation.

Organizational innovation capability

The organizational innovation capability is the ability of an organization toward innovation such as fast respond to new information, quick problem-solving as well as to what extent the firm's culture is open to new ideas (Hurley & Hult, 1998). This study categorizes organizational innovation into three types, based on Rajapathirana & Hui (2018): Product/service innovation, Process innovation, and Managerial/organizational innovation. As such, product/service innovation is defined as the development of new product or service that meet customers' needs by adding technical specification, incorporated software. In response to dramatic change in the market, product innovation is crucial in carrying out new business opportunities to gain market share and expand company's business (Slater et al., 2014). Process innovation refers to improvements in the way a company manufactures and delivers its products/services (Canh et al., 2019). Therefore, process innovation is considered a novel change that customers may not directly pay for, such as new way of commercializing products/services and it helps to increase productivity, add more value to stakeholders (Rajapathirana & Hui, 2018). However, process innovation, for example introducing new formalized process by adopting new technology, may have adverse effect if knowledge and experience are lack. It is suggested that process innovation should be implemented synchronously with managerial/organizational innovation (Letangule & Letting, 2012). Managerial/organizational innovation is defined as new organizational method of managing, implementing business practices, internal as well as external relations (Rajapathirana & Hui, 2018). Specifically, this type of innovation changes organizational systems by investing effort on improvement of administration, team collaboration, information sharing and learning. Process and managerial innovation are profound for service industry in terms of saving cost, increasing speed, especially in the telecommunication industry, where the product is infrequently changed unless there is big technological evolution.

Table 1. Recent studies on relationship between knowledge sharing and innovation capability

Author	Knowledge sharing operationalization	Innovation capability	Sample & Industry	Methodology	Main findings
Tassabehji (2019)	- Knowledge donation - Knowledge collection	Firm innovation capability	UK based companies/creative sector	Two-stage sequential explanatory mixed method approach	Importance of knowledge donation is confirmed but there is limited evidence of knowledge collection in the knowledge sharing process
Akram et al. (2018)	- Knowledge donating - Knowledge collecting	Employee innovative work behavior	115 employees/telecommunication sector	Correlation, multiple regression analysis	Knowledge donating and knowledge collecting are positively and significantly affect the innovative work behavior

Chan et al. (2017)	- Knowledge donating - Knowledge collecting	- Product innovation - Process innovation - Marketing innovation - Strategic innovation	62 companies in Taiwan/automobile	Structural equation modeling	Knowledge collecting and knowledge donating show positive effect on all types of innovation capability
Podrug et al. (2017)	- Knowledge donating - Knowledge collecting	Firm innovation capability	196 employees/Information communication technology	Structural equation modeling	Employee willingness to donate and collect knowledge enable the firm to improve innovation capability
Yesil et al. (2013)	- Knowledge donating - Knowledge collecting	Firm innovation capability	51 companies in Turkey	Partial Least Squares, Structural Equation Modeling	Only knowledge donating has positive influence on innovation capability
Wang & Wang (2012)	- Tacit knowledge sharing - Explicit knowledge sharing	- Innovation speed - Innovation quality	89 high-tech firms/Information & communication, electronics, petrochemicals & plastics, chemicals, medicals.	Structural equation modeling	Explicit knowledge sharing has positive impact on innovation speed and quality. Meanwhile, tacit knowledge sharing only has positive effect on innovation quality.
Kamasak & Bulutlar (2010)	- Knowledge collecting - Knowledge donating inside - Knowledge donating outside	- Exploratory innovation - Exploitative innovation - Ambidextrous innovation	246 middle and top-level managers/various industries	Exploratory factor analysis, regression analysis	Knowledge collecting had a significant effect on all types of innovation and ambidexterity, whereas knowledge donating did not have any effect on exploratory innovation
Lin (2007)	- Knowledge donating - Knowledge collecting	Firm innovation capability	172 respondents/Manufacturing, banking, computers, transportation, retail, real estate, health, utility	Structural equation modeling	Employee willingness to both donate and collect knowledge enable the firm to improve innovation capability.
Liao et al. (2007)	- Knowledge donating - Knowledge collecting	- Product innovation - Process innovation - Management innovation	355 respondents/electronic, financial insurance and medical industries.	Structural equation modeling	Knowledge donating and knowledge collecting have positive effect on absorptive capacity, leading to higher innovation capability.

Literature review shows that there have been a number of studies that investigate the relationship between knowledge sharing (consisting of “knowledge donating” and “knowledge collecting”) in various industries. However, most of them have focused on either only relationship between knowledge sharing and individual innovation capability or between knowledge sharing and firm innovation capability. There are limited studies that integrate all those three factors. Moreover, research about innovation capability in telecommunication industry in developing economy such as Vietnam is generally lack. Furthermore, the effect of knowledge donating and knowledge collecting on firm innovation capability in existing literature is somewhat inconsistent. Therefore, this paper aims at integrating three factors knowledge sharing, individual innovation capability and organizational one into a comprehensive framework and empirically test the model by using data of Vietnam’s telecommunication firms.

Relationship between knowledge sharing, individual innovation capability and firm innovation capability

Knowledge sharing in organization frequently happens among individuals, which is through daily interaction and conversation between employees, so it affects individual innovation capability of employees. It is argued that knowledge sharing helps employees to think more critically as well as creatively (Aulawi et al., 2009; Ologbo, 2015). Holub (2003) indicated that if there are more knowledge sharing activities among employees, it is more likely for employees to attain ability to think and create new things. Anwahi (2012) concluded that effective practice of knowledge sharing helps to innovate employees. Ologbo (2015) hypothesized model of knowledge sharing and employees' innovation capability, then using regression analysis to test the model. The result showed that more involvement of employees in knowledge sharing process, employees have greater capabilities of generating new ideas. In addition, in research of Yu et al. (2013) about finance and insurance industry in Taiwan, knowledge sharing, and interactive activities were found to have positive effect on employees' innovative behavior and their ability to innovative. Hence, it can be hypothesized that:

H1: Knowledge sharing practices including knowledge collecting and knowledge donating have positive effects on individual innovation capability.

The contribution of knowledge sharing to firm innovation capabilities has been studied in many existing literature (Lin, 2007; Song et al, 2008; Podrug et al., 2017). It is strongly proved by previous researches that knowledge sharing activities can assist organizational innovation capability in problem solving and react faster to new information in the market. Liao et al. (2007) argued that with adequate absorptive capacity of employees, knowledge sharing has direct positive relationship with firm innovation capability. Jantunen (2005) concluded that better knowledge sharing leads to superior firm innovation capability. His result follows the conclusion of several previous works, both in theoretical and empirical studies. For example, Yesil et al. (2013) extended study scope to analyze effect of knowledge sharing on innovation capability and innovation performance for the firm operating in Kahramanmaras. The study showed that only knowledge donating in knowledge sharing has significant impact on innovation capability. Recent research on innovation capability in Croatian ICT companies of Podrug et al. (2017) provides implication that knowledge sharing influences strongly to firm innovation capability. They argued that knowledge sharing is important for knowledge creation, which contributes substantially to innovation capability, and then firm performance can be improved. Therefore, it can be hypothesized that:

H2: Knowledge sharing practices including knowledge collecting and knowledge donating have positive impact on firm innovation capability.

There is strong linkage between individual innovation and company's innovation capability. According to Burton (2001), firm's innovation activities depend significantly on CEO's knowledge and ability to innovate. Andries & Czarnitzki (2011) concluded that apart from CEO and managers, non-manager employees also have strong impact on firm innovation. Additionally, Liao et al. (2007) concluded that knowledge sharing among employees has to be transformed into employees' relevant capabilities to benefit the firm and affect firm's innovation capability. According to Ologbo et al. (2015), firms

cannot achieve overall firm innovation capabilities without attaining innovation capabilities of employees working in the organization because overall firm innovation capabilities is the sum of all individual capabilities. Thus, they suggested that organizations should build platform for employees to exchange knowledge, increase employee innovation capabilities which in turn boost the overall organizational innovation capabilities. Therefore, we can hypothesize that:

H3a: Individual innovation capability has positive effect on firm innovation capability.

H3b: Individual innovation capability acts as mediator in the relationship between knowledge sharing and firm innovation capability.

Methodology

Analytical framework

Based on literature review and hypotheses development, an analytical framework is proposed to test impact of knowledge sharing on innovation capabilities. The framework is illustrated in Figure 1.

Figure 1. Analytical framework (compiled by authors)

In Figure 1, the meaning of each scale can be explained as follow:

- Knowledge collecting: Willingness of employees to seek for knowledge from colleagues and learn from them.
- Knowledge donating: Willingness of employees actively communicate with colleagues and contribute ideas to solve others' problem.
- Individual innovation capability: Willingness of employees to adopt something new and ability to create new ideas to achieve personal as well as organizational objectives.
- Product innovation: Organization's ability to utilize knowledge and ideas in developing new product and improving current products.
- Process innovation: Organization's ability to utilize knowledge and ideas in developing new way of doing things technically.

- Managerial innovation: Organization's ability to develop new managerial regulations, systems and methods, in order to achieve organizational performance.

Measurement of constructs

Knowledge sharing between employees in the firm is measured mainly by knowledge collecting and knowledge donating, based on many previous researches (Lin et al., 2007, Liao et al., 2007, Ologbo et al., 2015). Table 2 summarizes the items to measure knowledge sharing, including knowledge donating and knowledge collecting.

Table 2. Measured Items for Knowledge sharing

Constructs	Measured items	References
Knowledge donating	1. When I have learned new skills or acquired new information, I tell my colleagues about it.	Lin (2007); Van Den Hooff & De Ridder (2004); Liao et al. (2007); Fong & Wu (2007); Yu et al. (2013).
	2. When my colleagues have learned new skills or acquired new information, they tell me about it.	
	3. Knowledge sharing among colleagues is considered normal in my company.	
	4. I often share information, knowledge, skill and experience to my colleagues	
Knowledge collecting	1. I tend to collect information and skills from my colleagues.	Lin (2007); Liao et al. (2007); Wang & Wang (2012).
	2. Colleagues in my company share knowledge and skills with me when I ask them to.	
	3. I ask my colleagues to teach me about their experience and expertise.	
	4. People in my organization frequently share existing reports and official documents with members of my organization.	
	5. When I need new knowledge and information, I will ask others.	

This study reviews previous studies (Liao et al., 2007; Lin, 2007; Calantone et al., 2002; Rahab et al., 2011; An et al., 2015) and select items to measure firm innovation capability. For individual innovation capability, the scale is developed early from Hurt et al. (1977), and Hollenstein (1996). Their measurements are well validated and adapted by subsequent studies (Calantone et al., 2002; An et al., 2015). Table 3 below describes in more detail how we can measure individual and firm innovation capability.

Table 3. Measured items for individual and firm innovation capabilities

Constructs	Measured items	References
Individual innovation capability	1. I enjoy trying out new ideas	Hurt et al. (1977); Ganesan & Weitz (1996); An et al. (2015).
	2. I have strong eager of discovery leads to new ideas.	
	3. I seek out new ways to do things.	
	4. I frequently improvise methods for solving a problem when an answer is not apparent.	
	5. I consider myself to be creative and original in my thinking and behavior.	
	6. I feel myself become more creative because of continuous learning in organization.	
Firm innovation capability	Product innovation	Liao et al. (2007); Lin (2007); Calantone et al. (2002).
	1. Our company often develops new products and services well accepted by the market.	
	2. Our company can often launch new products or services faster than our competitors.	
	3. Our company is frequently the first to market new products and services.	
	4. Our company has better capability in R&D of new products or services than our competitors.	
	5. Our new product introduction has increased over the last 5 years.	Liao et al. (2007); Lin (2007); Rahab et al. (2011).
	Process innovation	
	1. Our company always acquires new skills or equipment to improve the manufacturing operation or service process.	
	2. Our company can develop more efficient manufacturing process or operation procedure.	
	3. Our company is creative in its operating methods	
Managerial innovation	4. Our company seeks new ways of doing things.	Liao et al. (2007); An et al. (2015).
	1. Our company's department heads will adopt new leadership approaches to lead all staff towards task completion.	
	2. Our company emphasizes innovative and creative capability when recruiting staff.	
	3. Staff are given incentives to generate new ideas as well as seek new ways of doing things.	
	4. Our company will change the division of work among different departments according to the needs of market management.	

Data collection

A questionnaire including multiple-item scales as mentioned above in Table 2 and Table 3. The questionnaire survey was designed to collect data from individuals working for Vietnam's telecommunication companies. Each item was evaluated on a seven-point scale ranging from (1) Strongly disagree to (7) Strongly agree. In order to reduce social desirability bias, the survey did not include any personal identification of the individuals, and the data analysis was restricted at an aggregated level. Prior to main survey, the questionnaire was pretested and revised to avoid interpretation errors and to increase the clarity of questions.

Regarding the main survey, we have contacted four largest domestic telecommunication companies in Vietnam including Viettel Telecom, Vinaphone, Mobifone, and FPT Telecom in Ha Noi (capital city in North of Vietnam), Da Nang (largest city in middle of Vietnam) and Ho Chi Minh (largest city in South of Vietnam). The place scope covers 3 big cities in Vietnam, which have dynamic working environment that facilitates communication as well as sharing behavior among employees. Those companies were selected because they are major players in the telecommunication industry in Vietnam; and practically, they are paying great attention in innovation as mentioned in the Introduction part. For example, FPT Telecom has been being famous for its innovative organizational culture, as the company respects everyone's strengths, weaknesses, and ideas of any employees are valued in company's meetings. Since the paper does not target at specific working positions, convenient sampling method was used to collect the data from various perspectives of employees from diverse positions and functions. Electronic link of questionnaire was sent to the person responsible for knowledge management in each organization. Those employees agreed to distribute the survey among their colleagues; thus, we cannot report about the response rate. The answer for questionnaire survey therefore is at individual level, measuring the variables by gathering employees' perception about individual and organizational innovation capability. Several previous studies have conducted similar sampling procedure (Akram et al, 2018; Podrug et al., 2017; Lin, 2007). Time to collect data is from December 2017 to February 2018. The survey collected 1,025 responses. Six hundred thirty three out of 1,025 responses were invalid and incomplete due to missing major values. Thus, the remaining 392 questionnaires were used for the analysis. Detail of the sample is provided in Table 4.

Table 4. Sample description

Category	Characteristic	Frequency	Percentage
Company name	FPT Telecom	73	18.6
	Mobifone	165	42.1
	Viettel Telecom	96	24.9
	VNPT	56	14.3
Industry	Telecommunication	392	100
Company type	State-owned	292	74.5
	Private	100	25.5
	Below 100	21	5.4
Size	101-200	36	9.2
	201-300	151	38.5
	301-500	40	10.2
	Over 500	144	36.7
	Hanoi	283	72.2
Workplace	Da Nang	61	15.6
	Ho Chi Minh	48	12.2
	Male	217	55.4
Gender	Female	175	44.6
	High school	1	0.3
Education level	Vocational	18	4.6
	College	38	9.7
	Bachelor	276	70.4
	Master or Doctor	59	15.1

In particular, data sample has a balance regarding gender (55.4% are male, 44.6% are female). Most of respondents have finished bachelor study or upper (85.5%). Thus, we assume that respondents are more oriented to knowledge sharing practices because they are well-educated. Lastly, it can be seen that employees including in the sample are diverse in terms of age, working experience and position. Therefore, the sample in this study can be generalized for the pull sample in some extent.

Data analysis

Descriptive analysis

The first step in analytical process is descriptive analysis, which is performed to provide minimum value, maximum value, mean value, standard deviation of the scales. The result is summarized in Table 5.

Table 5. Descriptive analysis

Scale	Min	Max	Mean	Standard deviation
Knowledge collecting	1.00	7.00	5.02	1.20
Knowledge donating	1.00	7.00	5.03	1.23
Individual innovation capability	1.00	7.00	5.02	1.16
Product innovation capability	1.00	7.00	4.98	1.23
Process innovation capability	1.00	7.00	5.14	1.28
Managerial innovation capability	1.00	7.00	5.17	1.20

Regarding mean value, it can be observed that there is an equality between knowledge collecting and knowledge donating, based on employees' perspectives. When it comes to organizational innovation capability, managerial innovation capability exhibits the highest mean value (5.17), followed by process innovation capability (5.14) and product innovation capability (4.98). It implies that managerial innovation capability is viewed by employees as most contribution for organizational innovation capability in Vietnamese telecommunication companies, while product innovation capability shows lowest contribution.

Reliability and validity test

Reliability and factor analysis

Reliability test is implemented to ensure the internal consistency between items measuring same construct. The indicator mostly used to analyze reliability is Cronbach's Alpha, with acceptable value is greater than 0.6 for each scale (Nunnally, 1978; Peterson, 1994; Slater, 1995). Exploratory factor analysis (EFA) is a statistical method that is commonly used by researchers to uncover the underlying structure of a relatively large set of variables (Norris & Lecavalier, 2009). EFA is recommended to be performed when there was no prior hypothesis about factors or patterns of measured variables. Mayers et al. (2012) indicated that the most popular way to fulfill EFA is using SPSS along with the use of "Dimension reduction" technique with "Principle component analysis" extraction method and "Varimax with Kaiser Normalization" rotation method. Since questionnaire items in this paper were adapted from various researches, we want to convergent validity of the underlying factors by EFA.

The result confirms satisfactory reliability of all scales as well as all questionnaire items. It can be seen that all Cronbach's Alpha are larger than 0.6, and values of Item total correlation are in excess of 0.4. Therefore, within a construct, all questionnaire items are linked strongly together, and they are reliable for further analysis.

EFA results show that all KMO value are inside the range from 0.5 to 1 (0.86, 0.90 and 0.94). Besides, Eigenvalues of all extracted components are greater than 1, all percentage of variance values exceed 50%, implying that measuring questionnaire items can explain over 50% the variability of underlying construct. Additionally, since all factor loadings are in excess of 0.6, all scales as well as items are kept for the next step.

To summarize, EFA result indicates that:

- Knowledge sharing practices are shortened into two separated variables, called "Knowledge collecting" and "Knowledge donating".
- Individual innovation capability items are linked and there is only one component is extracted. Hence, individual innovation capability is a single construct.
- Organizational innovation capability is extracted into three independent components namely "Product innovation", "Process innovation" and "Managerial innovation". These are 3 types of innovation capability to measure organizational innovation performance.

Table 6. Reliability and factor analysis

Construct	Measurement items	Item total correlation	Cronbach's Alpha	Eigenvalues	KMO	Percentage of variance	Factor loading
Knowledge collecting	KC1	0.74	0.90	4.50	0.86	75.33	0.81
	KC2	0.76					0.85
	KC3	0.80					0.88
	KC4	0.75					0.84
	KC5	0.72					0.78
Knowledge donating	KD1	0.83	0.91	2.29			0.91
	KD2	0.85					0.92
	KD3	0.72					0.80
	KD4	0.80					0.89
Individual innovation capability	IIC1	0.85	0.94	4.62	0.90	76.93	0.91
	IIC2	0.85					0.91
	IIC3	0.85					0.91
	IIC4	0.85					0.90
	IIC5	0.63					0.72
	IIC6	0.85					0.90
Product innovation capability	Product_IC1	0.85	0.95	8.84			0.76
	Product_IC2	0.91					0.87
	Product_IC3	0.92					0.86
	Product_IC4	0.91					0.85
	Product_IC5	0.88					0.83
Process innovation capability	Process_IC1	0.91	0.95	1.58	0.94	88.24	0.87
	Process_IC2	0.91					0.88
	Process_IC3	0.92					0.85
	Process_IC4	0.90					0.89
Managerial innovation capability	Manage_IC1	0.88	0.95	1.05			0.82
	Manage_IC2	0.90					0.82
	Manage_IC3	0.89					0.83
	Manage_IC4	0.85					0.79

Discriminant validity

Discriminant validity is performed to ensure all latent variables are unrelated, based on the rule of Fornell & Larcker (1981). Discriminant validity is acceptable when average variance extracted (AVE) of a factor is larger than any bivariate correlation between that factor and others. The result of discriminant validity is shown in Table 7, indicating that all variables demonstrate good discriminant validity.

Table 7. Discriminant validity testing

	Knowledge collecting	Knowledge donating	Individual innovation capability	Product innovation capability	Process innovation capability	Managerial innovation capability
Knowledge collecting	0.45					
Knowledge donating	0.19	0.73				
Individual innovation capability	0.18	0.60	0.71			
Product innovation capability	0.16	0.48	0.50	0.84		
Process innovation capability	0.07	0.23	0.29	0.40	0.87	
Managerial innovation capability	0.12	0.48	0.58	0.55	0.44	0.83

Bold numbers show average variance extracted values; others show square correlations between constructs.

Structural model

Model fit evaluation

Before doing path analysis to test hypotheses, it is necessary to assess the fit of structural model. There are several indices to evaluate the goodness of fit. Comparative fit index (CFI) exceeding 0.9 indicates a goodness of fit (Baumgartner & Hombur, 1996). Adjusted goodness-of-fit index (AGFI) is suggested to exceed 0.8 for an acceptable fit (Chau & Hu, 2001). Discrepancy function divided by degree of freedom (CMIN/DF) suggested by Bagozzi & Yi (1988) should have a value smaller than 3. Bollen (1989) developed some indices to measure the model fit, including normal fit index (NFI), incremental fit index (IFI) and relative fit index (RFI). It indicates more fit if NFI, IFI and RFI are closer to 1, normally greater than 0.9 is acceptable. In addition, based on Hu & Bentler (1999), Tucker Lewis index (TLI) is bigger than 0.9, root mean square error of approximation (RMSEA) is smaller than 0.08 would be acceptable for model fit. Table 8 presents the results for those indices above, showing good model fit for further analysis.

Table 8. Model fit evaluation

Index	Observed value	Optimal value	Evaluation
CFI	0.95	>0.9	Satisfied
AGFI	0.82	>0.8	Satisfied
CMIN/DF	2.89	<3	Satisfied
NFI	0.92	>0.9	Satisfied
IFI	0.95	>0.9	Satisfied
RFI	0.91	>0.9	Satisfied
TLI	0.94	>0.9	Satisfied
RMSEA	0.07	<0.08	Satisfied

Hypothesis testing

Afer confirming the validity of the structural model, next step is to estimate the coefficients of relationships to validate hypotheses. For H1, H2 and H3a, the authors want to investigate relationships between knowledge sharing, individual innovation capability and organizational innovation capability. Results showing in Figure 2 and Table 9 found that H1, H3a are supported, and H2 is partially supported.

Figure 2. Coefficients estimation

Table 9. Hypothesis testing (H1, H2, H3a)

Hypothesis	Relationship	Coefficient	Critical ratio	Result
H1	Knowledge collecting → Individual innovation capability	0.10*	2.50	Supported
	Knowledge donating → Individual innovation capability	0.69**	15.10	Supported
	Knowledge collecting → Product innovation capability	0.06	1.48	Not supported
	Knowledge collecting → Process innovation capability	0.06	1.12	Not supported
H2	Knowledge collecting → Managerial innovation capability	0.006	0.14	Not supported
	Knowledge donating → Product innovation capability	0.31**	5.30	Supported
	Knowledge donating → Process innovation capability	0.14	1.73	Not supported
	Knowledge donating → Managerial innovation capability	0.25**	4.20	Supported
H3a	Individual innovation capability → Product innovation capability	0.45**	6.94	Supported
	Individual innovation capability → Process innovation capability	0.53**	5.80	Supported
	Individual innovation capability → Managerial innovation capability	0.61**	9.09	Supported

Note: * $p < 0.05$; ** $p < 0.01$

Hypothesis H3b argues the mediating effect of individual innovation capability on relationship between knowledge sharing and organizational innovation capability. To test this hypothesis, indirect effects of knowledge sharing on organizational innovation capability through individual innovation capability are tested by using bootstrapping technique (Cheung & Lau, 2008). The two-tailed significance shows the significance of indirect (mediated) effects of independent variable on dependent variable, via a mediator. Table 10 shows that all two-tailed significance are smaller than 0.05, so we can conclude that individual innovation capability has mediating impact on relationship between knowledge sharing and organizational innovation capability, at 5% of significant level. Therefore, hypothesis H3b is supported.

Table 10. Testing indirect effects – two tailed significance (Bootstrap Confidence)
Mediator: Individual innovation capability

Indirect relationship	Two tailed significance (p-value)	Evaluation
Knowledge collecting → Product innovation capability	0.029	Significant
Knowledge collecting → Process innovation capability	0.030	Significant
Knowledge collecting → Managerial innovation capability	0.034	Significant
Knowledge donating → Product innovation capability	0.005	Significant
Knowledge donating → Process innovation capability	0.009	Significant
Knowledge donating → Managerial innovation capability	0.009	Significant

Robustness assessment – Nonlinear effects

Literature has shown high adoption rate of Partial Least Square - Structural Equation Modeling (PLS-SEM) technique in data analysis because of many conveniences it brings. However, the robustness of the result can be improved by several tests, which can be named as nonlinear effects, endogeneity and unobserved heterogeneity (Sarstedt, et al., 2019). We understand that there should be many other factors that can influence innovation, and the effect might be different among various sub-groups of data. However, since this paper only focus on effect of knowledge sharing on innovation without considering any control variables, we do not assess the endogeneity and unobserved heterogeneity, only non-linear effect particularly quadratic effect is tested. We assume that knowledge sharing initially can improve individual creativity, but too much knowledge sharing behavior can make employees overwhelm with a lot of redundant knowledge, therefore hinder their innovative capability. In short, whether knowledge sharing has quadratic impact on individual innovation capability is tested to assess the robustness of our results.

Following Svensson et al. (2018), non-linear effect assessment consists of 2 steps: First, we perform Ramsey RESET test to see wheter quadratic impact exists in the relationship between knowledge collecting, knowledge donating and individual innovation capability. Second, the significance of quadratic variables is checked. This process was done by using SmartPLS 3.0 software. The result is summarized in Table 11.

Table 11. Robustness assessment – Nonlinear effect

Nonlinear relationship	Coefficient	t-statistic	p-value	Ramsey RESET
KC*KC → IIC	-0.048	1.172	0.238	F(3,388) = 0.000027 p-value = close to 1
KD*KD → IIC	-0.037	1.127	0.260	

Note: KC: knowledge collecting, KD: knowledge donating, IIC: Individual innovation capability

The Ramsey RESET indicators suggest that the hypothesis “H0: There is no nonlinear effect” should not be rejected because the F statistic is too small. We further calculate the coefficients of quadratic variables by including them in the regression model together with ordinary variables that are knowledge collecting and knowledge donating. The result indicates two estimates of p-value that are greater than 0.05, therefore neither of the nonlinear effects is significant. Consequently, we conclude that there is no hindering nonlinear effect, and robustness of the linear effects model is confirmed.

Discussions and implications

Main findings

Main purpose of this paper is to evaluate the relationship among knowledge sharing practices, individual innovation capability and organizational capability in Vietnamese telecommunication companies. Through extensive literature review, an analytical framework is proposed, aiming at breaking down innovation capability into 2 levels (individual and organizational) especially categorizing 3 types of organizational innovation capability (product, process and managerial innovation). The main findings of this paper are discussed as below.

The first finding is described through descriptive analysis. Result shows that product innovation exhibits lowest mean value among 3 types of organizational innovation, while managerial innovation represents highest value. It reflects current situation of telecommunication industry in Vietnam that there is limited innovative products and services, innovation mostly comes from management such as changing in leadership style, the way of human resource management. Although there are more and more private investors in telecommunication industry in Vietnam, state-owned enterprises still have dominant market share and play key roles in the industry. As a result, competitive pressure is relatively low compared to other industries, leading to lessen innovation that derived from telecommunication companies. Furthermore, it is difficult to introduce radical product innovation in telecommunication industry, unless there is a huge change in technology development.

Second finding in this paper indicates positive impact of knowledge sharing on individual innovation capability and firm innovation capability. Relationship between knowledge sharing and firm innovation capability is confirmed in many extant literature (Jantunen, 2005; Lin, 2007; Song et al., 2008). However, there are limited studies that break down firm innovation capability into 3 independent types of innovation. This study found that employee's willingness to collect knowledge has no direct impact on product, process, managerial innovation. Besides, willingness of donating knowledge can improve product and managerial innovation significantly. The finding suggests that to implement new ideas or process, it requires knowledge sharing culture to disseminate knowledge throughout organization, thus linking all staff and creating synergistic effect to improve organizational innovation (Lin, 2007). When it comes to product and managerial innovation, companies are recommended to encourage collaboration among employees in different function, also raise as many employees' opinion as possible to

find out new and effective way of management. In addition, association of knowledge sharing and individual innovation capability can be found in several previous works such as Lee (2018); Hu & Zhao (2016); Jaber (2016). Yuan & Woodman (2010) indicated that knowledge exchange is profound to solve problems creatively in the workplace, because it helps to improve employees' mindset or cognitive capacity. Therefore, it is implied for managers to create supportive environment for knowledge exchange between employees, or provide training program, open discussion. It would help to better employee socialization, as well as enrich individual knowledge, leading to higher firm performance (Cummings & Oldham, 1997).

Subsequently, this paper found that individual innovation capability should be premise before achieving firm innovation capability, and higher individual innovation will result in higher organizational innovation. This result is similar in the study of An et al. (2015). It was argued in previous research that innovative ideas are first derived from individuals, those ideas are shared between group later and finally, they are implemented by employees in different function within company (Ologbo, 2015). Thus, when it is limited in product and process innovation in Vietnam's telecommunication industry, knowledge sharing practices are recommended to contribute to competitive advantage especially innovation (Wang & Wang, 2012). Equally important, it is noticeable that quality of knowledge sharing should be focused rather than intensity or volume of knowledge sharing (Lee, 2018). In case that knowledge is intensively shared, employees may feel overwhelmed and confused to apply the knowledge in practice. So, it requires company to have good management of social networks or other information communication technology (ICT) supports, which help to sustain sharing culture and build trust among employees.

The last finding in this paper shows that individual innovation capability acts as a mediating variable between knowledge sharing practices and firm innovation capability. This study indicates that if individual innovation is inadequate, knowledge sharing practices will have less direct impact on firm innovation capability, and vice versa. When knowledge sharing activities within firms can be implemented by people who have high competencies, knowledge learning among employees will be more effective, then the organization will be able to manage knowledge efficiently. This finding contributes to the work of Liao et al. (2007), showing that knowledge sharing can enhance employee's skills and motivation, then strengthen firm innovation capability. Once again, importance of individual innovation capability is confirmed as a key to enhance firm innovation strategy. Companies are suggested to empower, encourage employees to raise their enthusiasm of innovation, then creating creative workplace.

Implications

In general, this paper contributes to the literature and practice by: (1) verifying the effects of knowledge sharing behaviors including knowledge collecting & knowledge donating on organizational innovation capability via individual innovation capability as a mediator; (2) providing empirical evidence of how knowledge sharing drives innovation in the context of Vietnamese telecommunication industry. Namely, under

theoretical perspective, this study highlights the crucial role of individual innovation capability, which not only has direct effect on firm innovation capability, but it also plays as mediator fostering impact of knowledge sharing on product, process, and managerial innovation capability. This study contributes to the field of knowledge management and how to manage innovation effectively. Many researches have been focused on investigating the direct effect of knowledge sharing including knowledge collecting, knowledge donating on firm innovation capability. However, the findings are somewhat different. For example, Chan et al. (2017) and Podrug et al. (2017) found that knowledge donating and collecting have positive impact on firm innovation. Studies of Tassabehji (2019) and Yesil et al. (2013) point out the importance of knowledge donating only, while knowledge collecting has no significant impact on innovation. Besides, Kamasak and Bulutlar (2010) indicated that knowledge collecting has effect on all types of innovation, and knowledge donating has no influence on exploratory innovation. Inconsistency in existing literature motivates this study to develop more completed model illustrating relationship between knowledge sharing and innovation. Managers can utilize the findings in this study to implement knowledge sharing practices to drive specific type of innovation. We can remark that knowledge sharing practices should be implemented to boost up firm innovation, especially in the context with relatively low competitiveness such as telecommunication industry in developing country like Vietnam. Importantly, company should put the employees at the center of innovation because increasing employee's innovation capability through knowledge sharing would help to build up organizational knowledge as a whole and enhance firm innovation capability.

Conclusions

This study provides empirical evidence by testing research framework related to knowledge sharing practices (knowledge collecting, knowledge donating), individual innovation capability and firm innovation capability (product innovation, process innovation, managerial innovation) in the context of Vietnam's telecommunication industry. Data sample were collected from 392 respondents in Vietnamese telecommunication companies, which are diverse in workplace and working experience.

Most of the findings are satisfied with authors' initial arguments, except the direct link between knowledge sharing and organizational innovation capability. Knowledge collecting has no direct impact on organizational innovation capability, and knowledge donating is found to have direct positive impact on product and managerial innovation capability but not process innovation capability. Results of this paper confirm significant effect of knowledge sharing on individual innovation capability, and individual innovation capability was found as a determinant of product, process and managerial innovation capability. More importantly, it confirms the hypothesis that there is significant mediating role of individual innovation capability on the relationship between knowledge sharing and firm innovation capability. Theoretically, current study proposes a conceptual framework that considers innovation capability in two levels: individual and organizational, as well as divide organizational innovation into three

types: product innovation, process innovation and managerial innovation. Practically, knowledge sharing practices are emphasized within companies to facilitate employee socialization, enlarge employee's cognitive capacity as well as improve firm's competitive advantage regarding innovation. Specially, effect of each knowledge sharing practice on each type of innovation capability is provided. Managers can utilize analysis result in this work, depend on their objective of improving a specific kind of innovation capability.

It is important to view this study under its limitations. Firstly, data sample were collected during short period of time, so it leads to unexpected sample size with low response rate. Future researches can collect more data to re-examine the framework in wider context, so that providing results that are more generalizable. Moreover, another statistical technique could be used to provide more interesting results, such as implementing path analysis, adding control variables, etc. Second limitation in this paper is that questionnaire survey is based on perceptual data. It may create bias because there is involvement of personal opinion. This limitation can be handled by future works by measuring innovation capability by both subjective and objective way. Another method is undertaking longitudinal studies, consider impact of knowledge sharing on innovation in a long period of time. Lastly, more variables can be added into the model to fully understand determinants of knowledge sharing as well as innovation capability.

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