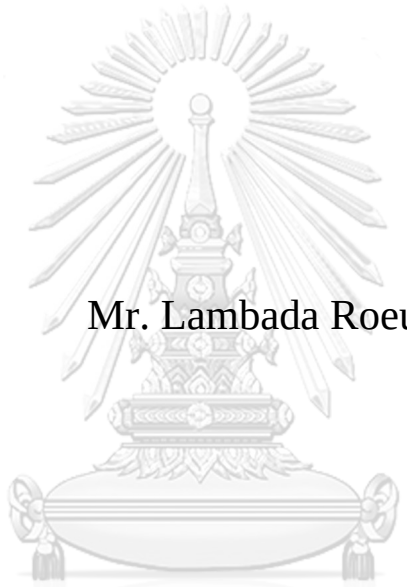
DEVELOPMENT OF CAUSAL RELATIONSHIP MODEL OF KNOWLEDGE SHARING IN CONSTRUCTION PROJECTS

Mr. Lambada Roeun



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การพัฒนาโมเดลความสัมพันธ์เชิงสาเหตุของการแลกเปลี่ยนความรู้ในโครงการก่อสร้าง

นายลำบาดา เรือน

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต
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Field of Study	Civil Engineering
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การแลกเปลี่ยนความรู้ระหว่างผู้ปฏิบัติงานในโครงการก่อสร้างเป็นสิ่งสำคัญอย่างยิ่งสำหรับการพัฒนาความสำเร็จและประสิทธิภาพของโครงการ โดยการแลกเปลี่ยนความรู้ยังช่วยลดข้อผิดพลาดในกระบวนการก่อสร้าง ปัจจุบันการจัดการโครงการมีการเติบโตที่ซับซ้อนมากขึ้นและผู้ปฏิบัติงานในโครงการจำเป็นต้องเรียนรู้แนวปฏิบัติที่ดีที่สุดจากผู้อื่น แต่การแลกเปลี่ยนความรู้ยังทำได้ไม่ดีนักเนื่องจากมีงานวิจัยจำนวนน้อยที่วิเคราะห์การประเมินความสัมพันธ์ของปัจจัยสนับสนุนที่มีผลต่อการแลกเปลี่ยนความรู้จากบริบทต่างๆในโครงการก่อสร้าง งานวิจัยนี้มีวัตถุประสงค์เพื่อพัฒนาโมเดลความสัมพันธ์เชิงสาเหตุของปัจจัยสนับสนุนในด้านจิตวิทยา บุคคล องค์กร และเทคโนโลยี ที่มีผลต่อตัวแปรส่งผ่าน เช่น พฤติกรรมการแลกเปลี่ยนความรู้ กระบวนการแลกเปลี่ยนความรู้ และประเมินระดับอิทธิพลของตัวแปรส่งผ่านต่อผลลัพธ์การแลกเปลี่ยนความรู้ แบบสอบถามที่ใช้ในการเก็บรวบรวมข้อมูลจาก 25 โครงการก่อสร้างอาคารในกรุงพนมเปญประเทศกัมพูชาซึ่งส่งกลับ 320 ชุด แสดงอัตราการตอบกลับ 64% การพัฒนาสมมติฐานและรูปแบบความสัมพันธ์เชิงสาเหตุใช้การวิเคราะห์ปัจจัยเชิงยืนยัน (CFA) เพื่อทดสอบความสอดคล้องของแบบจำลอง จากนั้นใช้แบบจำลองสมการโครงสร้าง (SEM) เพื่อทดสอบความสัมพันธ์ของสมมติฐานระหว่างตัวแปรอิสระของตัวแปรส่งผ่าน และตัวแปรตาม ผลลัพธ์เชิงประจักษ์แสดงให้เห็นว่าปัจจัยด้านจิตวิทยา บุคคล และองค์กรมีผลอย่างมีนัยสำคัญต่อตัวแปรส่งผ่านทั้งสอง อย่างไรก็ตามปัจจัยทางเทคโนโลยีมีผลกระทบเล็กน้อยในการศึกษานี้ นอกจากนี้การศึกษาแสดงให้เห็นว่าตัวแปรส่งผ่านทั้งสองมีอิทธิพลอย่างมีนัยสำคัญต่อผลลัพธ์การแลกเปลี่ยนความรู้ โดยพฤติกรรมการแลกเปลี่ยนความรู้นั้นมีอิทธิพลมากกว่ากระบวนการแลกเปลี่ยนความรู้ ผลลัพธ์ที่เป็นประโยชน์เหล่านี้สามารถนำมาใช้เพื่อสร้างความเข้าใจที่ดีขึ้นของการแลกเปลี่ยนความรู้ในบริบทของโครงการก่อสร้าง

สาขาวิชา วิศวกรรมโยธา ลายมือชื่อนิสิต .....

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KEYWORD: Causal relationship model, Knowledge sharing, Construction project, Structural equation modeling, Cambodia

Lambada Roeun : DEVELOPMENT OF CAUSAL RELATIONSHIP MODEL OF KNOWLEDGE SHARING IN CONSTRUCTION PROJECTS. Advisor: Asst. Prof. VACHARA PEANSUPAP, Ph.D.

Knowledge sharing among construction project members is very crucial for improving project success and project performance. It can also reduce mistakes in the construction process. Project management has been growing more complicated, and project members need to learn best practice from others. Currently, knowledge sharing is not well performed yet; especially, few research studies have been focused on the relationship evaluation of supporting factors that affect knowledge sharing from different contexts in construction projects. Therefore, this study aims to develop the causal relationship model of supporting factors from psychological, individual, organizational, and technological factors that affect mediators – knowledge sharing behavior and knowledge sharing processes, and evaluate the influence level of mediators on knowledge sharing outcomes. The questionnaire survey was used to collect the data from 25 building construction projects in Phnom Penh, Cambodia, of which 320 were returned indicating a 64% response rate. Research hypotheses and causal relationship model were developed. The confirmatory factor analysis (CFA) was employed to test the model fit. Then, the structural equation modeling (SEM) was used to examine the hypothesized relationships among the independent, mediators, and dependent variables. The empirical result illustrates that psychological, individual, and organizational factors have a significant effect on both mediators. However, the technological factor has an insignificant impact in this study. In addition, this study reveals that both mediators have a significant influence on knowledge sharing outcomes, but knowledge sharing behavior is strongly influenced than knowledge sharing processes. These useful results can be used to provide a better understanding of knowledge sharing in the context of construction projects.

Field of Study:	Civil Engineering	Student's Signature .....
Academic Year:	2018	Advisor's Signature .....

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Lambada Roeun

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1
INTRODUCTION

1.1 Background of Research

Knowledge has treated as an extreme complication in term of its nature. The most widely recognized nature of knowledge is known as "Tri-Partite" or "Justified, True, and Belief" (Nonaka and Takeuchi, 1995). In addition, Wiig (1997) defined that the knowledge consisted of facts, truths, and beliefs whereas the information consisted of facts and organized data. They noted that the knowledge can be created, and shared will depend on the commitment between knowledge's holders and knowledge's seekers. It is important for receiver to decide whether the information that they receive is the correct information or not. Practically, people have to interchange between data to information, and information to knowledge. Actually, the data (unprocessed raw facts) have to convert into information (meaningful aggregations of data); then the information also have to convert into knowledge. Regarding this conversion, the academics are stricly judge the nature of knowledge among data, information, and knowledge.

There are several meanings of knowledge that previous researchers have conducted for different advantages. However, the meaning of knowledge really hard to have a best one since there is very little agreement from the academicians and practitioners. Firstly, the knowledge is a vital resource which is considered as a combination of experience, information that could provides the framework for the evaluation (Davenport and Prusak, 1998). Secondly, knowledge can be judged as the foundation for an organization's competitive and long-term success in the construction organization (Zhang and Fai Ng, 2012). Lastly, knowledge could be a great resource for providing the successful of the project as well as the organization, especially it is a bright clue for decision making in the project's bidding (Kivrak et al., 2008). In general, knowledge is possible to determine as the processing of data to information and making the knowledge by human being.

In order to understand deeply about knowledge, Polanyi (1966) categorized the knowledge into two types for the first time: explicit knowledge and tacit knowledge. Accordingly, explicit is referred to the knowledge that can be coding, and exchanging in many forms or symbols in the human language. Whereas tacit is considered as the most valuable resource or knowledge that is stored in the human brain such as the experience or best practice that hard to explain or coding as explicit.. Even Nonaka and Takeuchi (1995) also stressed about tacit knowledge as individual behavior within the specific of personal skills, and emotions. These two types of knowledge are taken into account for more understanding from many researchers in the last few decades.

However, Hidding and Catterall (1998) said that knowledge will useless and meaningless if it does not use and share in some ways. Knowledge sharing is a part of knowledge management. According to Hong et al. (2011), knowledge sharing is valued as the heart of knowledge management. While knowledge sharing can provide many benefits such as improvement of people's capacity (Cohen and Levinthal, 1990), advance of sustainable competitive (Argote and Ingram, 2000; Kogut and Zander, 1992), increase the productivity (Dyer and Nobeoka, 2000), and improve the work performance (Hansen and Haas, 2007). Essential knowledge sharing can provide another benefit in the projects, it can help to avoid and reduce the mistakes from the beginning till the end of construction project (Javernick-Will and Levitt, 2009; Ma et al., 2008). There is bright enough to show about the extrem value of how knowledge sharing that can be generated a high potential.

Knowledge sharing in the construction project is inevitable. Even though many potential values are generated through knowledge sharing, the obstacle is still possible to happen. Fortunately, there are several researchers who have found some barriers related to the individual factors, organizational processes, knowledge sharing procedure, and technology support (Bigliardi et al., 2010; Leal et al., 2017; Li et al., 2017; Lin, H. F., 2007; Maqsood and Finegan, 2009). In the construction projects, the communication is highly considered like great tool to facilitate the performing of knowledge sharing (Asrar-ul-Haq and Anwar, 2016) and closely related to the workspace of the communication of employees (Coradi et al., 2015). On the other

hand, organizational culture and time constraint also determined as the significant issue in the construction project organizations (Carrillo et al., 2004; Robinson et al., 2001b). This highlight needs for continuing the research of knowledge sharing in the constrution projects.

In summary, everyone in this world is determining how hard of sharing knowledge or transferring knowledge in both ways whether inside and outside their team working environment. As evidence, Waveren et al. (2014) conducted the research that studied about the knowledge transfer within three theoretical concepts which are referred to the type of knowledge, knowledge transfer technique and mechanism, and the success of knowledge transfer. By the way, the theoretical framework to investigate individual's attitudes and intention toward knowledge sharing in construction teams provided essential interest implication for construction companies in this decade (Zhang and Fai Ng, 2012, 2013).

1.2 Problem Statement

Knowledge sharing has known as a great research area that has been taken in to account in various studies such as business, management studies, etc. as the new paradigms. Despite investigating many studies in various reseaches, knowledge sharing is seem like a new researh area for the project management domain. While lots of researches have been investigated on cost reduction and timely delivery of projects, relatively few researchers have taken into account of the significance of sharing the knowledge during the execution of the project (Egbu, 2004; Leal et al., 2017). However, the number of researchers in the project management domain had paid attention to the importance of sharing the knowledge, and a relatively large number of researchers notices its usability and application in this area. Thus, interests of knowledge sharing are growing, and knowledge sharing in the project management domain should be researched appropriately.

Since many academics stress the significant implementation of knowledge sharing in this recent years, there are several highlighted challenges as essential compositions to facilitate knowledge sharing in project management studies. Most of

the challenges occur due to the intrinsic characteristics of a project. Furthermore, it is so crucial in the project teams to indicate the trusting like factors for studying the knowledge sharing in project members (Ma et al., 2008). Kivrak et al. (2014) argued that without a trusting environment in the work place, people might be less attention to share their knowledge to other people in their organizations. If the members in the construction do not trust each other or some clarity issues are not addressed well, they are bound to fail the project. Additionally, many of knowledge management systems is often failure because of the affecting of factor from cultural is higher than the information technology. While knowledge is belonging to people-based and the characteristics of cultural of different groups of people, they play a key role in knowledge management successfully as well as knowledge transfer and the subsequent development of competencies within an organization (Argote and Ingram, 2000). Many scholars agree that the organization's culture poses one of the biggest challenges for knowledge transfer in projects because it influences the project members' decisions whether to share and exchange project knowledge or not (Ajmal and Koskinen, 2008; Kivrak et al., 2014; Wiewiora et al., 2009). Consequently, construction project management deals with the importance of sharing knowledge among its members between knowledge provider and knowledge recipient. It was shown that the knowledge of the team is derived from its members as stated by Foss et al. (2010): "Knowledge sharing is designed to transform the individual into organizational knowledge". Along with this academic support, the recent researchers are proud to take part in dealing with the rest challenge that currently faces regarding knowledge sharing in the project-based organization.

Since the knowledge sharing relies on individual, Walker and Maqsood (2007) characterized the knowledge as stickiness that is difficult to transfer. The same idea with Davenport and Prusak (1998), the human tendency is to hoard and not share knowledge easily. There is having a tendency to express their willingness, and the willingness to share and contribute to the organization especially in the construction projects. While the willingness of individuals and eagerness to participate and engage in project-based organizations have been notices (Egbu et al., 2001; Kelly et al., 2013; Wiewiora et al., 2009), little studies have reported from a perspective of individuals'

motivations who voluntarily contribute with others as well as to the organizations. It is important to engage a theory of psychology field in the developed model for helping and providing better understand how and why individual people in the project organizations share their knowledge and define what the real motivators are. This understanding may help individuals people decide to participate in knowledge sharing practices with others in the organization that will focus on identifying psychological factors influencing their decision-making. Because of the reason is that psychological factor is much fit to individuals motivation and there is little empirical research, so it is still a huge concern in term of factors that influencing knowledge sharing that should be investigated for this study.

Despite criticiam and barriers regarding knowledge sharing, researchers have focused on exploring and sharing knowledge to project-based organizations. According to Ajmal and Koskinen (2008), they presented two importance reasons for the improving of knowledge management in a construction project organizations, and it is demonstrated on knowledge sharing and transfer. Firstly, the work of projects have been growing more complicated than ever before from day to day. Also, the need for advanced technical and social relationships with project team members. Secondly, project members need to learn from other perople or completed projects that are already known in order to improve new knowledge and to enhance competence. Continuous learning will enable the corporation to acquire and consolidate the knowledge that resides in organizational memory as well as sustainability of the competitive advantages. That is why knowledge management is considered as best way to change these changing circumstances and to achieve the company's sustainable success and creativity. The only knowledge sharing and transfer could explore this advance for project-based organizations.

Briefly, knowledge sharing is actually becoming the essential topic of the researches in different aspects. As evidence, many researches found the relationship between several supporting factors that affect knowledge sharing (Idris et al., 2015; Issa and Haddad, 2008; Javernick-Will, 2012; Ma et al., 2008; Zhang and Fai Ng, 2012, 2013), the strategy and mechanism to implement the knowledge sharing (Dainty et al., 2005; Javernick-Will, 2012; Kivrak et al., 2014; Leal et al., 2017;

Mohd Zin and Egbu, 2011), the framework (Berg et al., 2012; Kelly et al., 2013; Leal et al., 2017), and the evaluation (Arif et al., 2017). Even though there are several researches study about supporting factors and its affecting on knowledge sharing in construction, it is still incomplete to make the sharing performance effectively. However, there are few researches about the evaluation of supporting factors and its affecting on knowledge sharing from different contexts of construction project-based organizations such as individual, organizational, and technology. Clearly that psychological context is out of the era of knowledge sharing. Actually, without psychological factors, the knowledge sharing might not fit or entirely successful. There might have something lacking like the explanation such as the benefit of psychological affect knowledge sharing, and nobody does this in construction projects. Therefore, without the evaluation of supporting factors, it does not enable to see which aspect has more influenced knowledge sharing. This research will conduct to fill in those gaps for two important things. Firstly, each factor will be identified responsively significant support for knowledge sharing behavior, and knowledge sharing processes. Lastly, this research will evaluate the influencing level of the knowledge sharing behavior, and knowledge sharing processes that affect knowledge sharing outcomes in construction projects. The conceptual framework of the four dimensions that have some relationship with the knowledge sharing for the study is presented in Figure 1.1.

1.3 Objectives of Research

The overall objectives of this research are described as follows:

1) To develop the causal relationship model of factors affects knowledge sharing in construction projects.
2) To evaluate
   (a) the direct hypothesized relationships of psychological, individual, organizational, and technological factors that affect knowledge sharing behavior, and knowledge sharing processes;

(b) the influence level of knowledge sharing behavior and knowledge sharing processes on knowledge sharing outcomes.

In order to achieve these essential purposes, a few sub-objectives are detailed as follows:

1) Propose a conceptual model for studying as shown in Figure 1.1.
2) Identify and categorize the factors into four groups – psychological, individual, organizational, and technological factors that affect knowledge sharing in construction perspective.

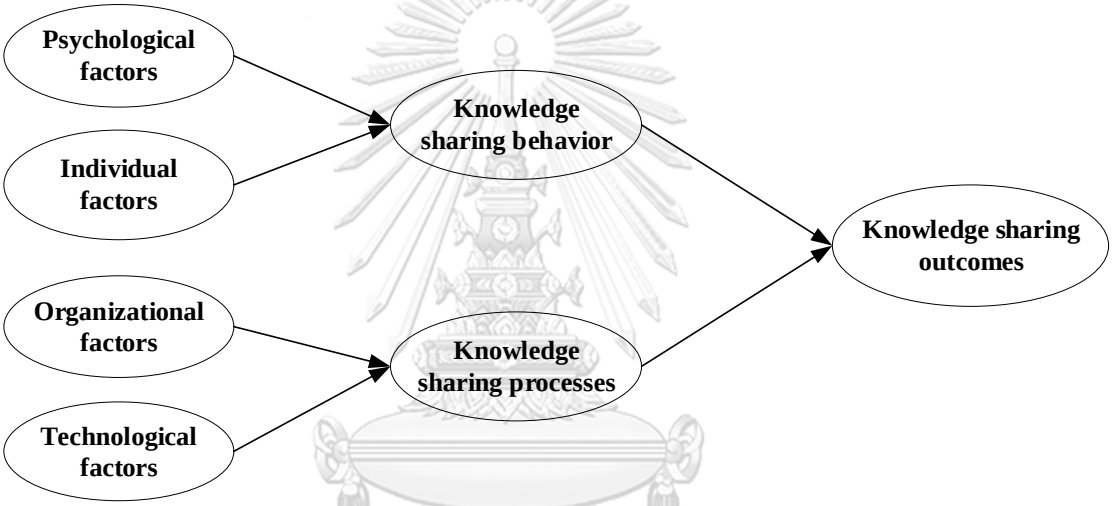


Figure 1.1: Conceptual model of knowledge sharing

1.4 Scopes of Research

This research demonstrates the evaluation of supporting factors effect the mediators, knowledge sharing behavior and knowledge sharing processes, then evaluate the influence of mediators on knowledge sharing outcomes which can maximize the benefit of knowledge sharing in building construction projects. Regarding the objectives, the study will be recognized as follows:

1) Investigate location: Phnom Penh Capital City, Cambodia
2) Target project: Mid-rise, and High-rise private building construction projects

3) Target respondent: Project manager, Site manager, Senior engineer, and Junior engineer

In Cambodia, most of the public construction are infrastructure projects such as bridges and roads. However, the building constructions of public projects are mostly schools, offices, and so on which are low-rise. In contrast, this study focuses on high-rise and mid-rise of private construction projects which is located in Phnom Penh, Cambodia.

Regarding the specific type of building construction projects, it will be classified depending on the height and the floor of the building. Based on the standard of American Society of Civil Engineers (ASCE), wind loads are imposed according to the heights of the building (Staff, 1994). The heights of the building are considered into two types, low-rise and high-rise. The low-rise building is considered with the heigh lower than 60 feet ($h \leq 60\ ft \approx 18.30\ m$) where the high-rise building is higher than 60 feet ($h > 60\ ft \approx 18.30\ m$). However, Akkar et al. (2005) classified the building depend on the story-based aspect which is used for this study. There are three types of the building as known as low-rise, mid-rise, and high-rise building. In addition, the low-rise building has the story between 1 to 3 stories, the mid-rise building is between 4 to 7 stories, and the high-rise has 8 stories up as summarized in Table 1.1.

Moreover, the respondent will be categorized by their gender, age, education degree, position, and experience. All of the respondents will be chosen in the construction projects which fit the objective of the research as clearly known that they are the knowledgeable and experienced engineers (managers and senior engineers) and new engineers (junior engineers).

Table 1.1: Building classification

Types of building	Number of stories	Total height
Low-rise	1 – 3	9.80 m
Mid-rise	4 – 7	9.80 m – 22.86 m
High-rise	8 up	22.86 m up

1.5 Methodology of Research

In order to accomplish these research goals, a quantitative approach is used. The research is appreciated in the quantitative study to use the primary and secondary data collection. The detailed methodology is designed as follows:

1) Literature reviews:
   a. Conduct the literature review and documentation on the concept of construction organizations toward knowledge sharing approaches
   b. Identify the factors in different dimensions that affect knowledge sharing in construction perspective
2) Pilot study:
   a. Arrange a set of questions for interviewing some experts or relevant target people in the construction sites in Cambodia
   b. Discuss questions for feedback on the problem statement and objective of the study
3) Questionnaire design: Design the survey questionnaire for respondents to provide their background information and perceptions of the factors affect knowledge sharing in construction projects
4) Data collection: This research has adopted the self-administered questionnaire type, and is sent out and return by mail (Internet and intranet-mediated questionnaires) and delivered to respondents by hand and collected later after completion (Delivery and collection questionnaires).
5) Data analysis:
   a. The SPSS and excel are used to input the data and analyze the descriptive statistics
   b. AMOS is used to analyze the confirmatory factor analysis (CFA) and structural equation modeling (SEM)
6) Result discussion and conclusion: The last part of the thesis will provide the conclusion of the research, recommendation as well as the limitation, and future research

1.6 Expected Outcomes

The success of this research would be able to obtain a well understanding of the level of influencing factor to affect knowledge sharing in construction project-based organizations. Moreover, the benefit from the knowledge sharing in construction is the most valuable asset of the project-based organizations for the long-term competitive market. In addition, the researcher expects the future benefits from this research that would be listed as follows:

1) This research is conducted on building construction which is located in Cambodia, a developing country, to execute the significant factors support to knowledge sharing approaches in project-based organizations. The significant factors will enhance knowledge sharing from different perspectives between individual, organizational, technological, and psychological support.
2) The evaluation of each supporting factors and its affecting on knowledge sharing in the construction projects will enhance more understanding across the individual, organizational, technological, and psychological support.
3) The project manager who is a main power in the organization will receive a better understanding of each dimension (individual, organization, technology, and psychology) whether any dimension needs to improve or pay more concentration in order to enable and find the best policy to promote knowledge sharing.
4) This research will enhance more understanding of both academicians and practitioners in the future research as well as the implementation.

Furthermore, the suggestion at the end of the research would be the critical thing to improve lives and society.

CHAPTER 2
LITERATURE REVIEW

2.1 Knowledge Management

This chapter describes the literature reviews on knowledge management and knowledge sharing. The benefits of knowledge management are to improve problem solving as well as barriers to implementing in the construction organization. This part provides the overall perspective related to knowledge management concept, process, and concentration with knowledge sharing such as its usefulness, obstacles, and a few important researches that attempt to solve the construction problem in the organization level.

2.1.1 Knowledge Management Concept

This section will provide the significant existing concept of theory and definition of knowledge management in the organizations associated with its perspective which is the most related to the outlines of this study. There were two types of knowledge: tacit and explicit knowledge (Polanyi, 1966). Within the construction context, Lin, Y. C. et al. (2005) mentioned that explicit knowledge is directed to documented information such as project information, drawing, specifications, manual, cash flow statement, risk analysis, and many other information which is collected, stored, and achieved by an organization in either paper-based or electronic format to be available for other knowledge recipients. While, tacit knowledge referred to the experience and expertise of personnel, the organization culture, lessons learned from previous projects. It was often perceived as valuables forms of the information.

However, knowledge management refers to processes or practices of creating, acquiring, capturing, sharing, and reusing knowledge wherever it aims to improve learning and performance in organizations (Scarbrough et al., 1999). Knowledge management is outlined as the identification, optimization, and active management of

intellectual assets that make value, improve productivity, and gain the sustainable competitive advantage (Webb, 2017). It can also be characterized as a process to identify or create, assimilate, and implement the knowledge or organization to exploit new opportunitiesa and to increase performance (Yang, 2011). Even though there are many definitions from different researchers regarding knowledge management, they would accept all of those definitions as a basic approach to how organizations should organize their activities in knowledge management to manage knowledge processes and to facilitate knowledge-related activities.

In general, knowledge management deals with the systematic to store and use knowledge within an organization that aim to improve their performance (Tan et al., 2010). The same researchers also proposed four sets of knowledge management perspectives which were the most related to the outlines of this research such as functionalist versus interpretivist, information system versus human resource management, interdisciplinary perspective, and soft and hard approaches.

Moreover, Stankosky, M. A. (2005) proposed four principal areas or groups whose knowledge management elements were grouped as shown in Figure 2.1.

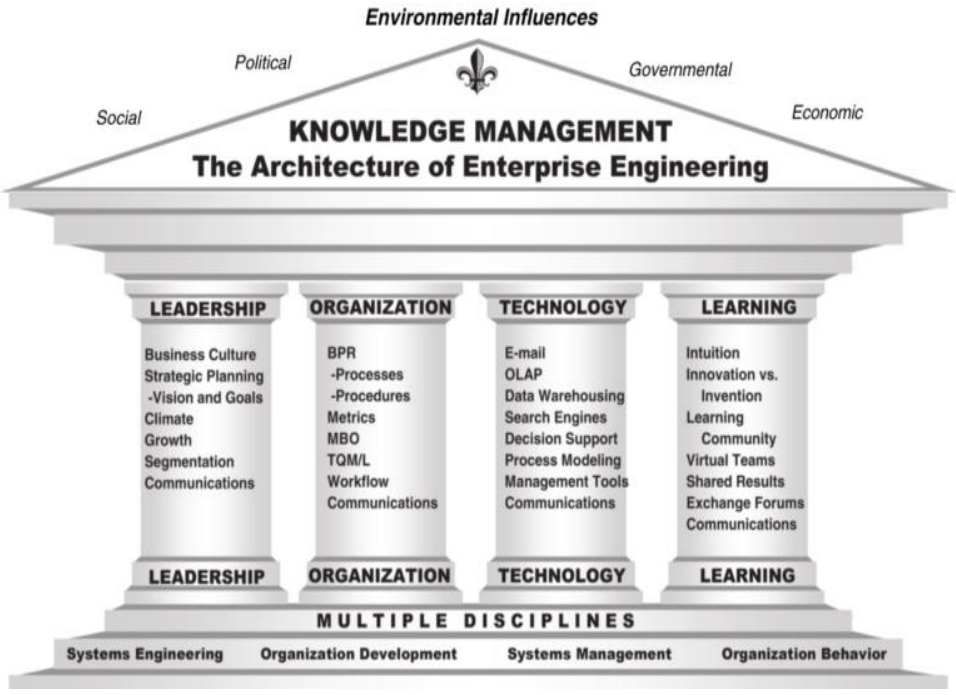


Figure 2.1: Four pillars of knowledge management (Stankosky, M., 2005)

Leadership: In terms of business culture, strategic planning, and decision-making processes of enterprise-level that involve the purposes, need, sources, and allocation of resource of the organization's knowledge assets.

Organization: Referring to this aspect, the knowledge management is consdiered as an aseets of the organization in which is including the process, procedure, and communication. It is available for both of informal and formal communication as well as the structure of the organization.

Technology: Acording to this aspect, information technlogy is used as a tool like email, data warehousing, management tools communication and strategy that help to support and coperate in term of knowledge management functions in the organization.

Learning: It is referred to the user that is going to deal with the behavior of the organization which is focusing on the practices of knowledge management and its principles in order to maximize the performing of knowledge sharing from the individual.

2.1.2 Knowledge Management Process

Many approaches that discuss under the umbrella of knowledge management are concerned primarily with exploiting existing knowledge. Knowledge management involves several items such as the identification and analysis of knowledge, subsequent plan, and follow-up activities to develop an assets of knowledge to meet the organizatioal goals (Macintosh, 1996). Generally, knowledge management has four components such as knowledge capturing, knowledge sharing, knowledge reuse, and knowledge maintain (Tan et al., 2010) as shown in Figure 2.2. However, other researchers also address this term in another form as shown in Table 2.1, but actually they are the same thing.

Table 2.1: Relationship of knowledge management components

Tan et al. (2010)	Scarbrough et al. (1999)	Stankosky, M. A. (2005)	Robinson et al. (2001a)
Capture	Creating Acquiring Capturing	Codification	Discovering Locating Capturing Organizing Storing
Sharing	Sharing	Transfer	Sharing Transferring
Reuse	Reusing	Generation	Modifying Applying
Maintain		Assurance	Archiving Retirement

Knowledge capture is well known as knowledge creation that can be defined as the mental process of reorganizing and connecting of knowledge for generating new knowledge. There are two primary sources of how to create new knowledge in the organization. Firstly, the ways of acquiring knowledge from external sources are hiring and training staffs, cooperating with other organizations, and buying knowledge products. The second primary source is internal sources that already exist within the company in some forms. Moreover, three types of knowledge capture are: identifying and locating knowledge, representing and storing knowledge, and knowledge validation.

Knowledge sharing is about giving accurate knowledge to the right people at the right time or the shortest time (Robinson et al., 2002). In addition, it is also referred to activities that can be transferred or disseminated knowledge from a person, group, and organization to other.

Knowledge reuse is referred to the re-implementation of knowledge such as the re-use of the best-practiced knowledge to innovate the necessary adaptation or

integration. The way of knowledge reusing through adjustment is involved re-conceptualizing the problem and finding the reusable ideas, then screening, evaluating and analyzing this reusable idea in depth and choosing one of the best ideas that may help lead to the innovation.

Knowledge maintenance is the process that includes the reviewing, editing, correcting, and updating the knowledge in order to keep it up to date, and removing the old knowledge. When content is maintained, the most important issue is about the quality versus quantity. Ensuring either of the two will require substantial effort, and going for both is usually neither affordable nor sensible. The option of quality rather than indiscriminate quantity will make more sense for many organizations.

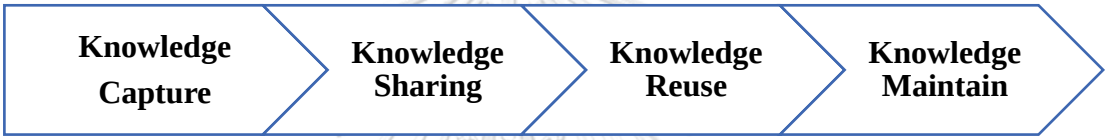


Figure 2.2: Knowledge management processes (Tan et al., 2010)

2.2 Knowledge Sharing

The previous section shows the knowledge management, but it does not provide specific enough about its components yet. Then, this section will provide more detail about knowledge sharing within different aspects from individual, and organization in the construction context. That is the reason why we would like to explain the knowledge sharing and its processes. Additionally, we will examine between the benefits and barriers of knowledge sharing from a construction perspective. This section is ended by attempting to solve the construction problem in the previous research including influencing factors, processes, and technologies for knowledge sharing.

2.2.1 Definition of Knowledge Sharing

Knowledge sharing is very critical for organizations when they want to use the knowledge in order to achieve in a competitive market. It is the primary key to knowledge management systems in an organization. The main thing of knowledge sharing focuses on the individual who can coding, explain, and communicate knowledge to others such as individuals, groups, and organizations. Some knowledge can be shared more easier, while some knowledge have a lot of difficulty to share if the levels of codification are different. According to Ma et al. (2008), three types of knowledge in a project team can be shared such as auxiliary knowledge, field knowledge, and technical knowledge. First, auxiliary knowledge is included the regulations and policies, documentation from internal and external, reports of accounting and financial, data of human resources, manual of instruction, operational processes, and technical documentation. Secondly, field knowledge is included the proposals, schedules of construction, budget reports, construction contracts, and other projects analyzing reports. The last type is technical knowledge which is mainly included in the technique of know-how and managerial expertise of organization members in order to accumulate their experiences. From these three types of knowledge, we observed that the first two types are more flavor to the explicit knowledge while the last one is most likely to the tacit knowledge.

Knowledge sharing is defined as a culture of social communication including knowledge transfer, employee knowledge exchange, sharing of experiences, and some skills by all of the departments or the organizations (Lin, H. F. et al., 2009). As considered by Rad et al. (2014), knowledge sharing that states as the knowledge interchange and transfer between individuals, groups, and organizations aimed to develop the organizational effectiveness through the real integration, exchange, and knowledge interaction. The definition of knowledge sharing that is used in this study is a willingness to contribute tacit knowledge (the best practices and lessons learned, skills, experience, and understanding) and explicit knowledge between experienced and inexperienced people collaborate with organizational support and facility with technology, which can lead to maximizing the sharing activity in the construction

projects. According to Tan et al. (2010), these were the ways to proof of working that contributed to the successful projects and must be avoided the mistakes in the future projects. This knowledge is often judged as the best practice guidelines and coding for the next practice. Then, Table 2.2 will offer some examples of the definitions from the multiple source views on knowledge sharing from the previous literature review.

Table 2.2: Definitions of knowledge sharing

Authors	Definitions
Lin, H. F. et al. (2009)	Knowledge sharing is defined as a culture of social communication including knowledge transfer, employee knowledge exchange, sharing of experiences, and some skills by all of the departments or the organizations.
Rad et al. (2014)	Knowledge sharing states as the knowledge interchange and transfer between individuals, groups, and organizations aimed to develop the organizational effectiveness through the actual integration, exchange, and knowledge interaction.
Robinson et al. (2002)	Knowledge sharing is about giving accurate knowledge to the right people at the right time or the shortest time.
Lin, H. F. (2007)	Knowledge sharing is the way to transfer knowledge from experience in the organization and make it available to others in the business.
Ipe (2003)	Knowledge sharing is the activity of the individual to provide knowledge to others in the organization.

2.2.2 Benefits of Knowledge Sharing in Construction

To understand the core value of knowledge sharing in construction, it is a great challenge. In the construction organization's context, the perception and principle of knowledge sharing are so important and related. Organizations cannot create knowledge by themselves, but they have to rely on their stuff to create, share, and use knowledge in the organization's work processes (Foss et al., 2010; Ipe, 2003). That is the reason why Hidding and Catterall (1998) supported that knowledge will

not have any value unless it is shared and used in some ways. There is bright enough to show that knowledge sharing will able to generate the value and it has a high potential.

Cohen and Levinthal (1990) stated that organizations need prior related knowledge in order to assimilate and implement new knowledge. It is the ability of absorptive capacity in the organization that depends on its members. Thus, absorptive capacity comes to be a part of an organization's decision calculus in distributing resources for innovation activity. By the way, knowledge sharing can help to reduce the same mistakes, provide a good quality product, and create an innovative environment in the organization which will advance the construction firm (Javernick-Will and Levitt, 2009). Hussain et al. (2004) indicated that knowledge sharing could benefit from losing the intellectual capital when any stuffs intent to leave from the organization, cost could be deducted, the unnecessary of knowledge-based activities could be reduced, productivity could be increased through making knowledge available, quick and easy, and increasing employee satisfaction.

Furthermore, the construction organizations can get the value from acting the knowledge sharing from many different choices that depending on the size of the organization. Mohd Zin and Egbu (2011) had indicated the three top benefits of knowledge sharing for improved performance in the construction organization such as increasing the effective operations and cut down the costs, make a better decision, and improving services ability in the project to the market faster. Moreover, in the construction firm, the disputes shall happen because of the order changes between project owners, construction project managers, site managers, and contractors during the process of construction. Chen, J. H. (2008) has developed a model of knowledge sharing for sharing information that will help the interested parties to avoid conflicts, dispute resolution, and providing the effectiveness of dispute resolution. Its benefits are not only to develop a sample of knowledge sharing but it also helps construction practitioners to use knowledge sharing to prevent costing and unneccessary usage. In addition, transferring of the best practice will be the one of the benefits of knowledge sharing that can be happened in both of within and acrossing the organization (Anumba et al., 2005).

2.2.3 Barriers to Knowledge Sharing in Construction

A literature review has indicated to the construction organization that it has begun to realize the necessary of implementing knowledge sharing. While as the benefits of knowledge sharing are proposed above, obstacles also exist to disrupt the successful knowledge activities. Even though the knowledge is able to share, inviting people to involve and to utilize knowledge is complicated. That is the reason why the barriers identification and recognition to knowledge sharing play an essential role in the success of a knowledge management strategy.

There are some reasons why studying the effectiveness of knowledge sharing approaches represents considerable importance. However, the effectiveness of knowledge sharing approaches has many barriers that are related to the people. The core component of knowledge sharing is human. In addition, Riege (2005) defined the literature reviews article and discussed the main three potential barriers affect knowledge sharing. Those three central potentials were categorized such as individual or personal, organizational, and technological barriers. This study also includes another domain calls psychological, so four potential areas affect knowledge sharing as shown in Figure 2.3.

2.2.3.1 Potential Individual Barriers

The barrier at individual or employee level, it is focused on the human. The knowledge sharing barriers are related to some factors that specific about the poor communication skills as well as the social networks among employees, difference culture, difference position statuses, lack of trust, not enough time for sharing (Riege, 2005). At this level, barriers are identified to find the importance that possibly to happen from the individual or employee in the organization. Besides that, people may fear knowledge sharing because of losing people's job security, low-value recognition as well as the benefit after performing that activity. Moreover, there is a limitation of evaluation, knowledge feedback, strong communication, tolerance of previous

mistakes in the organization. In somehow, the age, gender, and education level differences may also the factors that could be considered as well.

2.2.3.2 Potential Organizational Barriers

Another issue of knowledge sharing is the context of organization related to the environment and the conditions of the company. The organizational level, the problem would be considered from the firm or organization. The barriers tend to be related to the company's vision, strategy, leadership, and management style in the organization (Riege, 2005). Moreover, lacking motivation such as rewards system, and recognition systems also affect the performance of knowledge sharing. Within this context, insufficient support from an organization like resources, times, materials, opportunities, working environment, and sharing infrastructure may make the poor performance of knowledge sharing as well. Even though the hierarchical organization structure, it may inhibit or produce the sharing slowdown in some ways.

2.2.3.3 Potential Technological Barriers

The next key issue is about potential technological barriers that are a little doubt. It can perform as a facilitating tool in order to encourage and support sharing knowledge processes by making knowledge sharing more accessible and more effective. At the technological level, barriers are correlated with some factors like the unwillingness of using information technology applications, and the information technology systems (Riege, 2005). These are the lacking of internal and external technical support that could influence the communication flows. In addition, lacking training of new technology usage in the organization also a part that could affect to the knowledge sharing processes.

Issa and Haddad (2008) argued that information technology would assist, but it did not encourage people to share their knowledge at all, and it did not mean that all types of knowledge could be shared using information technology as well.

2.2.3.4 Potential Social Psychological Barriers

The last key issue is about potential social psychological barriers that are complicated, and it can perform as a facilitator to encourage and support individual knowledge sharing behavior. At this domain, barriers seem to correlate with factors such as the unwillingness of the participant (Zhang and Fai Ng, 2012). Thus, the psychology that works more effectively may fail because of the potential barrier as following:

- The unwillingness of personal attitude of employees towards knowledge sharing;
- Lack of subjective norm concentration between employees and supervisors
- Lack of the opportunity to share the knowledge
- Poor in motivation and encouragement among team member in the organization

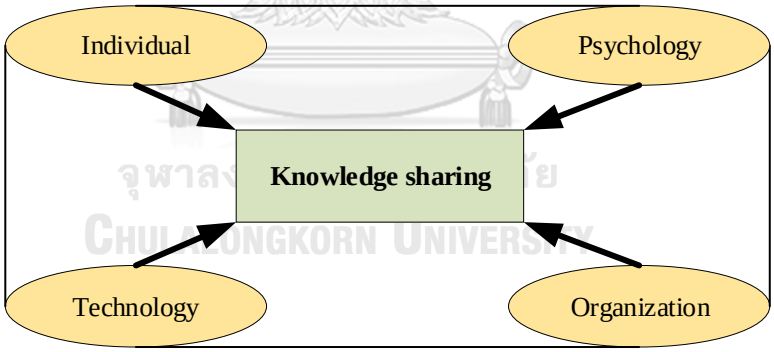


Figure 2.3: Potential knowledge sharing barriers

In addition, Robinson et al. (2001b) had conducted the research of knowledge management in big construction organizations in the United Kingdom (UK). They explored the perceptions as well as the barriers effect the implementation of knowledge sharing. The barriers were found in those research such as the organizational culture, the processes of standard work, time constraint, the resistance of employee, inadequate information technology infrastructure, meager budget, poor

understanding of knowledge management study, low organizational commitment, and the conflicting on resources demand in the organization.

Another study on large construction organizations in the UK was done by Carrillo et al. (2004). They presented four critical issues that faced in performing knowledge sharing in construction organizations including time constraint, organizational culture, limitation of conventional work processes, and not enough funding. Dainty et al. (2005) highlighted three concept obstructions to overcome the effects of knowledge management strategy in order to create the knowledge sharing culture in the organization. Those three primary obstacles were including an uncooperative culture, low communications structure, and time limitation.

Regarding the wide-ranging researches conducted previously, within the performing and development of knowledge sharing approaches, there are several critical case associated. In order to implement knowledge sharing, the construction organizations have to be familiar with these barriers because they may inhibit. Since many barriers have found above discussions, it is shown that setting up the knowledge sharing approaches is the most challenging for successful implementation in construction organizations. Thus, knowledge sharing in construct

2.3 Previous Research Attempts to Solve

This section presents the previous researches that lead to solving the issue in terms of knowledge sharing in the construction perspective. Therefore, there are three necessary things to do the literature review for giving the detail information such as the factor, process, and information technology approach in order to attempt for solving.

2.3.1 Supporting Factors Approach

Even though knowledge sharing is needed in every type of organization, it is difficult to implement for many causes. On the research of Anumba et al. (2005), knowledge could not be considered as a commodity that is simple to manage, trade,

and share. However, acting on certain contextual such as individual, organizational, and technological factors that influence knowledge flow could support on knowledge sharing.

2.3.1.1 Individual Factor.

Individual refers to the study at an individual or employee level which is strongly focused on a human. Some factors can lead to sharing knowledge to provide many benefits for people and organizations. For instance, the literature review indicates that most factors influence practitioners to improve knowledge sharing inside project teams such as explicit knowledge, tacit knowledge, and trusting environment (Ma et al., 2008). Upon as a significant factor of benefit for sharing knowledge in construction teams, some researchers had found two factors indicated that knowledge self-efficacy and knowledge feedback affected positively on individuals' attitudes toward knowledge sharing (Zhang and Fai Ng, 2012, 2013). Knowledge self-efficacy is discovered to be the most analitical motivation for individual's attitude toward knowledge sharing in the construction teams with highly tendency in order to set up trust work and capability. Another knowledge feedback is a significant benefit to knowledge sharing while knowledge receivers comment back questions, augmentation, and modifications that build on further value to the original sender, designing exponential total growth.

Javernick-Will (2012) highlighted the social motivations power in engineering and construction organizations. Some factors are identifying the cause why employees spread out their knowledge that can lead to knowledge sharing implementation successfully. Within an analytical review of the literature, it indicates that primary factors consist of resources, typically motivations, worldwide incentives, and communal motivations.

Leal et al. (2017) carried out a study to explore the individual and organizational circumstance that affect the process of putting a decision of knowledge sharing in the construction organization. The result was verified that individual factors characterized the facilitating factors of knowledge sharing in the construction part.

Throughout the literature review, facilitating factors were stated as financial or communal motivations, traditionalism to corporate culture, cooperation, perceived value and individuality of knowledge, peer recognition, honoring knowledge sharing dedications, impersonating the behavior of leaders, and culture.

Thus, the individual factor is a part of supporting the knowledge sharing since it is more specific on personal attitude and characteristic of the knowledge provider and knowledge receiver.

2.3.1.2 Organizational Factor

Organizational refers to the study at an organization level which is strongly focused on the firm. Issa and Haddad (2008) conducted the perceptions on knowledge sharing about the influences of organizational culture and information technology in the construction. The results indicated that an official organizational culture would enhance common trust in the institution under the assistant of information technology in somehow. Under the conclusion of this research, organizational culture will guide to more knowledge sharing between workers, common trust among employees to flow knowledge freely with an establishment, and technology revolution that is importantly to reach favorable knowledge management implementation.

There was one research regarding the consequence of environmental factors on knowledge sharing in the construction institution (Idris et al., 2015). It is actually referred to organizational factors – strategy and planning, organizational culture, and managerial leadership. Three of these parts were found positively remarkable consequence knowledge sharing.

From the above views, it shows that the organization factor is so critical in developing knowledge sharing. As evident, organizational parts really impact the performing of knowledge sharing activities. In conclusion, it is absolute essential for the construction organizations to decide to put these factors for performing knowledge sharing methods within the organization.

2.3.1.3 Information Technology Factor

In order to handle the knowledge well, information technology has employed by many organizations. It can be used to reserve and carry the explicit knowledge forms within and across organizations. However, information technology is not referred to computers only. Some useful materials such as video-conferencing may benefit in term of tacit knowledge sharing as defined by Nonaka and Takeuchi (1995).

Information technology becomes more critical for knowledge management in construction organizations. However, the construction organization is quite late to know about the benefits of using information technology as a significant communications tool (Egbu et al., 2001). Sharing information and knowledge within and across project organizations are the most critical issue for construction work as well as the construction institutions. Many experts and best practice knowledge has lost from one project to another project to cause weakness of the organization's development, primarily, the ability of the organization to generate new insights.

Nowadays information technologies play a primary role as an neccessary materials for direct communication between people in worldwide through the applications such as email, video-conferencing, chat-rooms, social media, and other groupware which can store data, and information in the databases (Egbu and Botterill, 2003). For information in the databases, they can also be re-determined fruitfully in a knowledge management outlook as resources for the best practices sharing and to preserve the intellectual capital of organizations. In general, the investments of information technology like a certain thing that necessary to improve knowledge management in projects. Two best factors appropriate for applying information technology in knowledge management. Firstly, the awareness of information technology limitation, and the fact that any information science deployment will not achieve much benefit if it is not occured by a changing of worldwide culture that could toward knowledge sharing values. Secondly, the availibility of information scientists who are expressly designed with knowledge management in the view.

Egbu et al. (2001) conducted a survey from 19 public and private companies which are small, medium and large construction organizations in British. They were asked about their opinion in order to rank the usage of information technology tools for knowledge management. From the respondents' view, several technology tools such as handphone, internet, intranet, email, and documentation were considered as the important and common used in the British construction organizations. Following these, face-to-face meetings and the interaction among employees were rated as the most popular implemented with the process of the supply chain. It is shown that many construction institutions still use conventional methods for capturing, sharing, developing, and storing knowledge. Especially, the handphone represences as an essential material for managing knowledge since it can be used to capture and share both tacit and explicit knowledge among people. Thus, Robinson et al. (2001a) shown another important software tool that can be used to collaborating the knowledge sharing and transferring is groupware.

The detailed finding for the significant factors that are influencing the knowledge sharing implementation for solving the construction problem will be discussed in the further chapter. On the other hand, Table 2.3 presents the supporting factors from individual, organization, and information technology factors effect knowledge sharing from different researchers in the previous study.

Table 2.3: Supporting factors of knowledge sharing

Author	Individual factors	Organizational factors	Technology factors
Arif et al. 2015; 2017	Autonomy Collective achievements Gender differences Power distance Uncertainty avoidance	Leadership behavior Management commitment Motivation Mutual trust Organizational structure Organizational form Relationship between employees Social networking	Communication technology
Egbu and Botterill 2003			Information technology
Ma et al. 2008		Trust	
Idris et al. 2015	Attitude to share	Managerial leadership Organizational culture Social norm for sharing Strategy and planning	
Peihau and Fai 2013	Knowledge feedback Knowledge self-efficacy		ICT support

Peihau and Fai 2012	Knowledge feedback Knowledge self-efficacy Losing face		
Javernick-Will 2012	Conformity to corporate culture Intrinsic motivations Mimicking the behavior of leaders Peer recognition Perceived value and uniqueness Reciprocity	Extrinsic global incentives Honoring KS commitments Resources	
Issa and Haddad 2008		Mutual trust Organizational culture	Information technology

2.3.1.4 Psychological Factor

The three dimensions, individual, organizational, and technological factors discussed above are identifying the major support knowledge sharing. The following part will consider another step and discuss in detail about knowledge sharing from the perspective of psychological factor. It is going to provide in-depth information related to the factor affecting the intention of human in order to share knowledge in the construction project organizations. Actually, psychology is referred to the scientific study that mostly focuses on how people's determination, feelings, and attitute that could be influenced by the reality or imagination. In addition, Ajzen (1991) proposed a theoretical framework to deal with the psychological approach in order to explain human behavior and human decision processes.

The theory of planned behavior (TPB) has been commonly used in social psychology research to explain many kinds of behavior. When applying to knowledge sharing, TPB had used to examine for human's behavior prediction in order to specify the decision-making processes (Ajzen, 1991). However, this theory has applied very little for investigating the knowledge sharing in construction (Idris et al., 2015; Zhang and Fai Ng, 2013). Then, this section will be reviewed on the theory of TPB in order to extend the model of knowledge sharing. The main idea to adopt this theory in this study is to understand how psychological can be used for prediction, depth understanding, and explaining the behavior of individual on knowledge sharing activity.

Ajzen (1991) provided the theory of planned behavior that widely known as the most popular in term of the psychological model that use for the prediction the individual's behavior within any specific contexts. Actually, the TPB was developed as an extension from the Theory of Reasoned Action (TRA) which is found by Ajzen and Fishbein (1980). The result from the extension theory was found that the behavior did not appear fully from their voluntary and within their control. Then, Ajzen (1991) extended this TRA by including the perceived behavioral control (PBC) as a new additional predictor that related to the intention and behavior of a human in order to develop the new TPB. Figure 2.4 illustrates the relationship process among the old and new constructs of TPB. These constructs were used to analyze the motivational factors influence human's behavior on knowledge sharing. It would help to provide more understanding regards the performance of knowledge sharing. Those main constructs will be discussed and provided its concept that would be a benefit to the knowledge sharing in the construction project organizations. The discussion is conducted in the following section.

According to Ajzen (1991), the first construct of the theory of planned behavior is the ***attitude towards the behavior***. It is referred to the degree or level of people that have a optimistic or pessimistic evaluation of their behavior in question. In reality, the engineer in every construction projects may likely to perform the knowledge sharing for solving any problem in the organization if they feel that those activity is providing more benefit to them in personality. They consider whether it is

beneficial or damage before decide to perform the knowledge sharing with other engineers.

Secondly, it is the ***subjective norm***; it is focused on how people could perceive social pressure whether it should be performed or not regarding the behavior. It is usually happened from the expectation from other people around us. In the construction organization, the managers, supervisors, and colleagues might be the relevant people that could affect the perceived social pressure. Especially, if the managers and professional believe in knowledge sharing, they would pay much intention to spread out their knowledge in cooperation with other people in the organization for sure.

Lastly, the third independent determinant is ***perceived behavioral control***. It is referred to how humans have perceived difficulty or ease from behavior to perform any activities. In reality, even some people who have a excellent favorable attitude to perform the knowledge sharing, they may still need some necessary support such as resources, tools, especially the opportunities that can be influenced successfully of knowledge sharing with others.

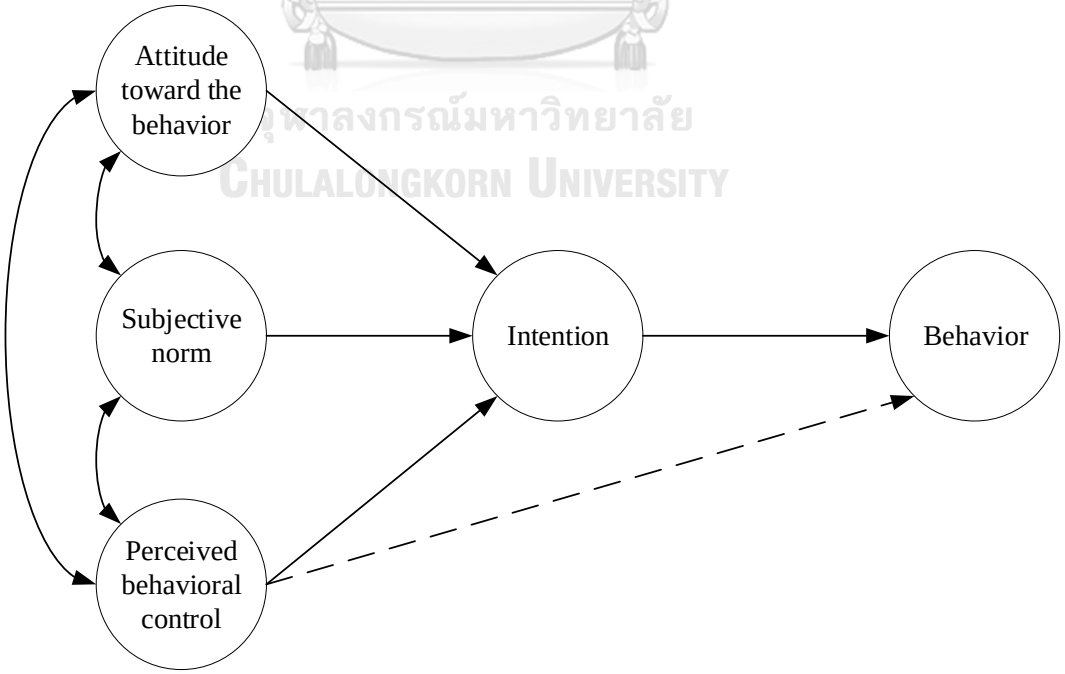


Figure 2.4: Theory of planned behavior (Ajzen, 1991)

2.3.2 Processes Approach

The knowledge sharing process can be considered as quite complicated. There are two theoretical approaches to knowledge sharing were classified by Inkpen and Dinur (1998). The first approach is the communication model originate idea from Shannon (1948); and the knowledge spiral model which is proposed by Nonaka and Takeuchi (1995) as the second approach. As stated by Lindsey (2006), communication was the process that uses for transferring the information from one to another. The transferring of information can be determined as knowledge, and it is possible to consider as communication or knowledge sharing. The following will discuss the two models representing to process approaches of knowledge sharing in general.

2.3.2.1 Communication Model

The communication model was proposed and explored to describe the processing of forwarding and getting information or a message (Shannon, 1948). In Figure 2.5 below will show the communication model.

In accord with Shannon (1948), a disclosure network consisted of five significant segments in the process of sending a message.

1) Information source: it makes the receiver have the communication through a message.
2) Transmitter: it is a transmittable signal network.
3) Channel: it is a place which can send the signal between the sender and the receiver.
4) Receiver: it transfers the transmission to the transmitter from the channel with the first news managed from the transmitted signal.
5) Destination: it is a place where a group of workers designs the posting.

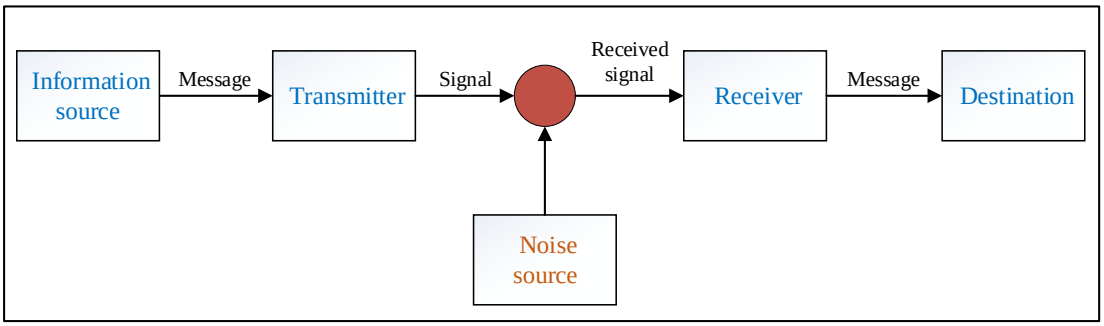


Figure 2.5: Communication model (Shannon, 1948)

The occurrence of noise can influence the knowledge sharing process. Normally, loud sound can impede the transference of the information. The more variations between the information source and the destination are the received information differs from the first information.

Inkpen and Dinur (1998) indicated that there were four steps that were vital for the procedure of contributing the awareness:

1) First: know how to contribute the awareness.
2) Adjustment: exchange the awareness following the receiver's need.
3) Explanation: owing to the adjustment to the updated text, it happens to the receivers' entity in the interest of the normal procedure of how to solve the problem.
4) Fulfillment: regularizing awareness is a fundamental point of the receivers' entity.

2.3.2.2 Spiral Model

In the handbook "The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation", Nonaka and Takeuchi (1995) embellished an approach of legislative awareness establishment that denoted the modernized awareness circular as displayed Figure 2.6. The composer requested that Japanese firms were more prosperous reflecting to the Western firms because of having many goods via obligatory for the first opinion of their standard.

The base of this approach was the differentiation between implicit and explicit awareness which was cultivated by Polanyi (1966). In accordance with Nonaka and Takeuchi (1995), these two kinds of awareness were not able to be disunited altogether. They adjust altogether via people's actions. Despite these interactions consciousness sharing, the reliability with the qualification of implicit awareness are observed like the important qualification in for the organization. The outcome for processing adaptation that happened among the individual is an understanding growth for feature quality and amount. The circular is established once the adaption of tacit and accurate knowledge sharing consequence in pseudo reasonable and metaphysical trims (Nonaka and Takeuchi, 1995) as shown in Figure 2.6.

Nonaka and Takeuchi (1995) classified four forms of consciousness setting up which provided to the consciousness setting up the procedure of a firm:

1) Socialization: the conversion from tacit to tacit knowledge.
2) Externalization: the conversion from tacit to explicit knowledge.
3) Combination: the conversion from explicit to explicit knowledge.
4) Internalization: the conversion from explicit to tacit knowledge.

Below, the four forms of consciousness setting up will be explicated through the intercommunication and adaptation between tacit and explicit knowledge. It is shown the process of knowledge conversion in which help to facilitate how knowledge could be shared in its form in the organizations straightly.

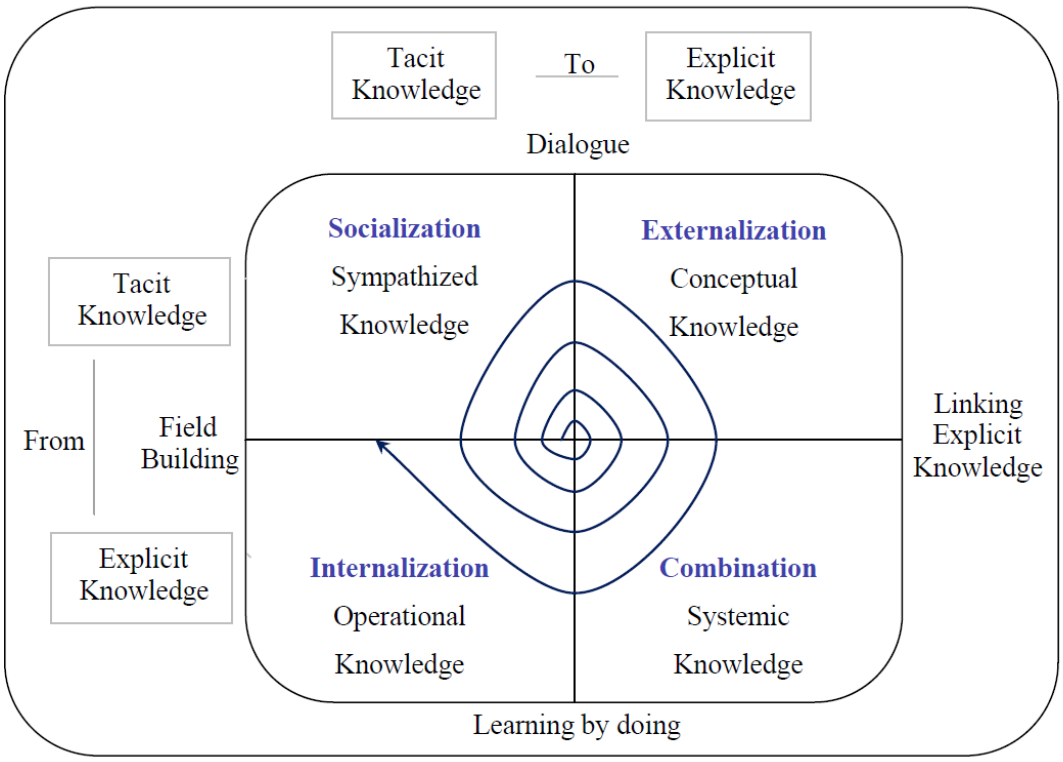


Figure 2.6: Spiral model (Nonaka and Takeuchi, 1995)

- ***Socialization: from tacit to tacit***

In accordance with Nonaka and Takeuchi (1995), socializing was a procedure of portion knowledge and thereby setting implicit consciousness such as shared intellectual models and technical talent.

To obtain the implicit consciousness experience is the basic. People are to share some types of experiences; alternatively, it is hard to study from other people's thoughts. Having no experiences sharing, the details transferring are difficult to fall into place.

That one may explain this form of awareness setting up, Nonaka and Takeuchi (1995) took an guidance as an ordinary instance. The edification is able to obtain tacit consciousness without using the language. Actually, the language will be substituted by surveying or observing from the job environment or on the job training.

- ***Externalization: from tacit to explicit***

In accordance with Nonaka and Takeuchi (1995), externalizing was a procedure of articulating implicit consciousness into explicit thoughts.

In this procedure, implicit education turns explicit in the forms of similarities, opinions, theories, allegories, and imitations. People use their language to indicate the importance of a feature, yet frequently it has an animosity or fissure among an image with the spoken or written emphasis. However, applying the expression goes over because they promote thoughts and interplays with human beings. Mainly, the substantiating is able to be found while setting thoughts such as linking cogitation and initiation. A short conversation and collective reflection trigger this type of awareness adaptation.

- ***Combination: from explicit to explicit***

In accordance with Nonaka and Takeuchi (1995), the linking was a procedure of systemizing thoughts into a consciousness network.

People combine and interchange education via different canals like conversations, files, and appointments. Modern communication and detail technology just as digitized exchanging information systems and large-scale databases help these interplays also. Via additions, classifications, connections, and granting actual information, definitive knowledge is updated, and recent training is to come out.

Through the circulating of systematized awareness and details, it is possible to have recent thoughts. In a firm, the central managing is a detracting successful point in this process.

- ***Internalization: from explicit to tacit***

In accordance with Nonaka and Takeuchi (1995), internalizing was a procedure of embodying explicit education into implicit education.

For internalization, explicit education has to be expansion and absorbed by a plenty of an institution in their implicit education base. Studying by practicing is connected powerfully to internalizing. Internalized experiences obtained in the

procedures of socializing, externalizing, and connecting turns very important resources. In accordance with Nonaka and Takeuchi (1995), the outcomes for the fruitful internalizing procedure were contributed intellectual imitation and technical qualification. Thus, it is beneficial when the education is ready for use in files, manuals, or storytelling since the filing, on the other hand, it expedites incarnating and generates it attainable which individual may learn with one another' experiment practically.

For arranging consciousness making, it needs the personal of the organization contribute their implicit ability with the other members. So, a new spiral of consciousness making is begun.

2.4 Research Gaps

After reviewing the previous literature studies, knowledge sharing has been researched to improve the performance by increasing the quality of sharing from an individual, organizational, and information technological aspect. However, there is some lack of aspect to make the model more confidence in term of knowledge sharing. Moreover, even though previous models have been developed, most of the aspects had a range of limitation of factors which support the knowledge sharing. Previously, Lin, H. F. (2007) studied knowledge sharing leads to superior company promotion competence in transportation management from three aspects – individual, organizational, and technology as modeled in Figure 2.7. This model did not use in the research of construction field. For this reason, the model requires to provide more aspect and other supporting factors, especially the aspect of psychological in construction work.

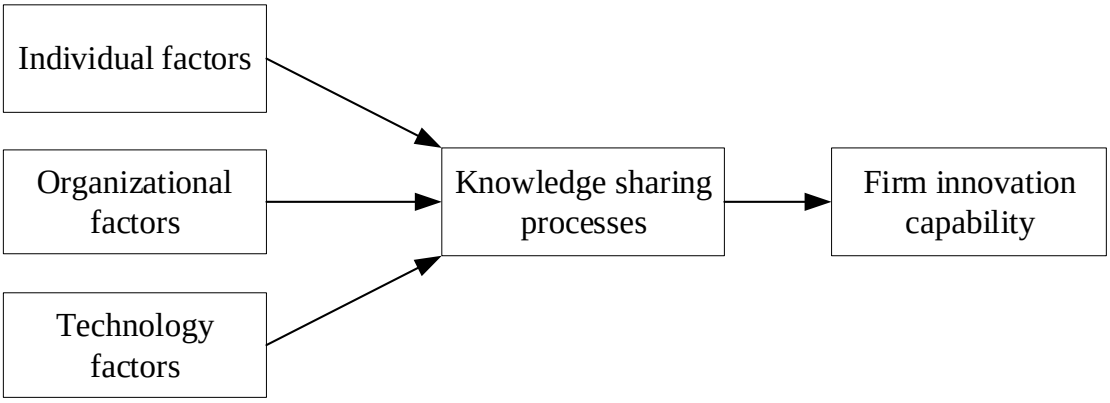


Figure 2.7: General framework for studying knowledge sharing (Lin, H. F., 2007)

Ma et al. (2008) explored the factors that affect knowledge sharing in the Chinese context. The researcher was customized to discover the communication model among dissimilar determinants with the intentions to provide the awareness as Figure 2.8. There were several factors such as explicit knowledge, tacit knowledge, fairness, faith, management method, and delegation that affect knowledge sharing. As we can see, the model still has some limitation for further studying.

The extension of the previous model as mentioned above is required to seek for appropriate and higher support of knowledge sharing. In addition, there are some support factors are need to be added to this model since the previous one has a few only. On the other hand, psychological factor is another crucial aspect that should be included in order to have full aspects in the model which is a critical impact to the human behavior whether they are willing to share or not to share. In order to make this model completed, knowledge sharing behavior may be necessary to role with the knowledge sharing processes. The model studies with the combination of knowledge sharing behavior plus with knowledge sharing processes may enhance the knowledge sharing outcomes effectively than separately. Hence, the previous model needs to extend with a whole aspect not only individual, organizational, and technology but also psychology and the behavior of knowledge sharing as well in order to provide the effectiveness of knowledge sharing outcomes.

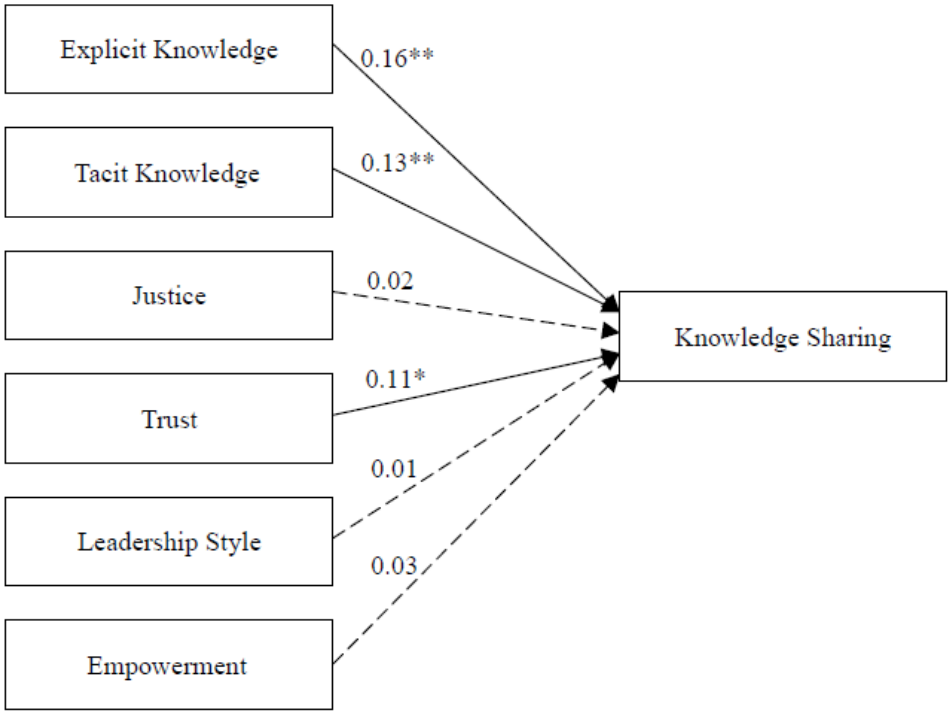


Figure 2.8: The research model for knowledge sharing (Ma et al., 2008)

2.5 Research Framework

In order to fulfill these gaps, the framework for the sample of qualification provision research is expanded with trial as shown in Figure 2.9. The model development shows about the relationship between each factor with knowledge sharing behavior (KSB) and knowledge sharing processes (KSP). Knowledge sharing behavior demonstrates the formation of knowledge in which tacit or explicit that people actually shares with others in his/her organization. On the other hand, knowledge sharing processes demonstrate the procedure human beings collaboratively swap the education with recent consciousness mutually. Both of knowledge sharing behavior and knowledge sharing processes have the influencing on knowledge sharing outcomes. As shown in the framework, the psychological factor has the only relationship with knowledge sharing behavior because it is related to human beings' concepts, emotions, and attitudes can be affected by the real, visualized, or deducible the others' phantom. Later on, individual factors can be influenced on knowledge

sharing behavior as well because it refers to the study at an individual or employee level which is strongly focused on a human. The organizational factor can be influenced on knowledge sharing processes only because its nature about how organization support and provide to their employee to perform the activities of knowledge sharing well. Organizational refers to the study at an organization level which is strongly focused on the firm. Lastly, technology factor also can be influenced on knowledge sharing processes because it refers to a manipulation of details and technical relationship with the organization in order to support the performing of knowledge sharing.

The relationship of each factor will be tested by the hypotheses to analyze the effect of factors on knowledge sharing behavior and knowledge sharing processes in construction projects. Then, these two will be tested the influenced level on knowledge sharing outcomes.

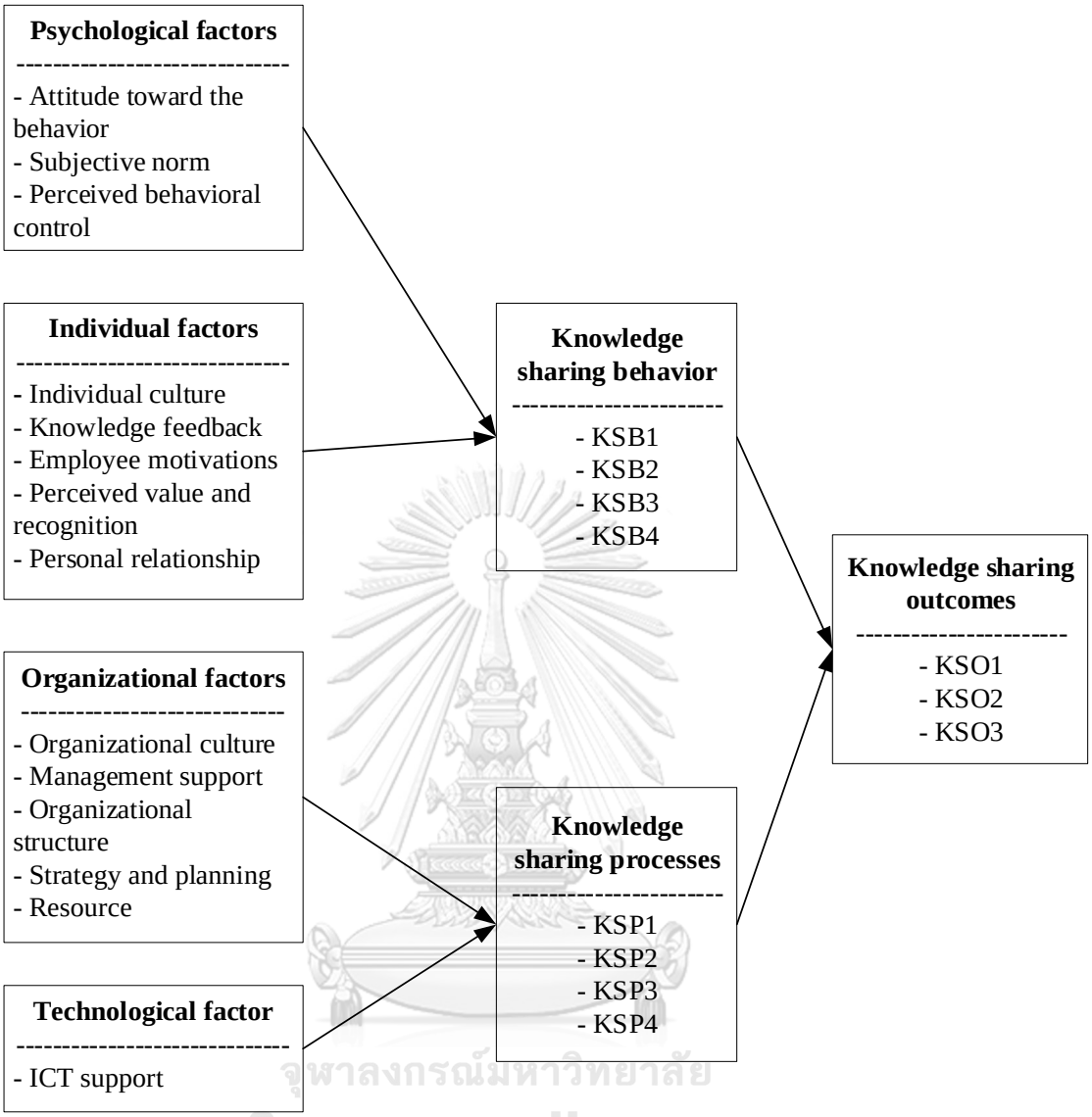


Figure 2.9: Research framework of the model development

CHAPTER 3
RESEARCH METHODOLOGY

3.1 General

This study is designed for studying an evaluation of supporting points that had consciousness sharing behavior and education offering procedures in construction projects. Then, the ability contributing attitude and consciousness provision processes would be evaluated its influence level on knowledge sharing outcomes. This chapter will present the survey study with review an order of research study, generally methodology is the concept of how the study would be underwrite, including the conceptual and philosophical usages that the study is located in and the association with the method accepted (Saunders et al., 2009). The method refers to the skills and processes that are to gain and do on a course database such as observations, evaluation, questionnaires, and technical statistic. The outline of the methodology is used for data collection, sample size, data examination, and consequence. Therefore, the research study is designed to reach the examination goal. All the gaits of the examination goal are indicated in the foundation survey in Figure 3.1.

3.2 Literature Review

The literature review of research methodology as shown in this part is well organized. For study revision, the main goal is to make the essential handouts or details connected to the condition and synthesis focused on some areas: knowledge management, knowledge sharing or transferring, and project-based organization in the construction organization context. The literature reviews are concerned about construction knowledge sharing in a lot of areas or dissimilar zoon. An antecedent of the written matter scrutinies are schoolbooks, presuppositions, chronicles, worldwide forum cardboards, or commodities and so on. Likewise, the cyberspace web site, networked athenaeums, camcorder data collection, wired glossaries, and additional bedding specks worldwide reports are the key beginning of the study revision also.

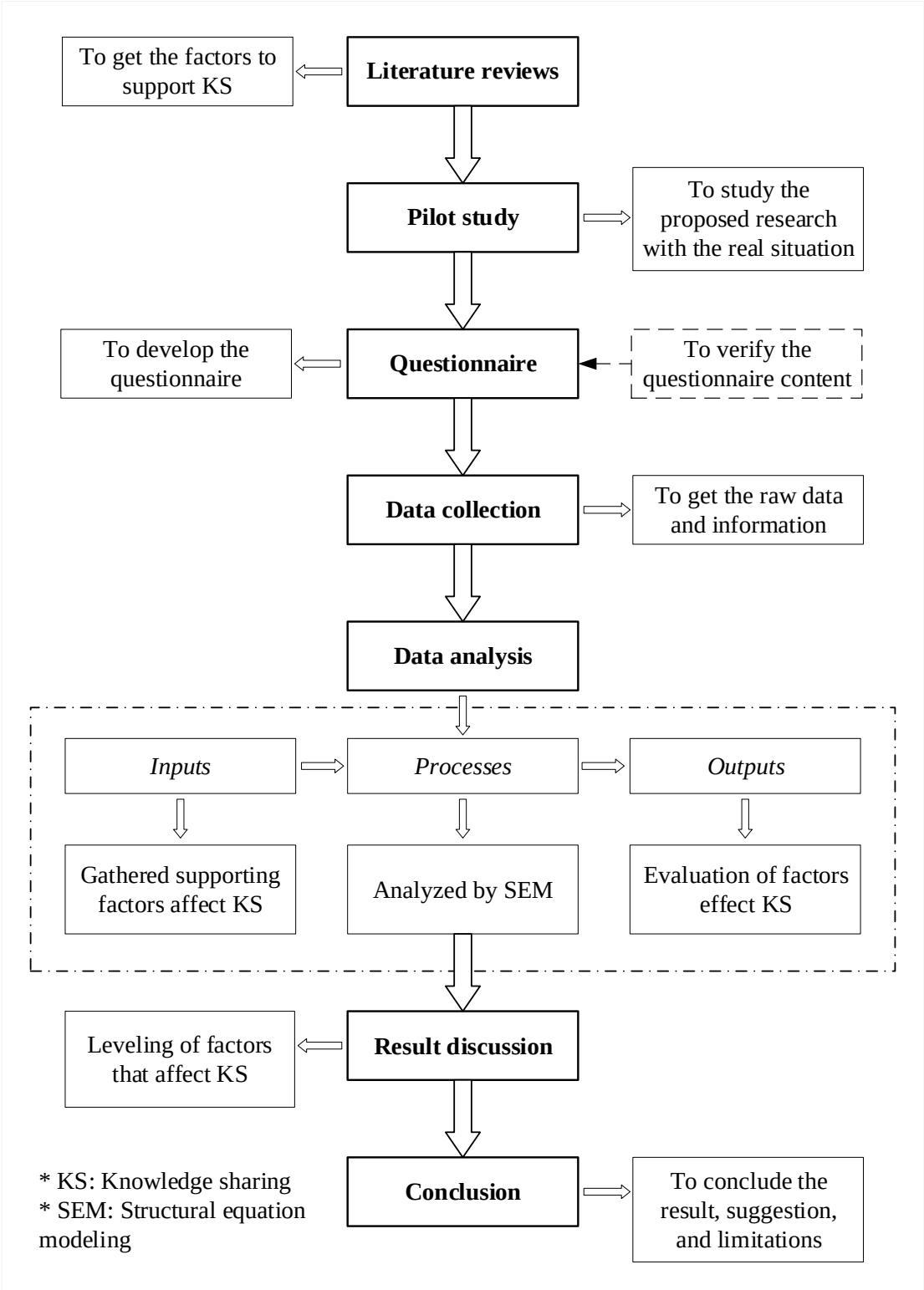


Figure 3.1: Framework of research methodology

3.3 Pilot Study

In somehow, the pilot study was introduced to conduct before we start to concentrate and design our research topic, research statement, and research objective. On the other hand, this study arranged a set of questions for interviewing some experts or relevant target people in the construction sites in Cambodia. The discussion questions gave feedback to the problem statement and objective of the study. Here are the important questions as following:

1. Do you think knowledge is important for you and your organization? How does it important? Please, explain your idea.
2. If you said that knowledge is important, do you think the knowledge would be an impact factor to your project performance?
3. What would you do if you think that it could impact to your work performance?
4. Do you want to learn how to improve the knowledge sharing in your organization?
5. Do you support if this research is conducted and want to see your cooperation in the data collection stage?

Table 3.1: Pilot study respondents

Position	Experience
Project Manager	13 Years
General Manager	16 Years
Project Manager	7 Years
General Manager	17 Years

In order to respond to all the questions above, the professional engineers were selected for interviewing for showing their opinion as well as the motivation to conduct this research area. The respondents also agreed to show their personal information as shown in Table 3.1. As what they stated during the interviewing and discussion, they did agree to the problem we proposed. In conclusion, all of them

absolutely supported this research because they also found that it was not easy to learn and share knowledge among people effectively. They thought that it was necessary for the construction company as well as the construction projects and it was a great method for better success in the future.

3.4 Research Model and Hypotheses Development

Referring to this part is to improve the study and the theory to examine the elements affecting consciousness provision behavior and knowledge sharing processes in construction project-based organizations. The current study also adopts the knowledge offering characteristics and awareness contribution processes for model consciousness provision outcomes. Following this, the research model is proposed, and the research hypotheses are developed.

3.4.1 Research Model

The survey sample has several indicators and explains causal communication and exogenous and endogenous varies. Theory of Planned Behavior (TPB) models is applied because it emphasizes the person's point of view and willingness as the two samples—encouragement and voluntary (Ajzen, 1991). The encouragement sample is dependent on a personal's quiet believing in the judging position of two important elements: behavior onto the characteristics and his/her objective completion. The voluntary sample is dependent on received attitude checking referring the easiness or hardness of showing a better attitude. Therefore, in promoted personal, voluntary procedure contemplate the impacts of willingness and guide it in a real attitude. When to ensure each structure, Figure 3.2 presents the research model of the different variable factors influencing an individual's intention and the psychological, organizational, and technology support to share his or her knowledge in construction project-based organizations.

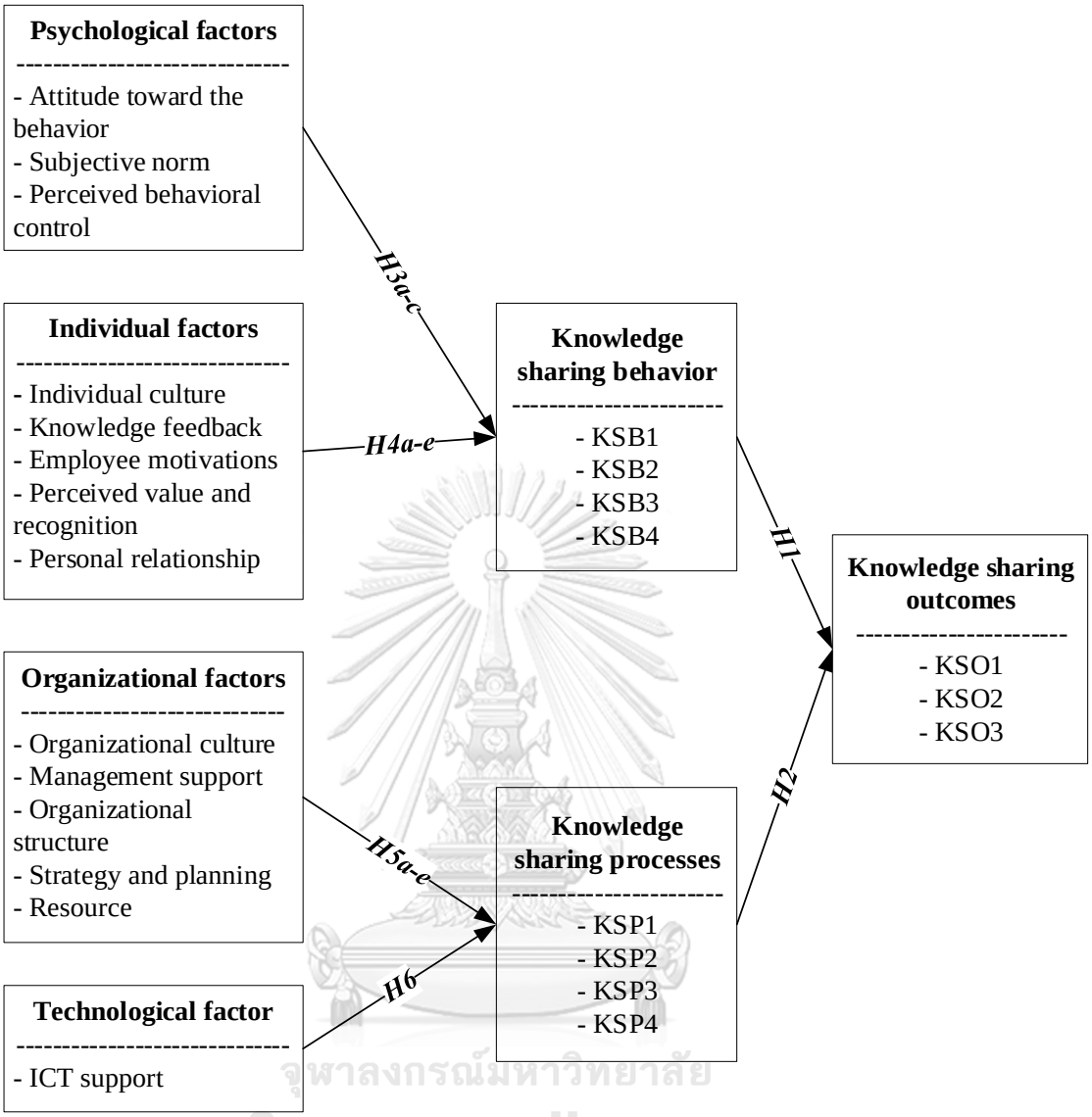


Figure 3.2: Research model

3.4.2 Research Hypotheses Development

In order to examine the research model as shown in Figure 3.2, the following hypotheses are proposed.

Hypothesis 1: The knowledge sharing behavior has a positive influence on knowledge sharing outcomes.

Hypothesis 2: The knowledge sharing processes have a positive influence on knowledge sharing outcomes.

Hypothesis 3a-c: The psychological factors have a positive influence on knowledge sharing behavior.

Hypothesis 4a-e: The individual factors have a positive influence on knowledge sharing behavior.

Hypothesis 5a-e: The organizational factors have a positive influence on knowledge sharing processes.

Hypothesis 6: The technological factors have a positive influence on knowledge sharing processes.

3.5 Quantitative Data Collection

There have a lot of dissimilar styles for detail collection focusing on the nature of the study. The conventional method of collecting data would have two kinds of groups such as quantity and quality research (Creswell, 2014). Some techniques are more effective to address certain types of questionnaires and subject matters, and this research is designed in the quantitative study. The quantity fact is the detail that can show only the numbers. This kind of figures is normally gathered from experiments, manipulation, and statistical analysis. Additionally, it can be represented numerically and visually in charts and graphs. This research will adopt the quantitative figure gaining strategy to achieve the study objectives. The quantitative data helps to complete the determinant that annoys awareness offering practices using the questionnaires. On the other hand, it helps to evaluate the factor impacts the knowledge sharing outcomes in the construction projects.

In term of quantitative data collection method, the study is related with two kinds of input: primary and secondary. Types of input help the researchers to gain the details while the input is collecting procedure from the constructing projects. The secondary consequence from the literature review helps to formulate the initial

framework and also helps to interpret the results of the primary data collection later by looking at the effect of supporting factors on consciousness contributing in the constructing projects. Supporting factors and model framework are secondary data collection through the literature reviews. In addition, the data of questionnaire surveys in this research are primary data collection.

The questionnaire survey is a utilization tool to gather useful data and information. The development of a questionnaire base on relevant literature reviews. The questions are structured in accordance with research objectives. Pattern survey can be detached for these two types depending upon however it is administrated and normally the numbers of contact that the learner is responsible (Saunders et al., 2009) as shown in Figure 3.3. An initial kind is named own-governed inquiries; almost of them can be really fulfilled by the answerers. It might be completed technically by surfing the net or intranet questionnaires posted to be responsible and returned by sending after finishing (Postal questionnaires), or taking by hand for each and gathering soon (Delivery and collection questionnaires). This study has adopted the self-administered questionnaire type, and is sent out and returns by mail (Internet and intranet-mediated questionnaires) and brought to answerers by directly after completion (Delivery and collection questionnaires). On the other hand, the second type of questionnaire is called interviewer-administered. The researcher records the interview by each respondent's answer. Questionnaires administer using phone (calling information) or using the evaluation physically that sees the respondents and asks those questions personally are known as a structured interview questionnaire.

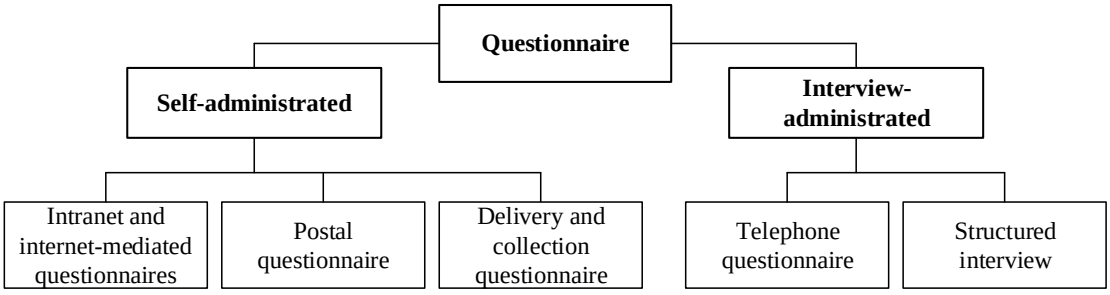


Figure 3.3: Types of questionnaire (Saunders et al., 2009)

3.5.1 Questionnaire Layout and Sample

This research has taken into account that the questions have to be understood easily during formatting the questionnaire, and sequence for questions will arrange to follow the sequence of main group factors. The researcher divides the questionnaire with two points. The first point in questionnaire obtains demographic details from respondents including general information such as job title, age, educational level, and gender which help the researcher to realize the model and connection with the study outcomes. The second section presents the supporting points just as personal, grouping, modernization, and psychological factors that power on awareness provision behavior and knowledge sharing processes which are influenced knowledge sharing outcomes in the construction projects. It also includes a cover letter to explain the matter and the goal for questionnaire shown in Appendix A. To obtain appropriate data, the target people are managers, senior, and junior engineers who are familiar with knowledge sharing activities by taking into consideration a number of issues such as education level, position, experience, and knowledge sharing practice. Before participants involved with completing the questionnaire, the researcher will give a background about the research topic and explain the questions to reduce data errors which can affect the research findings. In addition, a full set of questionnaire survey is designed and shown in Appendix B.

3.5.2 Measurement and Scaling

The questionnaire is made to survey the key points affected education contribution placing in the constructing projects. The research is in a reporting format, and five-section Likert range questions with optional answers rating from *"1 = strongly disagree"* to *"5 = strongly agree"* that are employed as shown in Table 3.2. However, in providing and gathering questionnaires, the five agreement sections on the rating scale allow answerers to tick the central *"neutral/not sure"*; it has no force for the respondents than admitting they do not realize. Using this kind of scale becomes easy for the survey doer to determine and assess the effect of each supporting factor on knowledge sharing in construction projects. Additionally, Likert

rating scale questions are one of the metric scales, often referred to as quantitative which support the quantitative data collection methods which this research used (questionnaire).

Table 3.2: Five-point Likert scale description

Scale	Description
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

3.5.3 Effective Factors to Knowledge Sharing

Begin with the preliminary data collections from the literature reviews, four main group factors (individual, organizational, technology, and psychological) are supporting knowledge sharing in construction. The description of each factor is illustrated in detail as shown in Table 3.3. From the literature review, some factors have been connected to a recent once so that reduces a number of factors for this study. It almost happened in the individual and organizational factors. In term of individual factors, five factors retained for further discussion in this study. Individual culture is one of the new emergings from the literature review that has been involved together with collectivism, gender differences, power distance, uncertainty avoidance, and conformity to cooperate culture (Hofstede, 1984; Kivrak et al., 2014). Employee motivation was combined between intrinsic motivation, and enjoyment in helping others (Lin, H. F. et al., 2009). Lastly, perceived value and recognition was included between peer recognition, and perceived value and uniqueness. In term of an organizational factor, five factors will be used for further discussion as well. There is an only organizational culture that has been considered to combined from various factors. Regarding this, organizational culture is including leadership behavior, trust, organizational form, and organizational rewards (Suppiah and Sandhu, 2011)

Table 3.3: Description of supporting factors

Dimension	Supporting Factor	Description
Psychological factor	Attitude toward the behavior	It mentions to the personal's affirmative or negative judgment for the characteristic interrogation.
	Subjective norm	It focuses on the perceptions of real procedure to act or to not act the provided characteristics.
	Perceived behavioral control	It is analogous to the concept of own strength focusing on personal's convenience in their knowledge to express a regular behavior.
Individual factor	Individual culture	It seems like personality characteristic of human being that favor of doing something depend on himself/herself.
	Knowledge feedback	It is defined as the return of knowledge in which comments, suggestions, and mistakes showed by the others.
	Employee motivation	It is the level of belief, confident, and commitment to achieve a goal.
	Perceived value and recognition	It is what people perceived values when performing knowledge sharing and got recognized from others.
	Personal relationship	It refers to connections between people that formed by emotional bonds and interactions.

Dimension	Supporting Factor	Description
Organizational factor	Organizational culture	It refers to something visible and invisible that use to characterizing the organization (e.g., structure, vision, mission, etc.).
	Management support	It refers to the generalize cares for the well-being of its employees.
	Organizational structure	It is a network which groups the way the real right doings are guided so that it achieves the aims at a group and commits the way the details go into the step by step in a firm (e.g., centralization).
	Strategy and planning	It is the operational strategies and objectives with specialized principles toward common goals.
	Resource	It is a source that can be supplied by an organization in order to function effectively.
Technological factor	ICT support	It is the technology infrastructures and materials to ease the sharing of valuable information, awareness, and thought.

3.6 Sample Size

Making enough model capacity for doing the test is another analytical decision made before data collection and analysis. Saunders et al. (2009) once enumerations are emerged in a sample, the invention is anticipating the values for a number of the people. Therefore, there would have some mistakes and the issue dependents on the other models. They grumbled about the huge model diameters, the tiny model has a problem. Regarding Monte Carlo researches the action of variable prediction stratgies,

it has been projected that the minimum model size of 200 needed in order to cut down biases to an suitable level for any SEM estimation. Similarity, Kline (2015) suggested a suggested a model of 200 or more are appropriate for a complex sample.

3.7 Data Analysis

Analyzing data is a critical stage in researches after data are collected. Data has to be analyzed to transfer the obtained data from interrogations with the useful details that one may achieve the study goals such a way of finding out the significant of supportive factors which affect knowledge sharing behavior and knowledge sharing processes in construction projects. The analysis is clear that the fact is relevant or essential to a goal as well as an outcome of the research. Mostly in research, the analytic fact has three main orders, in order to smoothly: fact arrangement, descriptive statistics, and inferential statistics (Saunders et al., 2009).

In accordance with Saunders et al. (2009), preparing data involves observing the fact, noting fac into the comp, sending the fact, developing, and filing a data structure that mixes the various measurements. Preparing quantitative data will be prepared by entering data collection from the questionnaire into the computer software (IBM SPSS Statistics 22). There are different kinds of fact that can be gained from the questionnaire. For this research, the questionnaire presents ranked data since the research adopted Likert scale questions to evaluate the supporting determinant that powers on awareness contributing behavior and education provision processes. A categorical data focuses on the nature of the factors (personal, grouping, technological, or psychological factors).

The descriptive statistics involves describing the study of fact which provides ordinary shortening of the model (Saunders et al., 2009). For quantitative data, researcher will present data using statistical analysis by using IBM SPSS Statistics 22. The statistical will be discussed later in this section. The statistical analysis provides diagrams and pie charts for each question or factor including the most frequency of a percentage of respondents. In other words, it provides the researcher with a graphic description distribution of the variaty. During the second stage structural equation

modeling will be tested and examined the relationships among variaty with the projected intellectual sample.

The final step is the statistics which checks interrogation and the in-depth framework. The end from the inferential statistics have the quick data alone by adding judgments about results and observe the significant findings (Saunders et al., 2009).

3.7.1 Confirmatory Factor Analysis

Analytics is a primary skill for many researchers, especially those who conduct measurement-related studies. The rationale of factor analysis is also exactly with SEM – so it is important to know about the basics of factor analysis when using SEM.

Byrne (2016) given the definition to analytical and statistical process for checking the relationship between the observed and latent varieties is worried about the extent watched variety indicated by the undertaking gifted structures. The turn focuses on an effect of the reversion paths from the elements to the variety. Element analysis offers and ensures the join of analytical facts shortening and feedback reducing.

There are two kinds of determinant analysis being reported in the literature (Kline, 2015; Tabachnick and Fidell, 2013): Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Exploratory factor analysis is designed to conclude if elements are involved. That doesn't have the education for the numbers of elements really have. Therefore, that relates concluding a plenty of elements and the samples of the elements copies. Hence, exploratory factor analysis is to ensure the communication among the elements and the usages variable skills to predict communication. Thus, it is thought to be the most of a hypotheses one than a idea processing. However, confirmatory factor analysis is used for study once the learner consists of consciousness for the real gifted variety structure and have the inside dependability for the measurement (Kline, 2015).

The recent research uses the materials of the confirmatory factor analysis to state the construct validity for the measurement used in the research. Firstly informed, the measurement used in the recent research has not been used altogether in any one search.

In conducting a confirmatory factor analysis on these measurements, the recent search can classify the construct validity of these measurements. However, confirmatory factor analysis aids to cut down or check the effects of simple strategy bias (Byrne, 2016; Kline, 2015).

3.7.2 Structural Equation Modeling

Containing the statistic description, structural equation modeling (SEM) is first employed to test the projected theoretical sample and the related study hypotheses. SEM is a variate and statistical analysis technique that can make researchers to examine correlations and tests both independent and dependent variables (Kline, 2015; Tabachnick and Fidell, 2013). It is a skill connecting aspects of determinant analysis and multiple regression. Two characteristics distinguish SEM: (1) prediction about variable and correlated free communication and (2) the awareness to show the worse opinoin in the communication and estimation trouble in the predictable procedure. These have two types of varieties in SEM: a measured variable and a latent variable. A measured variable focuses on a variety which can be seen generally. On the other hand, a latent variable is the theorized and worse opinoin which could only be estimated by detected or estimated variety (Kline, 2015; Tabachnick and Fidell, 2013). Hence, the researchers attempt to explore the relationships; the structural equation modeling can be more appropriate by ultilizing AMOS (Analysis of Moment Structures) version 20 with the aspects of factor analysis.

Based on Hair et al. (2010), SEM decision process has 6 stages as shown in Figure 3.4:

1. Defining individual constructs

2. Developing the overall measurement model
3. Designing a study to produce empirical results
4. Assessing measurement model validity
5. Specifying the structural model, and
6. Assessing structural model validity.

The 4 stages at the beginning are usually described the measurement sample when the last 2 orders usually described in the structural sample.

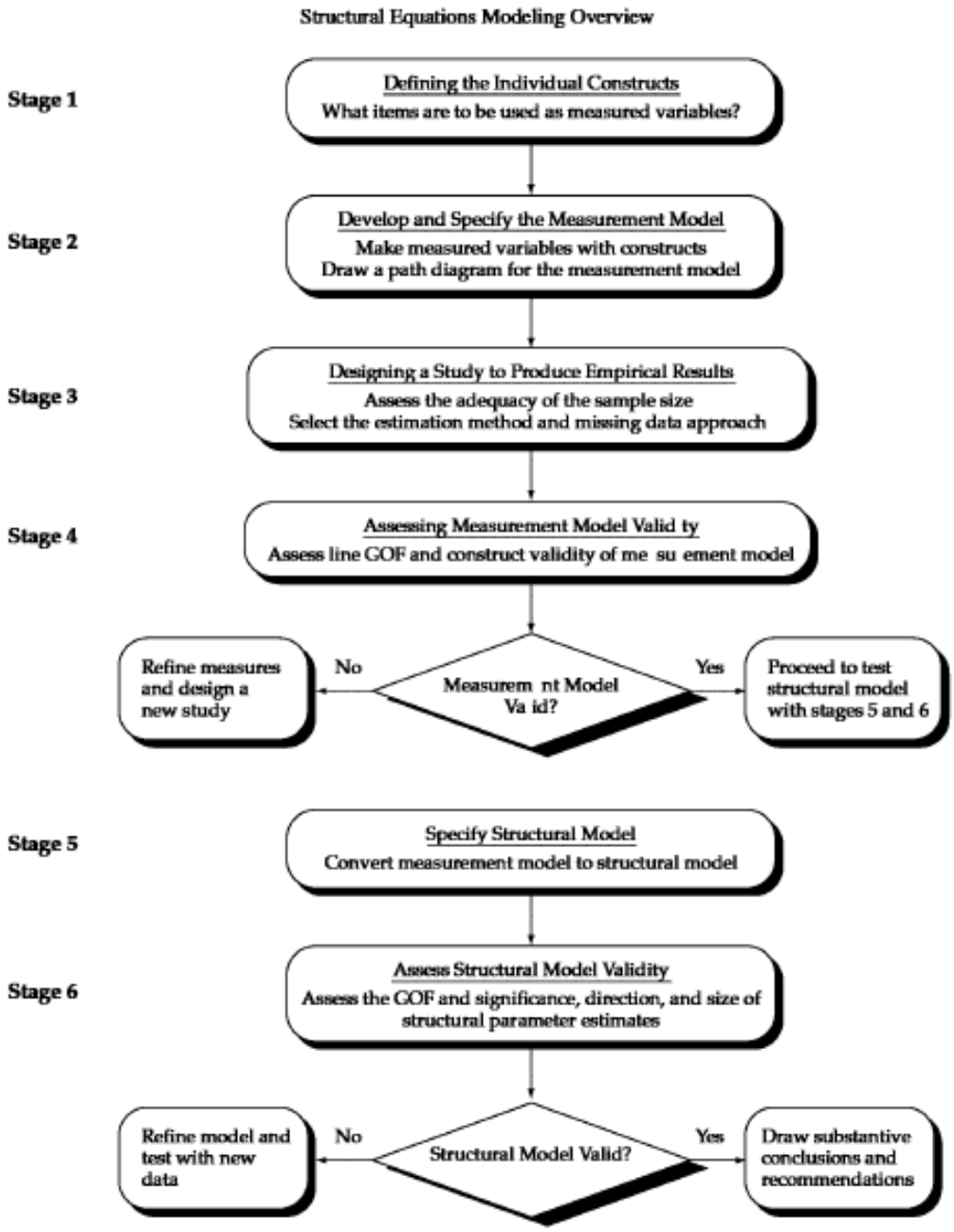


Figure 3.4: The six-stage process for structural equation modeling (Hair et al., 2010)

CHAPTER 4
DESCRIPTIVE STATISTICS

4.1 Preliminary Examination

The introductory test of the facts aims to protect losing detail, deviation, and formality via SPSS statistical package 22.0 and AMOS 20.0. This procedure is every essential in arranging the detail collection for the last analysis.

4.1.1 Data Screening and Missing

Every interrogation appeared for the study were secluded for any losing answers before entering the details. Even though this procedure was common, it was very analytical to enter the details easily. However, a statistical description for every tool was underwrote that one may ensure the actual information. For this one, we examined in contrast with responses of questionnaires which were created the rate worth with the first actual inquiries.

According to Hair et al. (2010), losing details is considered as the most constant trouble in analytical fact that may power on the consequence of the study goals. The effect of losing details is more analytical during using Structural Equation Modeling in AMOS 20.0. For instance, Chi-Square and other fit measures like Goodness-of-Fit-Index and also modification indications cannot be computerized when there is much losing detail in the model. After the first screening in SPSS 22, it was watched that the facts from an online survey has no losing details, but the offline survey has some losing details. Among 320 respondents, there are 7 respondents (cases 3, 6, 10, 196, 199, 207, and 219) which are approximately 2.2% of the whole respondents that have a vast incomplete dataset causes the analysis. After screening the missing data from a big dataset, we observed that only 313 respondents that could be used for further analysis. The frequency and percentage of losing details for the model is shown in Appendix C. Then, outliers and normality testing will be conducted

in order to give more accuracy and confidence of dataset for structural modeling analysis. These two steps will be discussed in the following.

4.1.2 Outliers Screening

For statistics, deviations are containers having points that are extensively dissimilar among the break (Hair et al., 2010). With this reason, there is very important information to defend deviators when they can conceivably incline a way and boost the typical outliers. In accordance with Kline (2015) and Hair et al. (2010), a multivariate deviator is known as one kind of deviators; the examination draws in detection and determination for much more than the enumerable outcomes changeable. For the recent research, Mahalanobis distance, D^2, an estimate to regulate the changeable deviator. Mahalanobis D^2 estimates the length of a normal item from the middle of the tentative items. For this survey, Mahalanobis D^2 was estimated by utilizing AMOS version 20.0. The logs which p1 value < 0.001 can consider of effective outliers and the equivalence among the changes with the answers is vitally dissimilar or abnormal to the recess of the setting data (Tabachnick and Fidell, 2013). Fourteen multivariate outliers were detected in this sample respectively. Because there are no perfect laws to analyze the real worth of Mahalanobis D^2 that would be protected, the researcher in this research would make a decision which cases over a hundred as a cancellation case. Although, the learner kept the deviations for the database because those could not be seen the set number with to the entire datasets an accepted with remote analyses (Hair et al., 2010; Kline, 2015). Outcomes of changeable outliers for the models can be denoted in Appendix C.

4.1.3 Normality

Doing the test of the presence of normality is important in multivariate analysis (Hair et al., 2010). Especially, if the data is not usually distributed then it may power on the analytical outcomes.

In the recent search, we hired the Skewness and Kurtosis quiz to control whether the fact is commonly shared. The odd skew denotes which the offering is set time for the upright; yet affirmative skew indicates the time set for the nigh side. Kurtosis offers detail about sharing top roof (Byrne, 2016). The affirmative kurtosis value expresses the high distribution; although a contradictory worth expresses a soften distribution. In according with Tabachnick and Fidell (2013), the suitable usual rate for skewness-kurtosis value is ± 3.75 while Byrne (2016) recommend between ± 5.0. Below this guideline, the whole cases in the information collection for the models were observed and normally distributed (i.e., < ± 3.75). More perfectly the Skewness and Kurtosis value for each item was in the rate of ±2 that is thought unimportant. The approvement was no main problem of abnormality of the data. The table of normality that clarified by the Skewness and Kurtosis value for the samples are indicated in Appendix C.

4.2 Demographic of Respondent

The target sample for this survey was Cambodian engineers that work in the construction project organizations in Phnom Penh City. The amount of 500 inquiries can be brought to 25 construction projects including 20 high-rise building projects and 5 mid-rise building projects. The questionnaires were distributed in both forms of offline (paper-based) and online form, of which 320 were become expressive a 64% answer the whole range. While covering for losing details, outliers, and normality, we kept 299 respondents are useful for data analysis.

Table 4.1: Summary of respondent's demography

Variables	Level	Frequency	Percentage (%)
Gender	Male	272	91.00
	Female	27	9.00
Age	< 25 years old	176	58.90
	26 – 30 years old	87	29.10
	31 – 35 years old	33	11.00

Variables	Level	Frequency	Percentage (%)
Age	36 – 40 years old	2	70.00
	Above 40 years old	1	30.00
Education	Bachelors	227	75.90
	Masters	71	24.70
	Doctorate	1	0.30
Position	Junior Engineer	224	74.90
	Senior Engineer	39	13.00
	Site Manager	13	4.30
	Project Manager	23	7.70
Experience	0 – 5 years	250	83.60
	6 – 10 years	37	12.40
	11 – 15 years	11	3.70
	Above 16 years	1	0.30

The summary of the respondent's demography obtained from the main survey is shown in Table 4.1. From the table, about 91% are male engineers and female engineers have a low percentage of 9% (27 engineers). As what we observed, about 58.9% of the total respondents are in range of engineer with young age of lower than 25 years old; 29.10% are in range of 26 – 30 years old; 11% are in range of 31 – 35 years old; 0.7% are in range of 36 – 40 years old and 0.3% are in range of above 40 years old. In term of the education level, a significant amount of 75.9% are holding bachelors' degree; 23.7% are masters' degree and just 0.30% are doctorates. Interestingly, there is 7.70% are project managers; 4.30% are site managers; 13% are senior engineers, and a huge number of 74.9% are young engineers.

4.3 Descriptive Statistics of Factors

An explanatory enumeration containing the method and regular modification for every liberated and vulnerable changes consumed in the projected study sample can be indicated in extension. Generally, the ways can be ranged from 2.23 to 4.21 for

a sample size of N=299. The descriptive statistics for both of means and standard deviation (SD) with the samples are discussed next.

4.3.1 Descriptive of Psychological Factors

Table 4.2 and Figure 4.1 summarized the respondent's response to the attitude toward behavior (ATB) construct. It shows the number of the respondent, the minimum and maximum response of the five-point Likert scale, mean, and standard deviation value for three statements of the ATB. It can be observed that most of the respondents have a positive feeling with ATB1 and ATB2 on the same mean value of 4.21, and the SD are 0.675 and 0.635, respectively. However, ATB3 has quite low mean value of 2.23 because it is the negative item that a researcher has to be transformed before taking into the analysis. ATB3* is the reverse of ATB3 that have a mean value of 3.77 and SD is 1.164.

Table 4.2: Statistic analysis of ATB items

Code	N	Min	Max	Mean	SD
ATB1	299	2	5	4.21	0.675
ATB2	299	2	5	4.21	0.635
ATB3	299	1	5	2.23	1.164
ATB3* (Reverse)	299	1	5	3.77	1.164

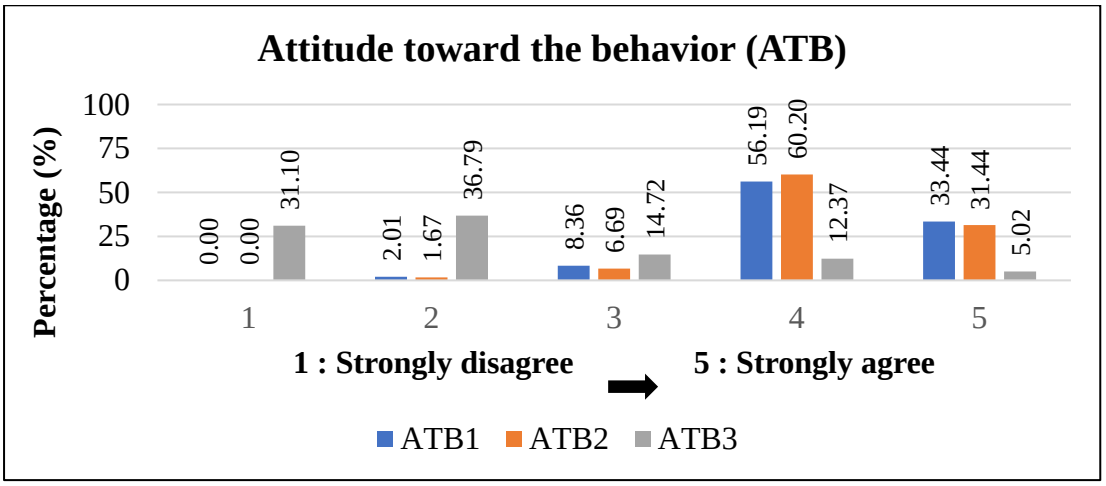


Figure 4.1: Percentages of ATB statements

Subjective norm (SN) has two items that go the same direction for the analysis. From Table 4.3 and Figure 4.2, it can be observed that respondents totally agree with both of these statements (SN1 and SN2) that support to SN. The first statement of SN1 giving the mean of 4.03 with an SD of 0.69. Similarly to the second statement, SN2 have the mean value of 4.10 with SD of 0.614. In term of the feeling of the respondents, they give a positive agreement with number 4 (Agree) to both SN1 and SN2 with 60.54 and 63.55 percentage, respectively. It would be the high percentage if it was compared to other scales such as 1, 2, and 3.

Table 4.3: Statistic analysis of SN items

Code	N	Min	Max	Mean	SD
SN1	299	2	5	4.03	0.690
SN2	299	2	5	4.10	0.614

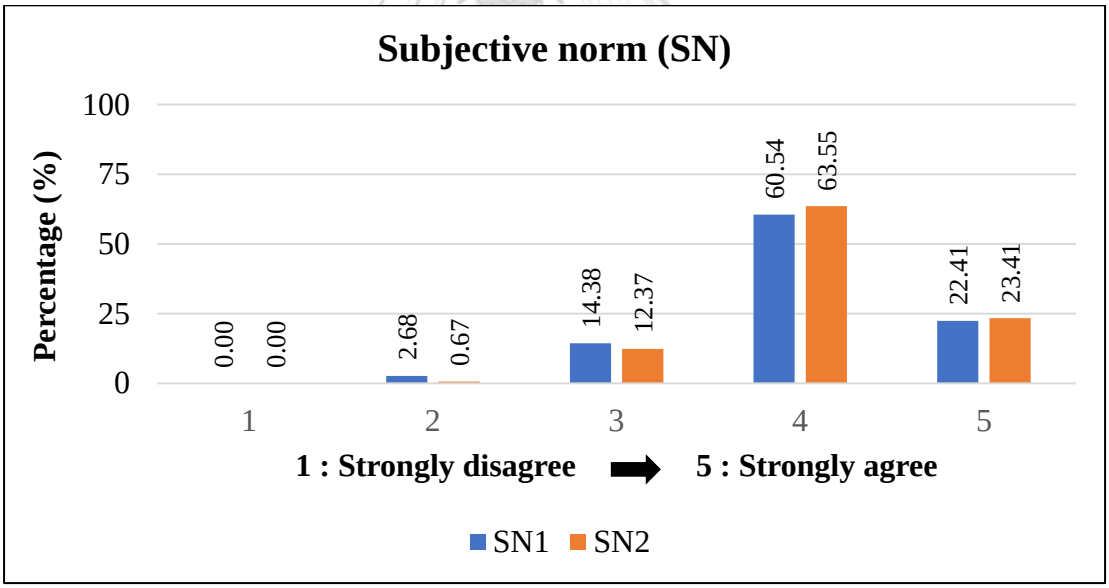


Figure 4.2: Percentages of SN statements

From Table 4.4, it shows the high mean value range from 3.45 to 4.06 and the SD range from 0.561 to 0.930. As what we observed, perceived behavioral control have three items which are PBC1, PBC2, and PBC3. PBC1 is pretty high in term of mean value compared with the other two; it is 4.06. However, PBC2 is the lowest mean value of 3.45 and SD is 0.930. As we can see in Figure 4.3, PBC1 has been

agreed by 71.24% of the whole respondents; PBC2 is 48.49%, and PBC3 is 66.22%. It is shown that respondents are able to share knowledge with others but it might not under their control at all.

Table 4.4: Statistic analysis of PBC items

Code	N	Min	Max	Mean	SD
PBC1	299	2	5	4.06	0.561
PBC2	299	1	5	3.45	0.930
PBC3	299	1	5	3.87	0.677

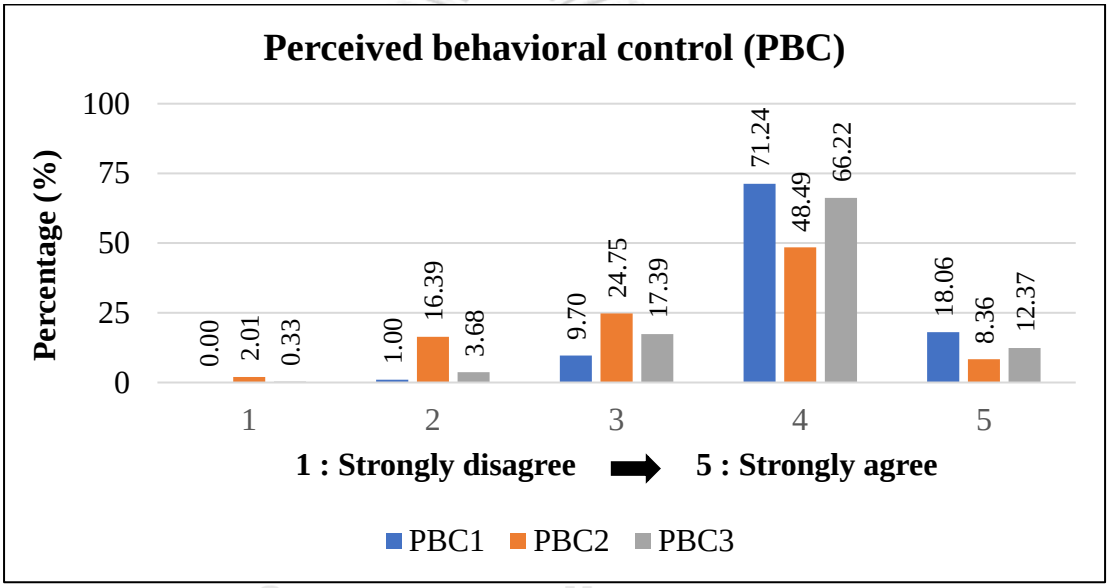


Figure 4.3: Percentages of PBC statements

Based on the statistical analysis of psychological factors, respondents mostly think that knowledge sharing with their colleagues is good and beneficial. It does not harmful at all. It is how the respondents' attitude toward the behavior which is coming from their own perceptions. It is indicating about the positive evaluation feeling on knowledge sharing activity. In addition, subjective norm (SN) also perceived highly agree that their seniors and managers are thinking in the same direction. It is what the respondent's perception of social pressures to perform or not to perform a given behavior. Lastly, it is referred to the respondents' perceived behavioral control. Most of them are under the concept of self-efficacy, which refers to an individual's

confidence in his/her ability to perform knowledge sharing, but they might not under their control at all. It means that they are able to share knowledge with colleagues.

4.3.2 Descriptive of Individual Factors

Individual culture (IC) is measured by five items which are IC1, IC2, IC3, IC4, and IC5. From Table 4.5, it can be easily seen that respondents do agree with three items such as IC2, IC3, and IC4 with the average of mean 3.54, 3.84, and 3.76, and SD of 0.828, 0.704, and 0.816, respectively. However, IC1 and IC5 seem like a little bit low with the average of mean 2.68 and 2.54 only. Based on Figure 4.4, it can be observed that about the half of respondents agree with IC2 (54.18%), IC3 (59.20%), and IC4 (58.53%). In the opposite, 22.07% of IC1 and 17.39% of IC5 little agreed by the respondents. These two statements were rated highly in scaling number 2 (disagree) approximately 37.46% and 38.46%, respectively.

Furthermore, it shows about the managers' expectation on their employees to closely follow the instructions and procedures of working. The standardized work procedures also help the employees' working. Especially, they do not want to see anyone leave the group when he or she faces difficulties. However, it is shown a little agreement that managers should make most decisions without sharing the idea with employees. Plus, in term of knowledge sharing, it does not entirely agree with high responded that men might share the knowledge more effectively than women.

Table 4.5: Statistic analysis of IC items

Code	N	Min	Max	Mean	SD
IC1	299	1	5	2.68	1.035
IC2	299	1	5	3.54	0.828
IC3	299	2	5	3.84	0.704
IC4	299	1	5	3.76	0.816
IC5	299	1	5	2.54	1.097

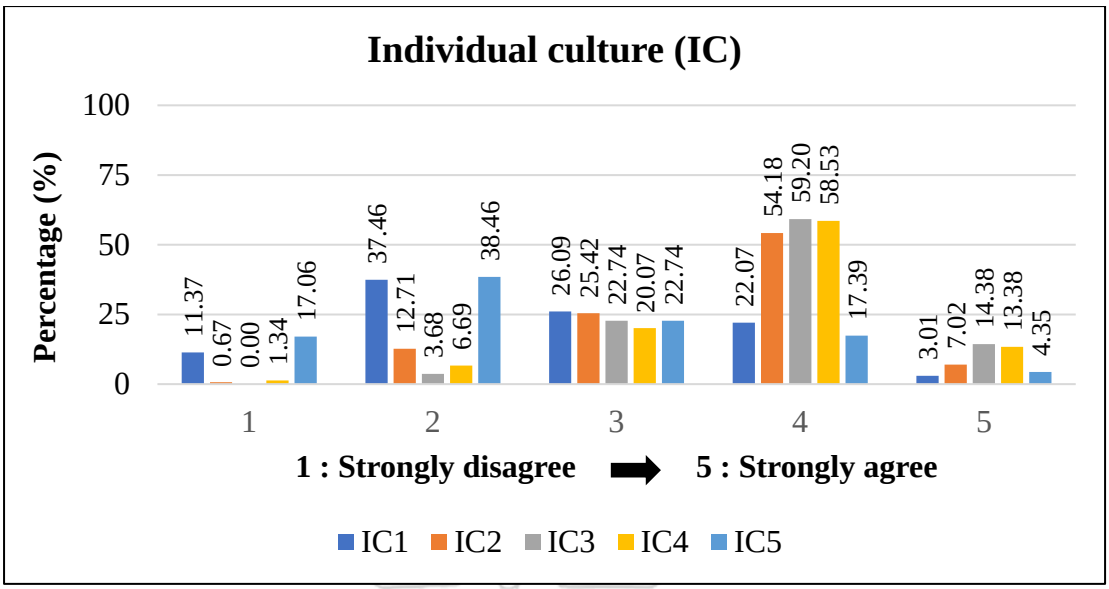


Figure 4.4: Percentages of IC statements

From Table 4.6, it shows the mean value range from 4.03 to 4.13 and the SD range from 0.613 to 0.706. As what we observed in knowledge feedback construct, all of those four items which are KF1, KF2, KF3, and KF4 are having a little different in term their mean value such as 4.03 (SD = 0.706), 4.05 (SD = 0.630), 4.09 (SD = 0.636), and 4.13 (SD = 0.613), respectively. On the other hand, the respondent mostly agrees with these four statements and rate for number 4 (agree) with the high percentage of KF1 (63.55%), KF2 (65.89%), KF3 (65.55%), and KF4 (65.55%) as shown in Figure 4.5. It is shown that respondents agree on the knowledge feedback that is the expectation of knowledge sharing between each other.

Based on these statistics, knowledge feedback (KF) is highly agree from many respondents. They are also looking for mistakes correction from others by sharing the knowledge. Through the knowledge feedback concept, they could refine their thinking, develop new insights, and learn new things from others' response and comments. It is what the respondents' perception on knowledge feedback that pointed out by others.

Table 4.6: Statistic analysis of KF items

Code	N	Min	Max	Mean	SD
KF1	299	1	5	4.03	0.706
KF2	299	1	5	4.05	0.630
KF3	299	1	5	4.09	0.636
KF4	299	1	5	4.13	0.613

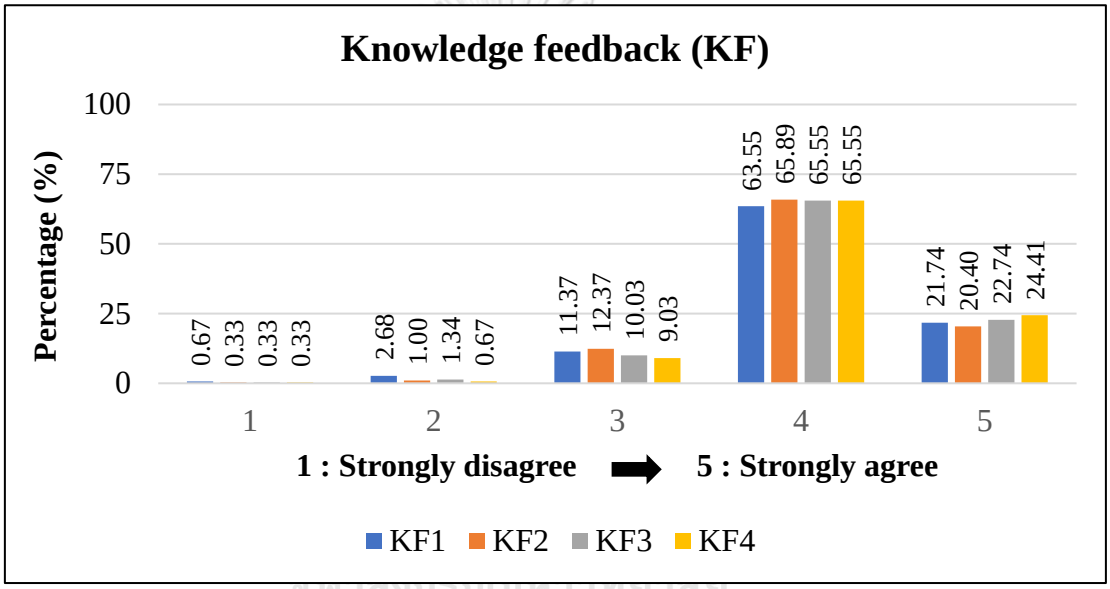


Figure 4.5: Percentages of KF statements

Employee motivations (EM) has four items (EM1 – EM4) that go the same direction for the analysis of EM construct. From Table 4.7 and Figure 4.6, it can be observed that respondents strongly agree with EM3 (Mean = 4.11, SD = 0.577). It is shown what they really enjoy helping colleagues by sharing their knowledge. Similar to EM3; EM1, EM2, and EM4 are moderate with the mean value of 3.83 (SD = 0.67), 3.91 (SD = 0.581), and 3.74 (SD = 0.763), respectively.

Based on these statistics, it is found a huge respondent that enjoy helping others by sharing their knowledge. Especially, they believe that when they share knowledge with colleagues, the future requests will be responded. In addition, they

are confident in their ability to provide knowledge that others consider valuable and respectful. These are the employee motivations on knowledge sharing perceptions.

Table 4.7: Statistic analysis of EM items

Code	N	Min	Max	Mean	SD
EM1	299	2	5	3.83	0.670
EM2	299	2	5	3.91	0.581
EM3	299	2	5	4.11	0.577
EM4	299	1	5	3.74	0.763

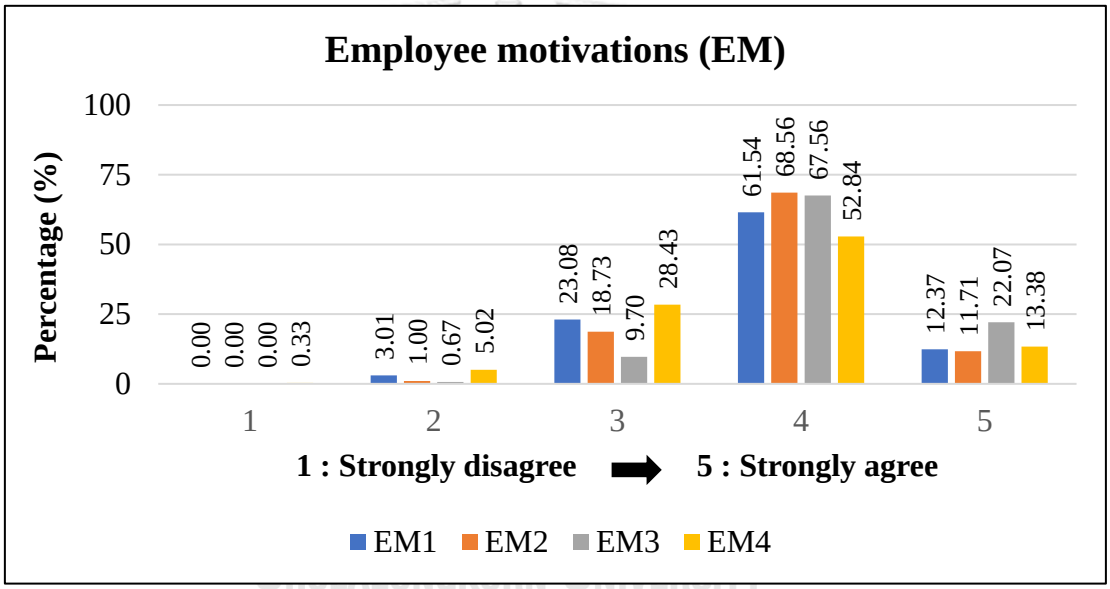


Figure 4.6: Percentages of EM statements

Perceived value and recognition (PVR) has four items such as PVR1, PVR2, PVR3, and PVR4. From Table 4.8 and Figure 4.7, it can be observed that respondents agree that knowledge sharing is reinforced as valuable learning in the project organization which is stated in PVR4 (Mean = 3.99, SD = 0.658) and motivated them by recognition which is stated in PVR2 (Mean = 3.99, SM = 0.591). On the other hand, PVR1, and PVR3 are quite moderate with the mean value of 3.90 (SD = 0.639), and 3.68 (SD = 0.793), respectively.

Perceived value and recognition (PVR) highly agree because it is could be appreciated when they share the work-related experience. When they are recognized from this activity, it also a part to motivate them to share with others as well. However, they might not be sure whether they could perceive value depend on the type of knowledge sharing.

Table 4.8: Statistic analysis of PVR items

Code	N	Min	Max	Mean	SD
PVR1	299	2	5	3.90	0.639
PVR2	299	2	5	3.99	0.591
PVR3	299	1	5	3.68	0.793
PVR4	299	1	5	3.99	0.658

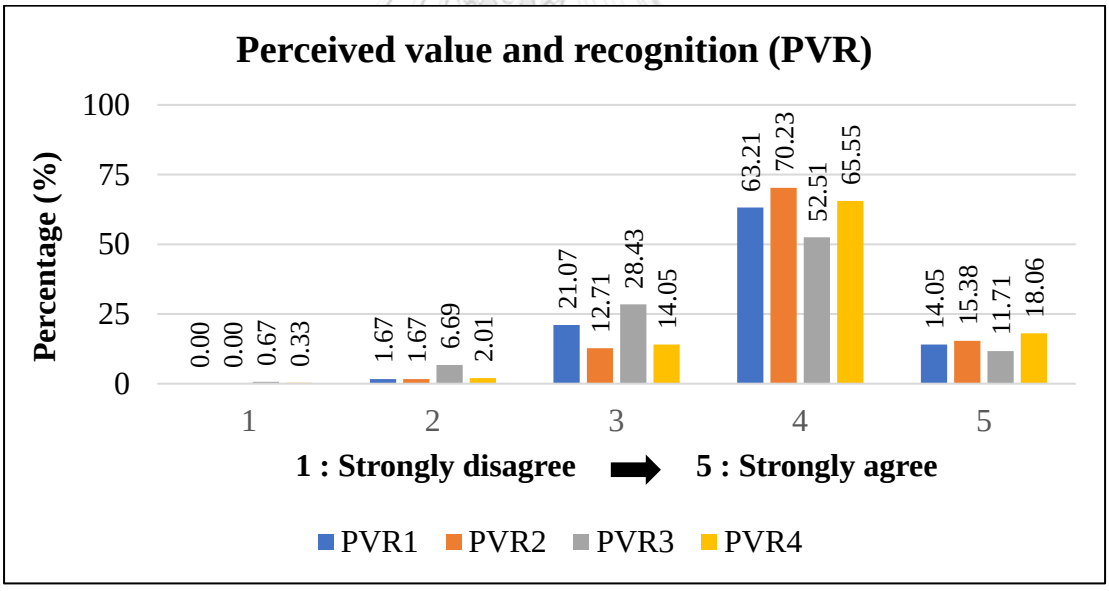


Figure 4.7: Percentages of PVR statements

From Table 4.9, it shows the mean value range from 3.46 to 3.84 and the SD range from 0.799 to 0.991. As what we observed in the personal relationship (PR) construct, all of those three items which are PR1, PR2, and PR3 are having a little different in term its mean value such as 3.46 (SD = 0.991), 3.84 (SD = 0.799), and 3.82 (SD = 0.831), respectively. In addition, the respondent's rate number 4 for

agreement with these three statements with the percentage as follows: 45.82% for PR1, 58.86% for PR2, and 54.52% for PR3 as shown in Figure 4.8.

Regarding this analysis, half of the respondents agree on the personal relationship (PR) factor. The personal relationship is hardly for them to reject for knowledge sharing request from their friends. They think that sharing knowledge with a best friend is inevitable. However, we can see that some amounts of respondents do not agree and not sure when the data and information could be shared for those who have a close relationship. So, we can see that some people rely on the relationship as a critical choice for sharing the knowledge while some people do not rely on it.

Table 4.9: Statistic analysis of PR items

Code	N	Min	Max	Mean	SD
PR1	299	1	5	3.46	0.991
PR2	299	1	5	3.84	0.799
PR3	299	1	5	3.82	0.831

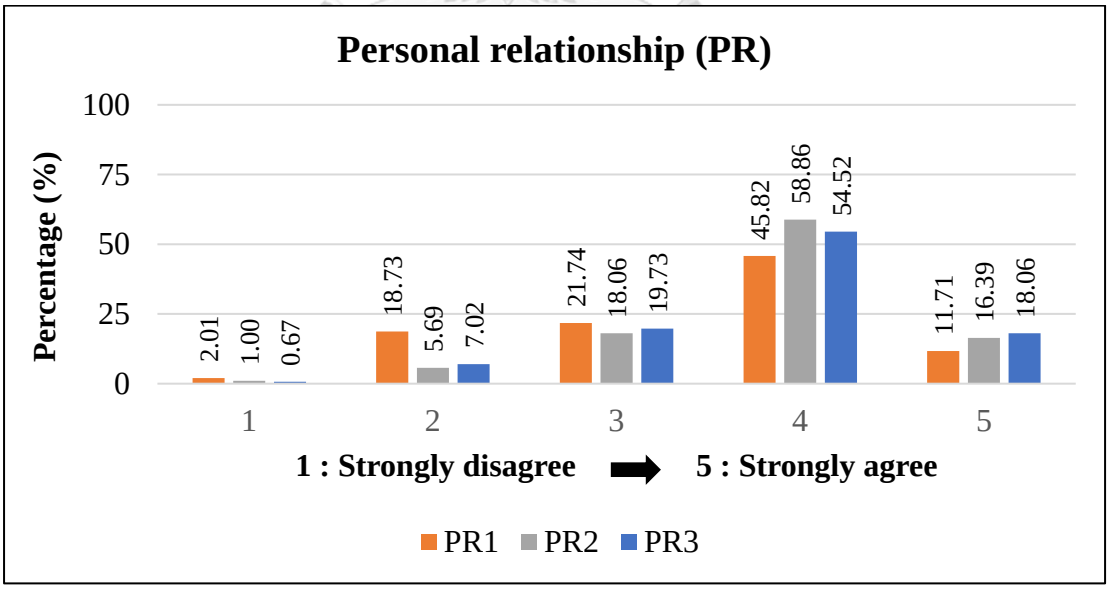


Figure 4.8: Percentages of PR statements

4.3.3 Descriptive of Organizational Factors

Under the umbrella of organizational factors, organizational culture (OC) is one of the latent variables that need to be measured. It is measured by two items which are OC1, and OC2. From Table 4.10, it can be observed that both measure variables are giving the average of mean 3.34, and 3.56 with the SD of 0.862, and 0.847, respectively. Both items are given the moderate result from the respondents. Based on Figure 4.9, these two items are properly rated by using a five-Likert scale of number 3 (neutral) and number 4 (agree) quite a high percentage than another scale. OC1 was evaluated by neutral scale is 38.46% while for agree scale is 39.13%; OC2 was evaluated by neutral scale is 27.76% while for agree scale is 52.17%.

It shows that the respondents do not really strongly agree and actively support the organizational culture could affect knowledge sharing at all. The organizational culture refers to the tradition of organization performance. Half of the respondents think that the environment of working should perfectly for innovation and leadership, challenge, creativeness, and results-oriented. It is unsure from many respondents as well. As we can see, many respondents unsure whether the knowledge sharing in the organization is considered structured and systematic or not.

Table 4.10: Statistic analysis of OC items

Code	N	Min	Max	Mean	SD
OC1	299	1	5	3.34	0.862
OC2	299	1	5	3.56	0.847

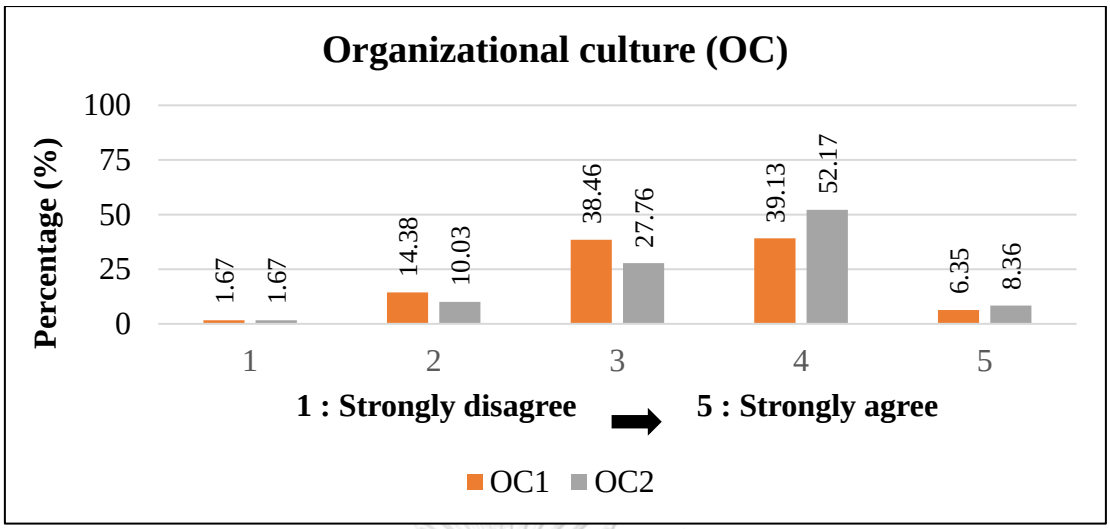


Figure 4.9: Percentages of OC statements

From Table 4.11, it shows the mean value range from 3.64 to 4.00 and the SD range from 0.673 to 0.783. As what we observed in management support construct, all of those four items which are MS1, MS2, S3, and MS4 are having a little different in term its mean value such as 4.00 (SD = 0.673), 3.64 (SD = 0.783), 3.85 (SD = 0.710), and 3.95 (SD = 0.722), respectively. In addition, the respondent mostly agrees with these four statements and rate for scale number 4 (agree) with the high percentage of MS1 (64.21%), MS2 (50.50%), MS3 (61.87%), and MS4 (62.21%) as shown in Figure 4.10. It is shown that respondents believe in the management support that is what the management team have to support and encourage their employees to share the knowledge.

From the statistics above, management support (MS) has quite great from respondents' agreement. Management support actually refers to the general care from the organization for the well-being of its employees and values their contributions. Regarding the respondents' perception, managers always support and encourage employees to share the knowledge with colleagues. In addition, managers really want to see their employees happily share the knowledge as well. In term of management support, managers need to practice as examples for others to follow, primarily, they provide most of the necessary help and resources to enable knowledge sharing in their organization.

Table 4.11: Statistic analysis of MS items

Code	N	Min	Max	Mean	SD
MS1	299	1	5	4.00	.673
MS2	299	1	5	3.64	.783
MS3	299	1	5	3.85	.710
MS4	299	1	5	3.95	.722

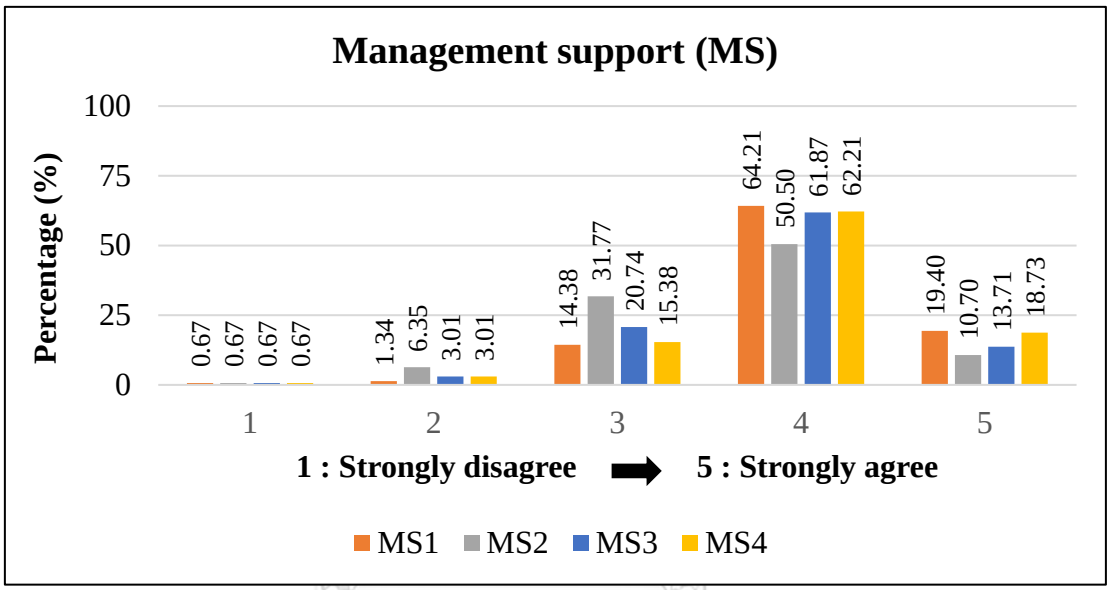


Figure 4.10: Percentages of MS statements

From Table 4.12, it shows the mean value range from 3.62 to 3.66 and the SD range from 0.704 to 0.782. As what we observed in the organizational structure (OS) construct, all of those three items which are OS1, OS2, and OS3 are having a little different in term its mean value such as 3.66 (SD = 0.704), 3.62 (SD = 0.782), and 3.66 (SD = 0.722), respectively. In addition, the respondent's rate number 4 for agreement with these three statements with the percentage as follows: 58.53% for OS1, 56.19% for OS2, and 55.85% for OS3 as shown in Figure 4.11.

According to the meaning, organizational structure refers to a network which describes the way the actual activeness are forthright that one may reach the purpose for the assembling and conclude how well the detail cascades step by step in an organization. Regarding the statistical analysis above, most of the respondents agree with the organizational structure that the work tasks in the project organization should

have a standard operating procedure, spelling out the ways to handle work tasks, and especially, the organization secures employees participation in decision-making process. Anyway, we still see some amounts of respondents are unsure with this factors as well.

Table 4.12: Statistic analysis of OS items

Code	N	Min	Max	Mean	SD
OS1	299	1	5	3.66	0.704
OS2	299	1	5	3.62	0.782
OS3	299	1	5	3.66	0.722

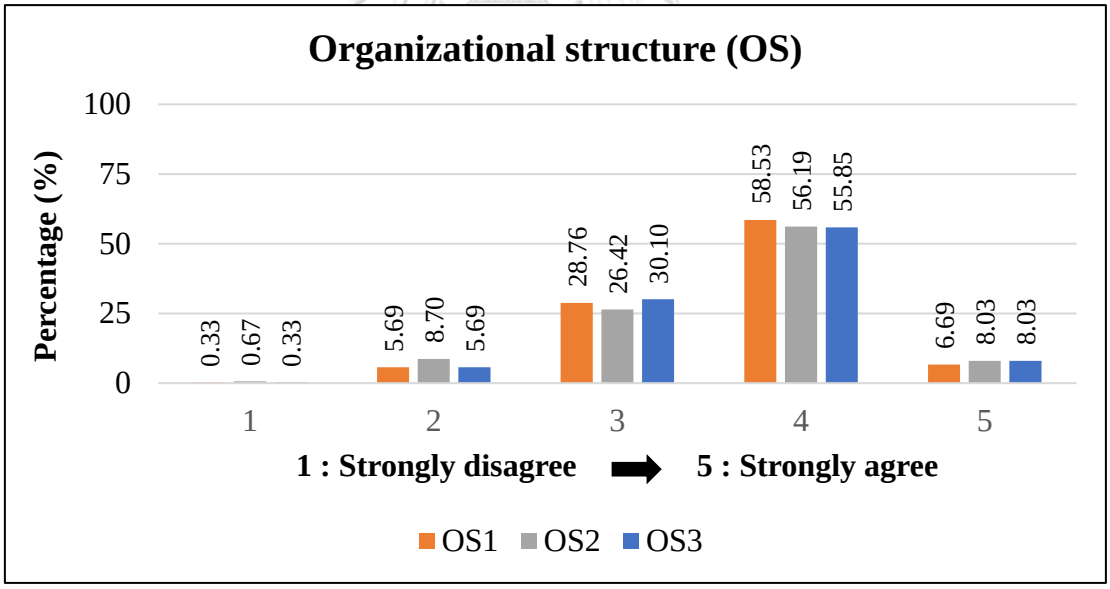


Figure 4.11: Percentages of OS statements

Strategy and planning (SP) is one of the latent variables that need to be measured. It is measured by two items which are SP1, and SP2. From Table 4.13, it can be observed that both measure variables are giving the average of mean 3.59, and 3.58 with the SD of 0.778, and 0.829, respectively. Both items are given the moderate result from the respondents. Based on Figure 4.12, these two items are properly rated

by using a five-Likert scale of number 3 (neutral) and number 4 (agree) quite a high percentage than another scale. SP1 was evaluated by neutral scale is 31.77% while for agree scale is 50.84%; SP2 was evaluated by neutral scale is 29.10% while for agree scale is 50.17%.

From the point of view from the respondents, they agree with the strategy and planning factor. They agree with the standardized knowledge sharing programs or regulations, and another one is the ways and means about knowledge sharing. Even though more voices agree but some respondents still not sure about this factor. So in term of neutral and agree are not far differentiate.

Table 4.13: Statistic analysis of SP items

Code	N	Min	Max	Mean	SD
SP1	299	1	5	3.59	0.778
SP2	299	1	5	3.58	0.829

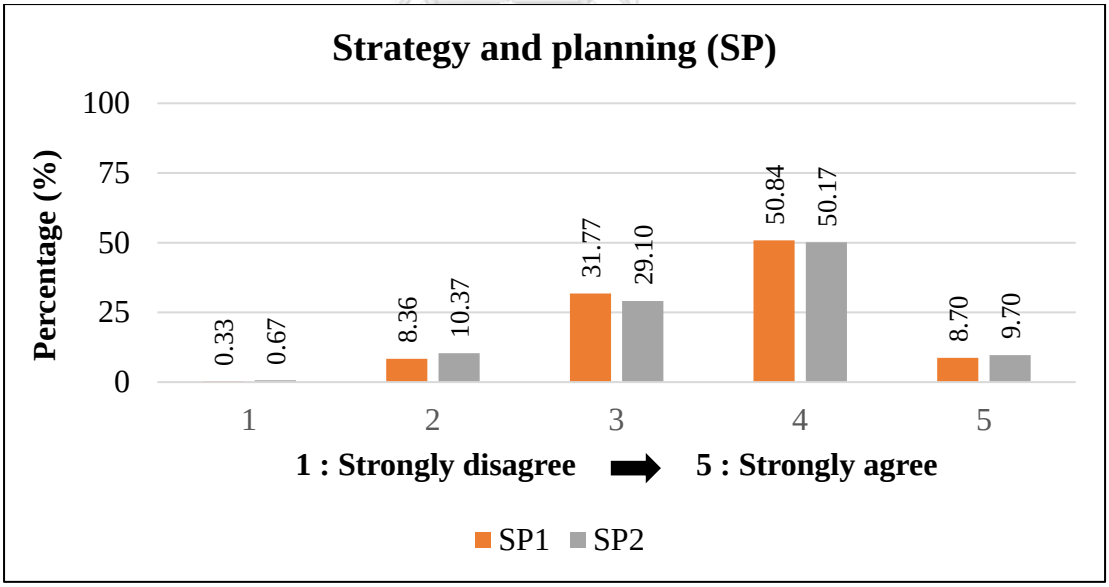


Figure 4.12: Percentages of SP statements

From Table 4.14, it shows the mean value range from 3.54 to 3.92 and the SD range from 0.700 to 0.836. As what we observed in the resource (RES) construct, all of those three items which are RES1, RES 2, and RES 3 are giving a little different

in term its mean value such as 3.92 (SD = 0.700), 3.54 (SD = 0.832), and 3.55 (SD = 0.836), respectively. In addition, the respondent's rate agrees with these three statements with the percentage as follows: 62.54% for RES1, 51.51% for RES2, and 52.51% for RES3 as shown in Figure 4.13.

Regarding the resources (RES), the employees have the same opportunity to share their knowledge with colleagues. Especially, the organization also supports the discussion room and another facility such as material in order to facilitate knowledge sharing activity.

Table 4.14: Statistic analysis of RES items

Code	N	Min	Max	Mean	SD
RES1	299	2	5	3.92	0.700
RES2	299	1	5	3.54	0.832
RES3	299	1	5	3.55	0.836

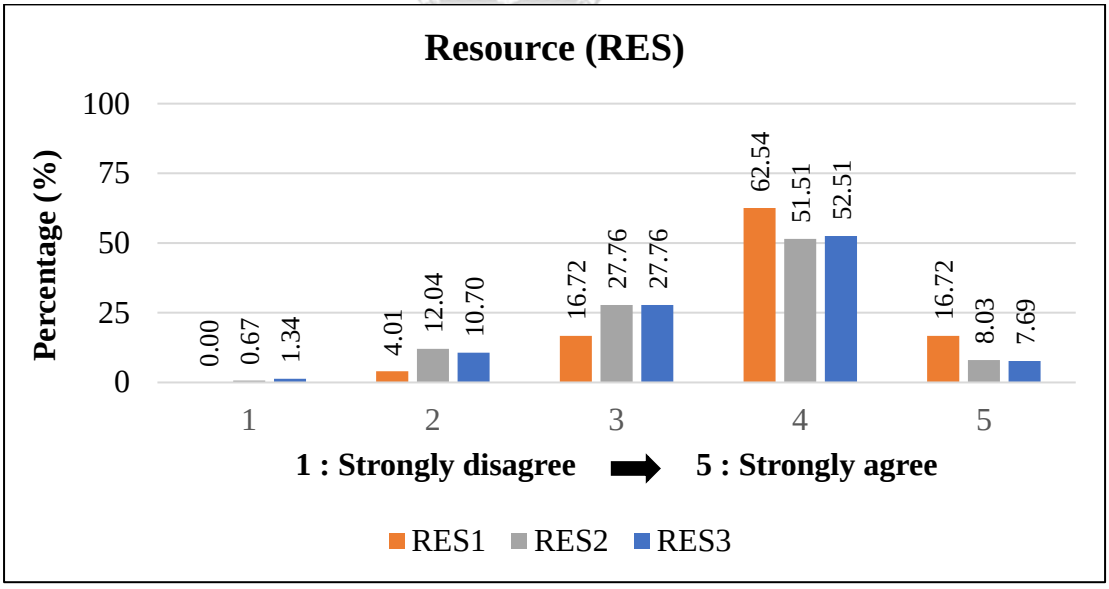


Figure 4.13: Percentages of RES statements

4.3.4 Descriptive of Information and Communication Technology Factors

Under the information and communication technology factors, ICT support (ICT) is the latent variables that need to be measured. It is measured by four items which are ICT1, ICT2, ICT3, and ICT4. From Table 4.15, it can be observed that those measure variables are giving the average of the mean from 3.95 to 4.02 with the SD of 0.653 to 0.675. All of those items are given the high moderate result from the respondents. Based on Figure 4.14, these four items are properly rated by using a five-Likert scale of 4 (Agree), and 5 (Strongly agree) quite a high percentage than another scale. With the percentage of the respondent from Agree's scale, ICT1 gets 62.21%; ICT2 get 60.54%; ICT3 gets 60.20%; and ICT4 gets 61.20%.

It shows that the respondents agree with the information and communication technology factors affect knowledge sharing. They really know that ICT could allow them to share knowledge with colleagues so easily. The answer from the respondents shows the agreement with the perception that ICT is the tool to enable knowledge sharing more quickly and efficiently. It is perceived with a highly acceptable.

Table 4.15: Statistic analysis of ICT items

Code	N	Min	Max	Mean	SD
ICT1	299	2	5	3.95	0.653
ICT2	299	2	5	3.99	0.675
ICT3	299	2	5	3.96	0.662
ICT4	299	2	5	4.02	0.655

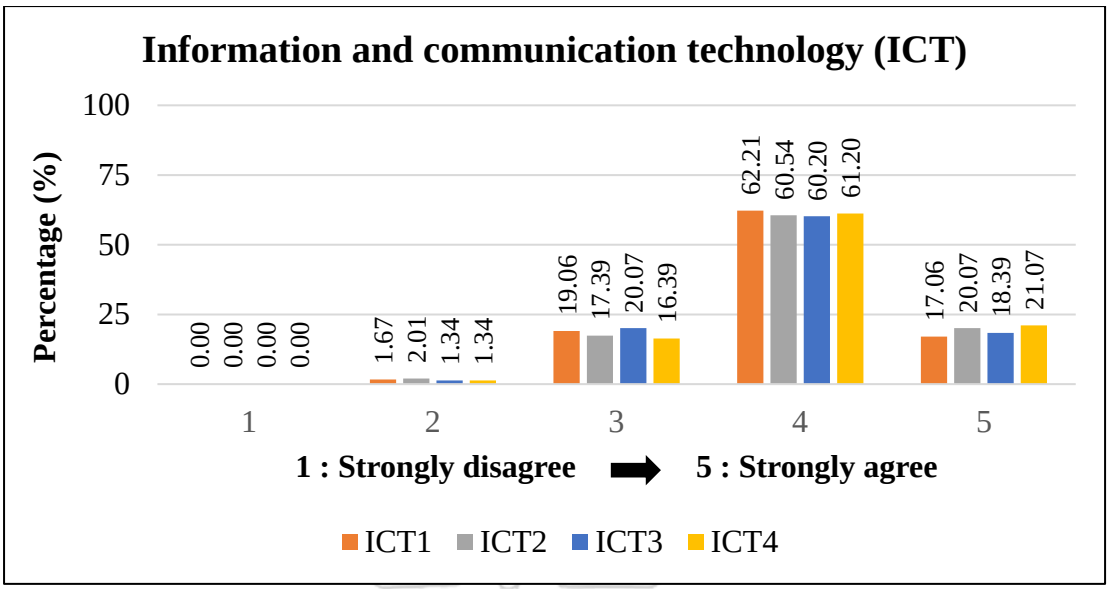


Figure 4.14: Percentages of ICT statements

4.3.5 Descriptive of Knowledge Sharing Behavior

Under the knowledge sharing behavior factors, four observed variables need to be measured. There are KSB1, KSB2, KSB3, and KSB4. From Table 4.16, it can be observed that those measure variables are giving the average of mean value 4.07, 4.02, 3.83, and 3.99 with its SD of 0.532, 0.582, 0.763, and 0.599, respectively. All of those items are given the high moderate result from the respondents. Based on Figure 4.15, these four items are properly rated by using a five-Likert scale of 4 (Agree), and 5 (Strongly agree) quite a high percentage than another scale. With the percentage of the respondent from agree's scale, KSB1 gets 73.24%; KSB2 gets 69.23%; KSB3 gets 60.54%; and KSB4 gets 70.23%.

From the analysis above, it shows that the respondents agree with the knowledge sharing behavior factors affect knowledge sharing. They agree that they are sharing technical skills, management expertise, and project knowledge with colleagues. However, some cases such as official documents still confidential to the organization that is not much freely share to other colleagues. Following this perception, knowledge sharing behavior is so critical for knowledge sharing outcomes.

Table 4.16: Statistic analysis of KSB items

Code	N	Min	Max	Mean	Std. Deviation
KSB1	299	2	5	4.07	.532
KSB2	299	2	5	4.02	.582
KSB3	299	1	5	3.83	.763
KSB4	299	2	5	3.99	.599

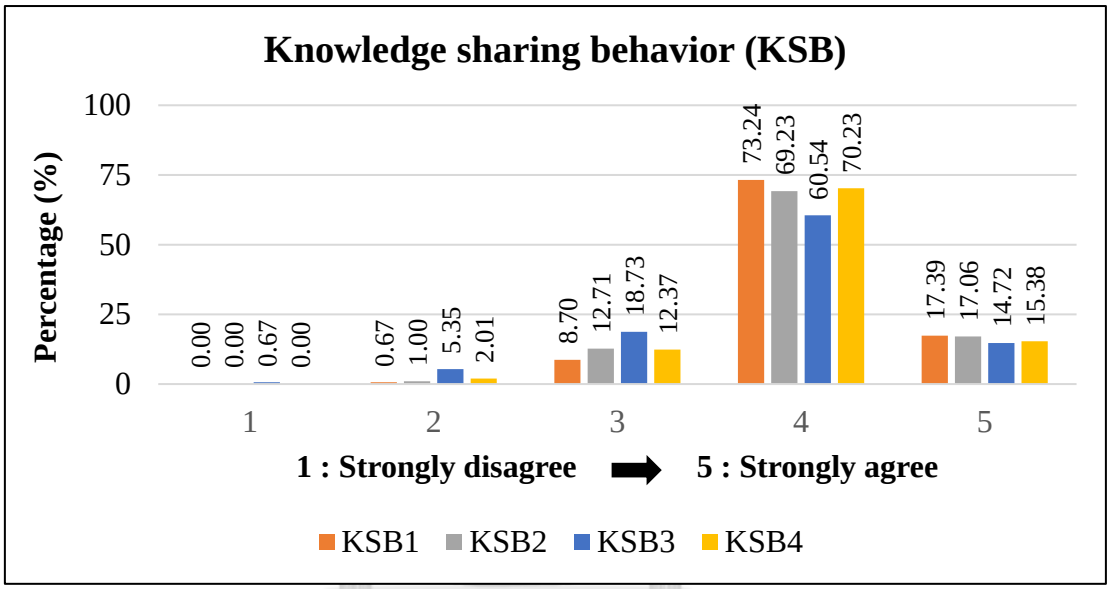


Figure 4.15: Percentages of KSB statements

4.3.6 Descriptive of Knowledge Sharing Processes

Table 4.17 and Figure 4.16 summarized the respondent's response to the knowledge sharing processes (KSP) construct. It shows the number of the respondent, the minimum and maximum response of the five-point Likert scale, mean, and standard deviation value for four statements of the KSP. It can be observed that most of the respondents have a positive feeling with KSP1, KSP2, KSP3, and KSP4 on the mean value of 3.53, 3.77, 3.88, and 3.77 with the SD of 0.816, 0.781, 0.653, and 0.763, respectively. In addition, KSP1 have been agreed by respondent approximately 48.16%; KSP2 about 59.87%; KSP3 is the highest percentage of 66.22%; and KSP4 just only 52.51%.

Following this result, the knowledge sharing processes is mostly happened by the informal communication between colleagues. They also conduct the regular discussion and share the experience for problem-solving as well as when anyone in the group has learned something new. Another choice is professional training or organizational learning within the project organization, but some respondents do not familiar with this training so much in their organization.

Table 4.17: Statistic analysis of KSP items

Code	N	Min	Max	Mean	Std. Deviation
KSP1	299	1	5	3.53	.816
KSP2	299	2	5	3.77	.781
KSP3	299	2	5	3.88	.653
KSP4	299	2	5	3.77	.763

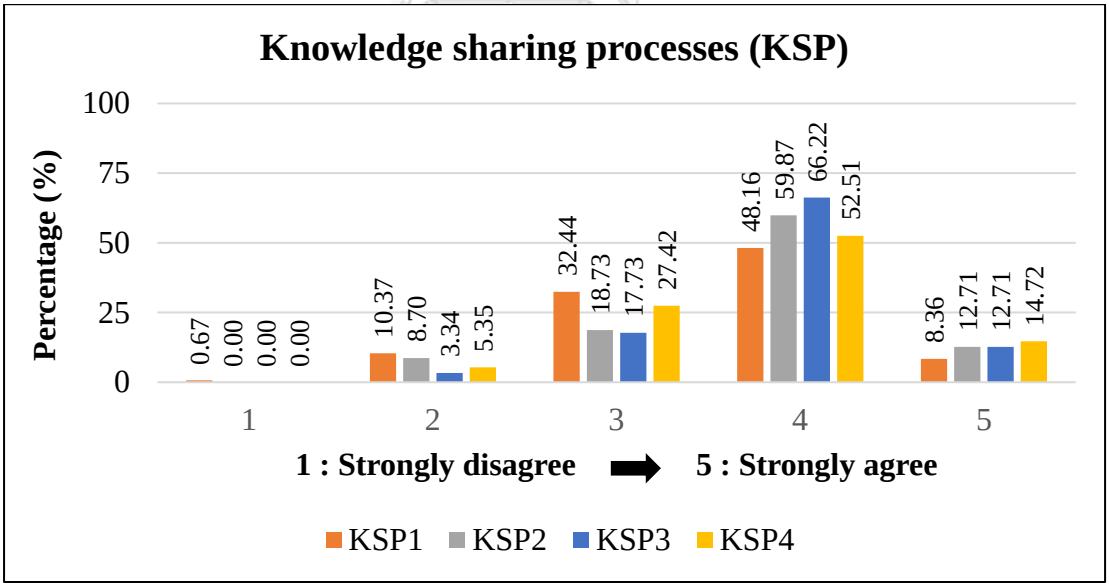


Figure 4.16: Percentages of KSP statements

4.3.7 Descriptive of Knowledge Sharing Outcomes

Table 4.18 and Figure 4.17 summarized the respondent's response to the knowledge sharing outcomes (KSO) construct. It shows the number of the respondent, the minimum and maximum response of the five-point Likert scale, mean, and standard deviation value for three statements of the KSO. It can be observed that most of the respondents have a positive feeling with KSO1, KSO2, and KSO3 on the mean value of 4.09, 4.19, and 4.15 with the SD of 0.664, 0.556, and 0.619, respectively. In addition, KSO1, KSO2, and KSO3 have been agreed by the respondent that almost the same percentage of 64.21%, 66.56%, and 64.21%.

The respondents show how helpful of the knowledge sharing outcomes in the construction project organization. Many respondents agree and strongly agree with this activity. Based on their perception, it mostly helps to enrich the work, then helps to reduce errors at work and improve the work performance.

Table 4.18: Statistic analysis of KSO items

Code	N	Min	Max	Mean	Std. Deviation
KSO1	299	2	5	4.09	.664
KSO2	299	2	5	4.19	.556
KSO3	299	1	5	4.15	.619

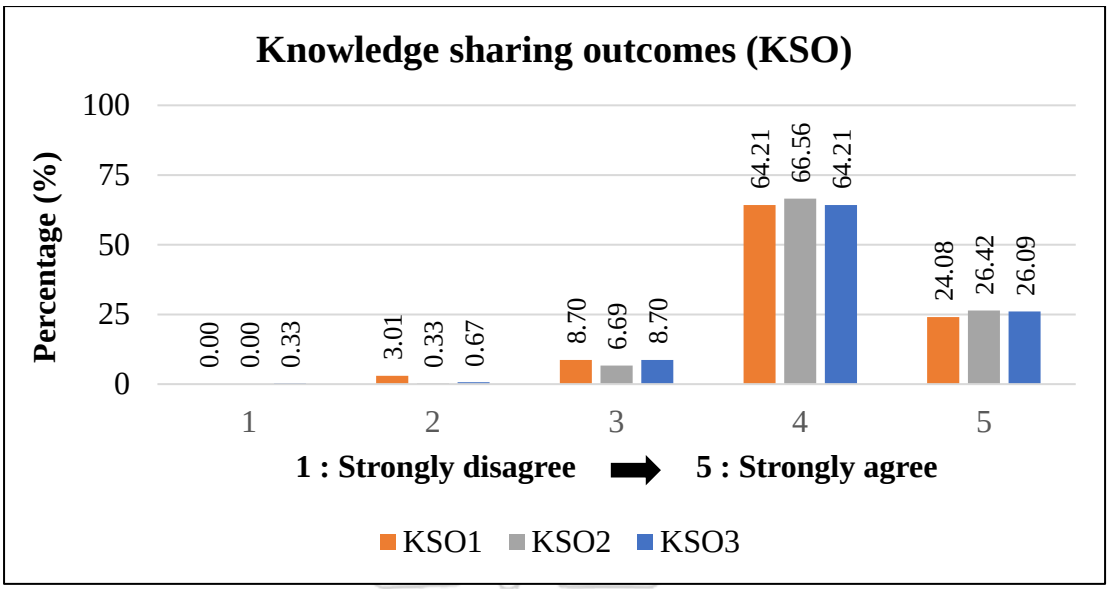


Figure 4.17: Percentages of KSO statements

CHAPTER 5
MODEL TESTING RESULTS AND DISCUSSION

5.1 General

For this section it offers the inisde critical of the communicatiopn between the structures in the projected sample study. In order to study about the relationship of knowledge sharing, modeling analysis is necessary. One set of complex structural equation modeling is estimated. The last episode, the symposium of the outcomes can be declared to offer an exact comprehension for model estimation.

5.2 Data Structure for Modeling

The information of questionnaire survey from the respondents toward knowledge sharing outcomes in construction projects was result for the data by having SPSS 22. Such a part of details was indicated in a formal number with dissimilar kinds of estimations (scale, nominal, and ordinal) in accordance with its pure. the variable description appeared in Table 5.1.

Table 5.1: Description of variables

No.	Variables	Measure	Value	Description
1	Gender	Nominal	1/2	1: Male; 2: Female
2	Age	Ordinal	Integer	Range aging of respondent
3	Education	Nominal	Integer	Education degree of respondent
4	Position	Nominal	Integer	The current position of the respondent in the construction project
5	Work experience	Ordinal	Integer	Respondents' working experience in construction
6	Attitude toward the behavior (ATB)	Scale	Integer	Respondent's attitude toward knowledge sharing

No.	Variables	Measure	Value	Description
7	Subjective norm (SN)	Scale	Integer	Respondent's subjective norm toward knowledge sharing
8	Perceived behavioral control (PBC)	Scale	Integer	Respondent has perceived behavioral control toward knowledge sharing
9	Individual culture (IC)	Scale	Integer	The individual culture of the respondent toward knowledge sharing
10	Knowledge feedback (KF)	Scale	Integer	Respondent's knowledge feedback toward knowledge sharing
11	Employee motivations (EM)	Scale	Integer	Respondent's motivations toward knowledge sharing
12	Perceived value and recognition (PVR)	Scale	Integer	Respondent's perceived value and recognition toward knowledge sharing
13	Personal relationship (PR)	Scale	Integer	Respondent's relationship with others toward knowledge sharing
14	Organizational culture (OC)	Scale	Integer	Respondent's organizational culture toward knowledge sharing
15	Management support (MS)	Scale	Integer	Respondent's management support toward knowledge sharing
16	Organizational structure (OS)	Scale	Integer	Respondent's organizational structure toward knowledge sharing

No.	Variables	Measure	Value	Description
17	Strategy and planning (SP)	Scale	Integer	Strategy and planning of respondents' organization toward knowledge sharing
18	Resource (RES)	Scale	Integer	Resource of respondents' organization toward knowledge sharing
19	ICT support (ICT)	Scale	Integer	ICT support from respondents' organization toward knowledge sharing
20	Knowledge sharing behavior (KSB)	Scale	Integer	Respondent's knowledge sharing behavior toward knowledge sharing
21	Knowledge sharing processes (KSP)	Scale	Integer	Respondent's knowledge sharing processes toward knowledge sharing
22	Knowledge sharing outcomes (KSO)	Scale	Integer	Respondent's perception on knowledge sharing outcomes

5.3 Scale Reliability of Construct Items

It is a vital order before undertaking to test the theory in the projected study sample to test the dependability for the estimation like this may influence the results and the goals of the research (Hair et al., 2010). The construct reliability of the points with the dimensions measuring each factor was evaluated using the Cronbach's alpha coefficients. SPSS 22 can be consumed to determine the notoriety examinations on exploration that might be shown in Table 5.2. Cronbach's Alpha estimates the way the point of tools estimates one unidirectional real building. Dissimilar dependability worth was thought preference by dissimilar learners. For example, it would have at least 0.7 in accordance with DeVellis (2012). As a guideline, Kline (2015) suggests

that an alpha coefficient around 0.90 is superior, around 0.80 is so well, and around 0.70 is enough. Additionally, Hair et al. (2010) approve that the costs of 0.60 to 0.70 are at the lower limit of prestige. Cronbach alpha values are, although, extremely delicate to the number of materials in the ranking. For abridged sequences (e.g., item for less than ten parts) this might be common to seek extremely low - set Cronbach values (e.g., 0.5). Especially, when Cronbach alpha receives closer to 1.0, it is about that the constructs have high dependability.

Table 5.2: Summary of Cronbach's Alpha

Variables	**Full Items**	
	Number of Items	**Cronbach's Alpha**
Attitude toward the behavior (ATB)	3	0.436
Subjective norm (SN)	2	0.780
Perceived behavioral control (PBC)	3	0.483
Individual culture (IC)	5	0.566
Knowledge feedback (KF)	4	0.846
Employee motivations (EM)	4	0.737
Perceived value and recognition (PVR)	4	0.710
Personal relationship (PR)	3	0.646
Organizational culture (OC)	2	0.554
Management support (MS)	4	0.859
Organizational structure (OS)	3	0.804
Strategy and planning (SP)	2	0.844
Resource (RES)	3	0.745
ICT support (ICT)	4	0.893
Knowledge sharing behavior (KSB)	4	0.760
Knowledge sharing processes (KSP)	4	0.730
Knowledge sharing outcomes (KSO)	3	0.806
Number of Items	57	

From the above table, it can be observed that some variables need to improve the Cronbach's Alpha that is why some items need to delete. In the beginning, ATB has three items with its Cronbach alpha is 0.436, so some items will need to be deleted in order to improve the Cronbach alpha. In the same case, PBC, KF, PVR, RES, and KSB are faced with this issue. Table 5.3 shows about the improvement of the construct's reliability of items deleted and item-total correlation in order to reach the acceptable reliability. As you can see, PR has its Cronbach's alpha between 0.60 to 0.70 which is at the lower limit of acceptability for structural modeling. On the other hand, PBC, IC, and OC are lower than 0.60 which are ranging from 0.521 to 0.566. We assume these are acceptable for the model analysis. In addition, six items were deleted from the whole constructs, so 51 items were used for further analysis.

Table 5.3: Cronbach's alpha of construct's reliability

Variables	**Items Deleted**		
	Number of Items	**Corrected Item-Total Correlation**	**Cronbach's Alpha**
Attitude toward the behavior (ATB)	2		0.823
ATB1		0.701	
ATB2		0.701	
Subjective norm (SN)	2		0.780
SN1		0.644	
SN2		0.644	
Perceived behavioral control (PBC)	2		0.521
PBC1		0.358	
PBC3		0.358	
Individual culture (IC)	5		0.566
IC1		0.380	
IC2		0.357	
IC3		0.258	
IC4		0.288	
IC5		0.360	

Variables	Items Deleted		
	Number of Items	**Corrected Item-Total Correlation**	**Cronbach's Alpha**
Knowledge feedback (KF)	3		0.851
KF2		0.707	
KF3		0.725	
KF4		0.733	
Employee motivations (EM)	4		0.737
EM1		0.514	
EM2		0.532	
EM3		0.624	
EM4		0.482	
Perceived value and recognition (PVR)	3		0.715
PVR1		0.477	
PVR2		0.600	
PVR4		0.532	
Personal relationship (PR)	3		0.646
PR1		0.380	
PR2		0.529	
PR3		0.481	
Organizational culture (OC)	2		0.554
OC1		0.383	
OC2		0.383	
Management support (MS)	4		0.859
MS1		0.674	
MS2		0.707	
MS3		0.717	
MS4		0.723	
Organizational structure (OS)	3		0.804
OS1		0.641	
OS2		0.708	

Variables	Items Deleted		
	Number of Items	Corrected Item-Total Correlation	Cronbach's Alpha
OS3		0.611	
Strategy and planning (SP)	2		0.844
SP1		0.732	
SP2		0.732	
Resource (RES)	2		0.788
RES2		0.650	
RES3		0.650	
ICT support (ICT)	4		0.893
ICT1		0.709	
ICT2		0.765	
ICT3		0.804	
ICT4		0.781	
Knowledge sharing behavior (KSB)	3		0.774
KSB1		0.599	
KSB2		0.664	
KSB4		0.571	
Knowledge sharing processes (KSP)	4		0.730
KSP1		0.553	
KSP2		0.577	
KSP3		0.528	
KSP4		0.435	
Knowledge sharing outcomes (KSO)	3		0.806
KSO1		0.587	
KSO2		0.757	
KSO3		0.633	
Number of Items	**51**		

5.4 Analysis of Measurement Model Fit

That one may examine a testing of conceptual sample within different constructs, second order was used during the data analytical procedure. Firstly, the confirmatory factor analysis (CFA) was hired to examine the model apt. An alongside order hired the SEM technique to employ the theory in communication between the variable dependence and independence. Being a two-side strategy shoes that the constructures stored for the search twhich have proper reliability estimates will be appeared in the fundamental sample (Hair et al., 2010; Kline, 2015).

In CFA, it does not have to interchange between dependent and independent variables when it is necessary during the model testing stage (Hair et al., 2010). Once should be indicated in Figure 5.1, the variety are closedly connected, and the building points (measured variables) are indicated in in rectangular shapes. The covariance is normally pointed out by two-headed arrows, even though a one-headed arrow expresses a usual connection with build shower. At this stage, the correlation of each variable was observed to test the significant level ($p<0.05$). The significant level was clarified by p-value as shown in Appendix D (Covariances). The covariances between variables are significant at $p < 0.05$, except (ATB <--> RES) that is insignificant because it has $p = 0.2$, thus this correlation was considered to delete before starting to look at another parameter.

Most of us receive the maximum-likelihood strategy to capsulate the model's sets where all critical ones were focused on variance-covariance pure (Hair et al., 2010). The idifications woul be talked over assessing the sample of goodness-of-fit (Hair et al., 2010; Kline, 2015). First, the ratio of the Chi-square (χ^2) statistic to its degree of freedom (χ^2 / df) was used, with a value of less than three indicating acceptable fit. Hair et al. (2010) suggest the following indifications to indicate acceptable fit such as Goodness of Fit Index (GFI); Normed Fit Index (NFI); Root Mean Square Residuals (RMSR); Comparative Fit Index (CFI); Adjusted Goodness-of-Fit Index (AGFI); and the Root Mean Square Error of Approximation (RMSEA). Byrne (2016) also suggest the most popular incremental fit indices such as Normed

Fit Index (NFI); the Trucker-Lewis Index (TLI); the Comparative Fit Index (CFI)and the Incremental Fit Index (IFI). Furthermore, this model had to be considered some acceptable fit indices, so there will be six indices were measured as described in the following term in Table 5.4.

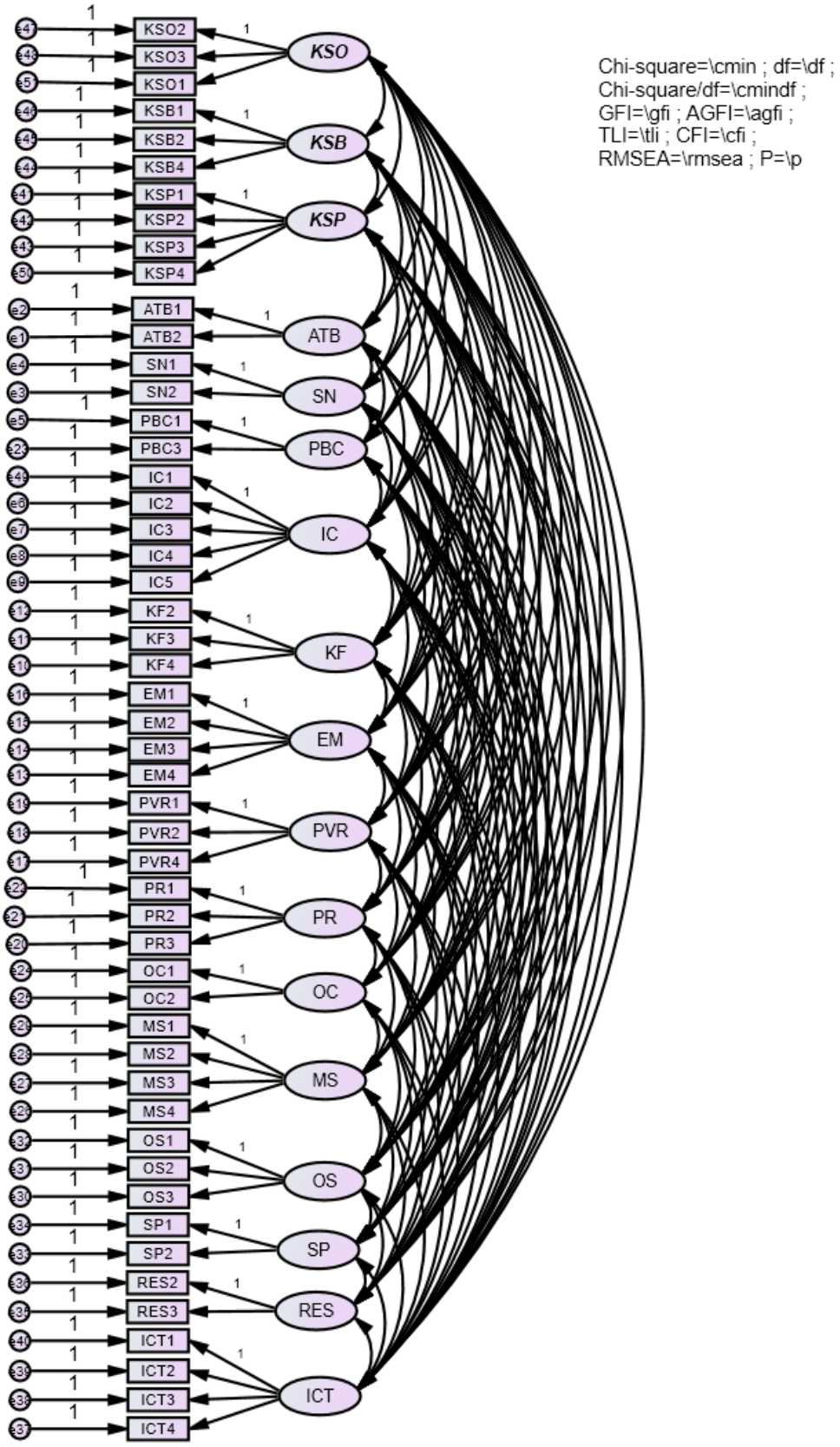


Figure 5.1: Hypothesized CFA model

Table 5.4: Key terms of model fit indices

Fit Index	Terminology used
Chi-square/ degree of freedom (χ^2 / df)	A ratio between Chi-square (χ^2) and the degree of freedom (df)
Goodness-of-fit index (GFI)	Measuring index indicating what a perfect sample remakes covariance pattern between the expressions vary.
Adjusted Goodness-of-fit index (AGFI)	The AGFI is to differ grade from complicated sample. It is the GFI by a rate of the degree of freedom used in the total degree of available freedom.
Trucker-Lewis index (TLI)	Trucker and Lewis' first aim at improvement the appendix was to number the grade that regular discovery element mode is an enhancement a zero point ones checked by utmost ones.
Comparative fit index (CFI)	The CFI is a really suitable appendix which is a developed adaptation of NFI. The CFI is completed in order to values rate between 0 and 1, with higher costs is denoting really well.
Root mean square error of approximation (RMSEA)	It has much freed measurement usage which attempt to be right for the bias of the good-of-fit analytical quiz to refuse samples for a huge model; a plenty of variety seen is the stem square trouble for estimation. Lower RMSEA costs denote very well.

In addition, all six indices were measured against the following criteria:

- $\chi^2 / df < 3.0$ (Byrne, 2016; Hair et al., 2010; Kline, 2015)
- $GFI > 0.8$ (Dawes et al., 1998; Kim et al., 2016; Sarkis et al., 2010)

- $AGFI > 0.8$ (Hair et al., 2010; Kim et al., 2016)
- $TLI > 0.8$ (Kim et al., 2016)
- $CFI > 0.8$ (Hu and Bentler, 1999; Kim et al., 2016)
- $RMSEA < 0.08$ (Byrne, 2016; Hair et al., 2010)

Table 5.5 shows the level of acceptance fit obtained with the survey data. The model revealed the following results for the 299 sample such as $\chi^2 / df = 1.670$; GFI=0.812; AGFI=0.771; TLI=0.870; CFI=0.889; RMSEA=0.047. The results of model fit indices were indicated a good measurement model fit to the data, so it was good enough to accept for this study. Thus, this model will not need to improve the measurement model fit anymore.

Table 5.5: Model fit summary for the measurement model

Fit Index	**Recommended Value**	**Measurement Model**
Chi-square/degree of freedom (χ^2 / df)	<3	1.670
Goodness-of-fit index (GFI)	>0.80	0.812
Adjusted goodness-of-fit index (AGFI)	>0.80	0.771
Tucker-Lewis index (TLI)	>0.80	0.870
Comparative fit index (CFI)	>0.80	0.889
Root mean square error of approximation (RMSEA)	<0.08	0.047

5.5 Analysis of the Structural Modeling and Hypotheses Testing

This part is to quiz the communication among the exogenous and endogenous real varieties which can be done while the structural sample. Like the CFA, there is a need to set up among variable independence and dependence. SEM uses the covariance among the independent variable independence expressed by two-headed arrows, but the usual communication from a variable independence to a variable dependence is indicated by one-arrow. Thus, the communication among

building is perfect after the connection with the estimation sample to the building sample.

Below the hypothese was about to exame the face and back sides communication among the 14 independents, 2 mediators, and 1 dependent variable. The communication weas shown in Chapter 3 when the sample and hypothese improvement step. The exogenous constructs were categorized into four groups. The first group was about psychological which was contained of three latent variables such as attitude toward the behavior, subjective norm, and perceived behavioral control. The second group was about an individual which contained five latent variables such as individual culture, knowledge feedback, employee motivations, perceived value and recognition, and personal relationship. The third group was about organizational which was contained five latent variables such as organizational culture, management support, organizational structure, strategy and planning, and resource, and the last group was about information and communication technology which had ICT support as the only one latent variable. Two mediators mediated between independent and dependent variables were used in the model, there was knowledge sharing behavior and knowledge sharing processes, while endogenous variable was knowledge sharing outcomes.

H1: The knowledge sharing behavior (KSB) has a direct positive influence on knowledge sharing outcomes (KSO).

H2: The knowledge sharing processes (KSP) have a direct positive influence on knowledge sharing outcomes (KSO).

H3a-c: The psychological factors have a positive effect on knowledge sharing behavior.

H4a-e: The individual factors have a positive effect on knowledge sharing behavior.

H5a-e: The organizational factors have a positive effect on knowledge sharing processes.

H6: The technological factors have a positive effect on knowledge sharing processes

The assessment procedure for the structural modeling included a test of the apt indicators with the standardized path coefficients. This approach was taken to offer a base which is suitable to deny the hypothesized communication. The precedent for the sample apt indicators accepted in the investigation can be like to those in the calculation sample evaluation in CFA stage. For the hypothesized communications with promoted, the patterned course cooperative might be appropriated to the importance of the $p < 0.05$ level, and higher than 0.30 to be considered meaningful (Byrne, 2016). However, the significant at $p < 0.1$ level also acceptable for this study. Therefore, most of us followed to test the theory communication in tour sample. Table 5.6 depicts the path coefficients for the hypothesized communication in the projected study sample. The structural model for the study is depicted in Figure 5.2.

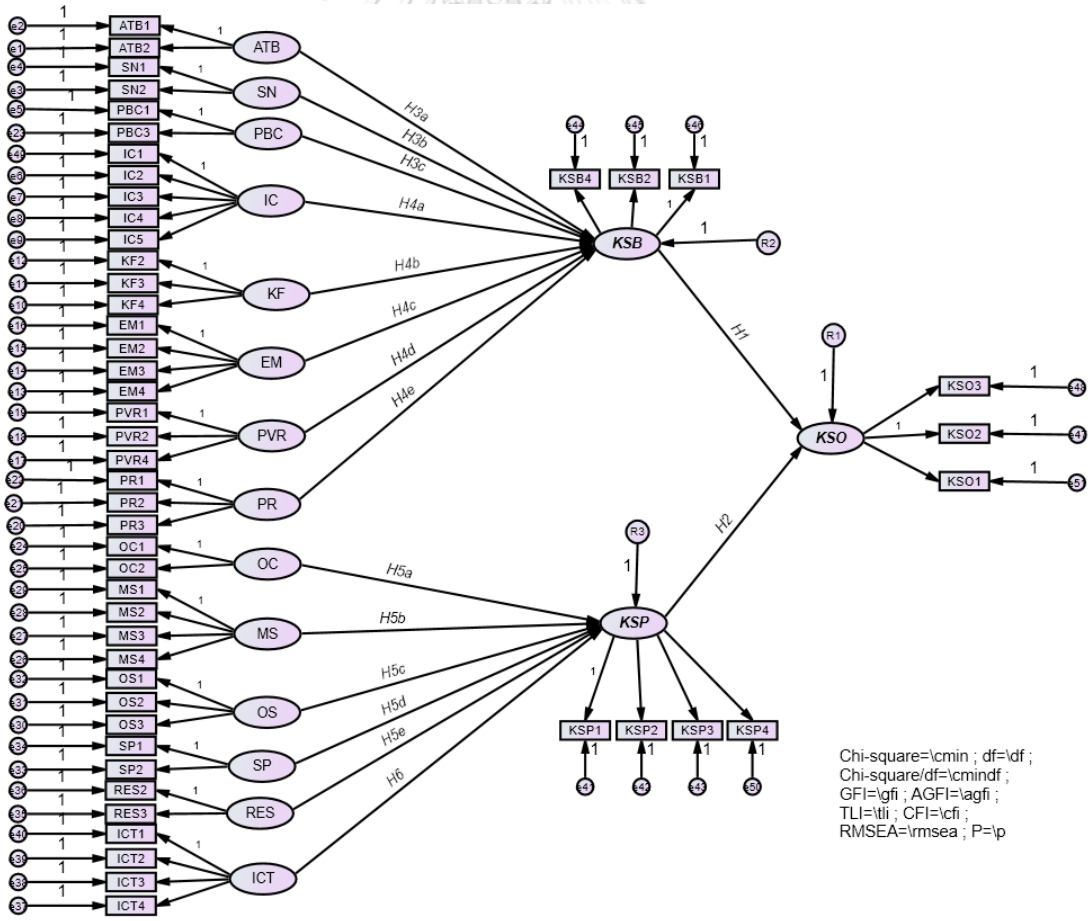


Figure 5.2: The structural model of the study

As a result shown in Figure 5.3, the same criteria were used for the measurement model. The results of the fit indices were pretty good with $\chi^2 / df = 1.717$; GFI=0.803; AGFI=0.766; TLI=0.861; CFI=0.878; and RMSEA=0.049. Even though AGFI was slightly lower, but it almost close to the acceptable level that we can accept for further analysis. Because in the structural model, the good fit indices does not guarantee that the model is the single best representation of the data like the CFA model (Hair et al., 2010). Therefore, there are to wend the test on theory communications in the sample. Table 5.6 illustrates the course cooperation for hypothesized relationships within the proposed model.

As what we can see in Table 5.6, some hypotheses were supported, but some hypotheses were rejected as shown in Appendix E (Structural model). Nine out of sixteen direct hypotheses were supported in the proposed model. Both of KSB (0.46***) and KSP (0.22***) can be looked for an important affirmative effect on knowledge sharing outcomes, which was supported by H1 and H2. However, some hypotheses were not supported because of the significant level higher than 0.1 (p>0.1), and the path coefficient was negative which against the background of theoretical. As you can see, the information collection declines to bolster the explicit communication among SN, IC, KF, PVR, and PR with KSB; OC, and ICT with KSP, thus it is indicating that its hypothesis was rejected.

Table 5.6: The summary of direct hypothesized results

Hypothesis	Proposed relationship	Effects type	Path coefficient	Study results
H1	KSB ⟶ KSO	Direct	0.46 ***	Support
H2	KSP ⟶ KSO	Direct	0.22 ***	Support
H3a	ATB ⟶ KSB	Direct	0.34 ***	Support
H3b	SN ⟶ KSB	Direct	-0.12	Not support
H3c	PBC ⟶ KSB	Direct	0.74 ***	Support
H4a	IC ⟶ KSB	Direct	0.08	Not support
H4b	KF ⟶ KSB	Direct	0.10	Not support
H4c	EM ⟶ KSB	Direct	0.37 **	Support

Hypothesis	Proposed relationship	Effects type	Path coefficient	Study results
H4d	PVR ⟶ KSB	Direct	-0.35 *	Not support
H4e	PR ⟶ KSB	Direct	-0.29 **	Not support
H5a	OC ⟶ KSP	Direct	-0.07	Not support
H5b	MS ⟶ KSP	Direct	0.34 ***	Support
H5c	OS ⟶ KSP	Direct	0.20 **	Support
H5d	SP ⟶ KSP	Direct	0.25 ***	Support
H5e	RES ⟶ KSP	Direct	0.14 *	Support
H6	ICT ⟶ KSP	Direct	0.07	Not support
Notes: * p < 0.1; ** p < 0.05; *** p < 0.01; NS p > 0.1				

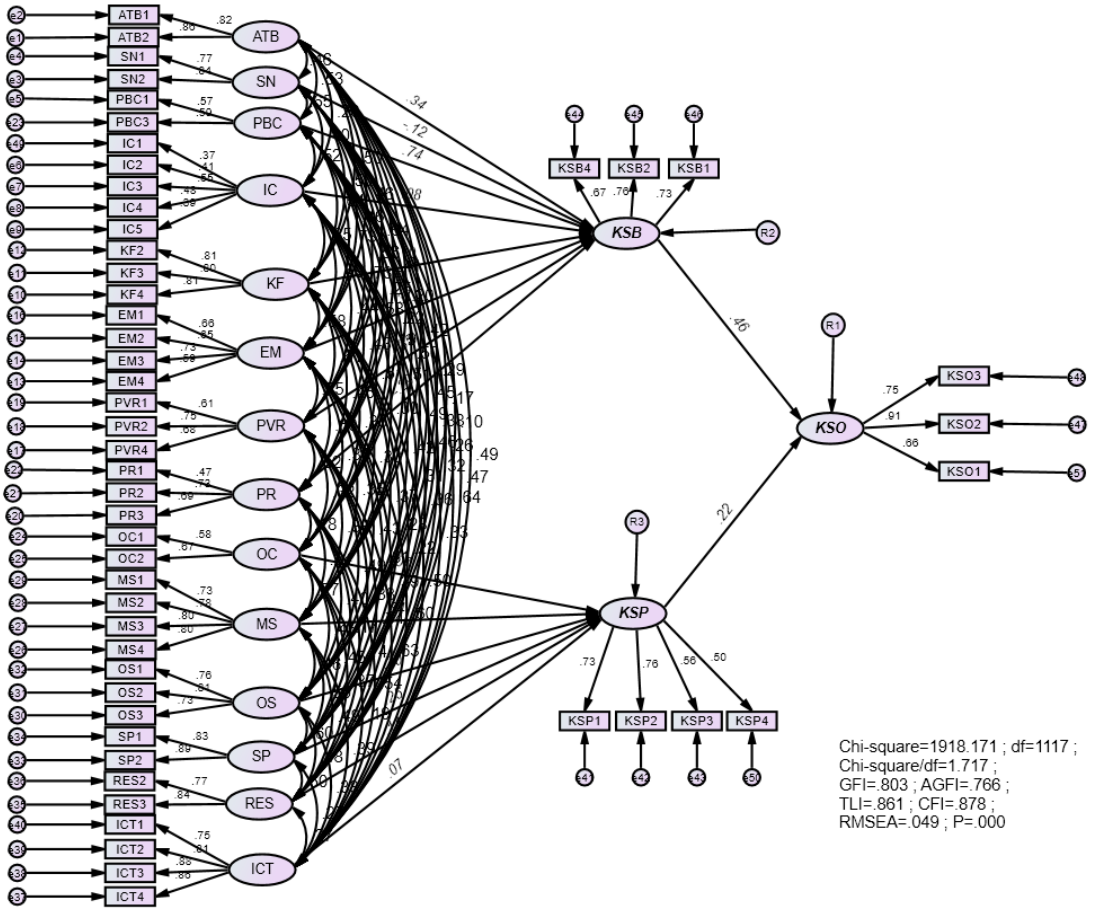


Figure 5.3: Assessment results of the structural model

For this sample, the straightforward, roundabout, and amount influence was requisite to calculate. As you can see, KSO is influenced straightforward by KSB, and KSP and roundabout by ATB, SN, PBC, IC, KF, EM, PVR, PR, OC, MS, OS, SP, RES, and ICT. The roundabout influence might be the goods of the courses which might be connected to the reliant changeable. The amount ancillary influence can be the quantity of all the courses. The outcomes of the straightforward, roundabout and amount influences in KSO can be indicated in Table 5.7.

Table 5.7: The calculation of direct, indirect, and total effects on KSO

Variables	Direct effect	Indirect effect	Total effect
KSB	0.46	-	0.46
KSP	0.22	-	0.22
ATB	-	0.16	0.16
PBC	-	0.34	0.34
EM	-	0.17	0.17
MS	-	0.07	0.07
OS	-	0.04	0.04
SP	-	0.05	0.05
RES	-	0.03	0.03

As shown in Table 5.7, both of KSB and KSP have a positive influence on KSO, but KSB has a strong influence than KSP while KSB is supported by H1 (the total effect is 0.46) and KSP is supported by H2 (the total effect is 0.22), respectively. On the other hand, some variables have a low effect which caused weak influence on KSO. The explanation and discussion will be conducted in the next part of this chapter.

5.6 Discussion

This part might be attendance to significant searching and outcomes of the recent search. It aims to provide the clear consultation about the straightforward

communications in the study sample. For the point is about to address for the comprehension about the detracting aspect of psychological, individual, and organizational factors play in affecting the knowledge sharing behavior and knowledge sharing processes; and discuss the relationship of knowledge sharing behavior and knowledge sharing processes towards knowledge sharing outcomes adoption in the construction projects. On the other hand, the result of technological factors that do not affect the knowledge sharing processes will be shown for discussion in this part as well.

The results revealed that 7 out of 14 paths between independent variables and mediators of this study were supported (Figure 5.4). The empirical results have shown that the psychological, and individual factors affect to the knowledge sharing behavior; and organizational factors affect to the knowledge sharing processes in construction projects in Cambodia while the only one factor of technological aspect did not show its affecting in the model. The standardized path coefficient of the factors affecting the knowledge sharing behavior and knowledge sharing processes in ths expected intellectual study for model of N=299 is shown in Table 5.6.

The regression weight output in AMOS 20 indicates that among the four groups, seven hypothesized relationships were supported. More specifically, ATB (0.34***) and PBC (0.74***) can be found an important positive influence on knowledge sharing behavior (KSB), supporting H3a, and H3c, respectively. The result is shown that psychology role importantly in term of knowledge sharing in construction projects. The effective of ATB on KSB provide a clear insight that people have positive feeling on sharing their technical skill, managerial expertise, and project knowledge with colleagues. The term of positive feeling, they think that knowledge sharing is good and beneficial. In addition, the effect of PBC on KSB also provide an understanding that they are confident to perform the activity in this particular behavior. Plus, they feel like they are able to perform knowledge sharing with colleagues.

Another result of individual factor which is indicated that four out of five hypothesized relationships were rejected. On the other hand, employee motivation

(0.37 **) can be found an important affirmative influence on KSB with the path coefficient of 0.37, supporting H4c. This is because the employees have a strong motivation to perform knowledge sharing. When he/she share the experience or other technical skill with his/her colleagues, he/she believes to be responded in the future. One more thing, the employees may enjoy sharing the experiences, managerial expertise, project knowledge with colleagues so much. Another employees' motivation is perceived respectful when sharing this kind of knowledge.

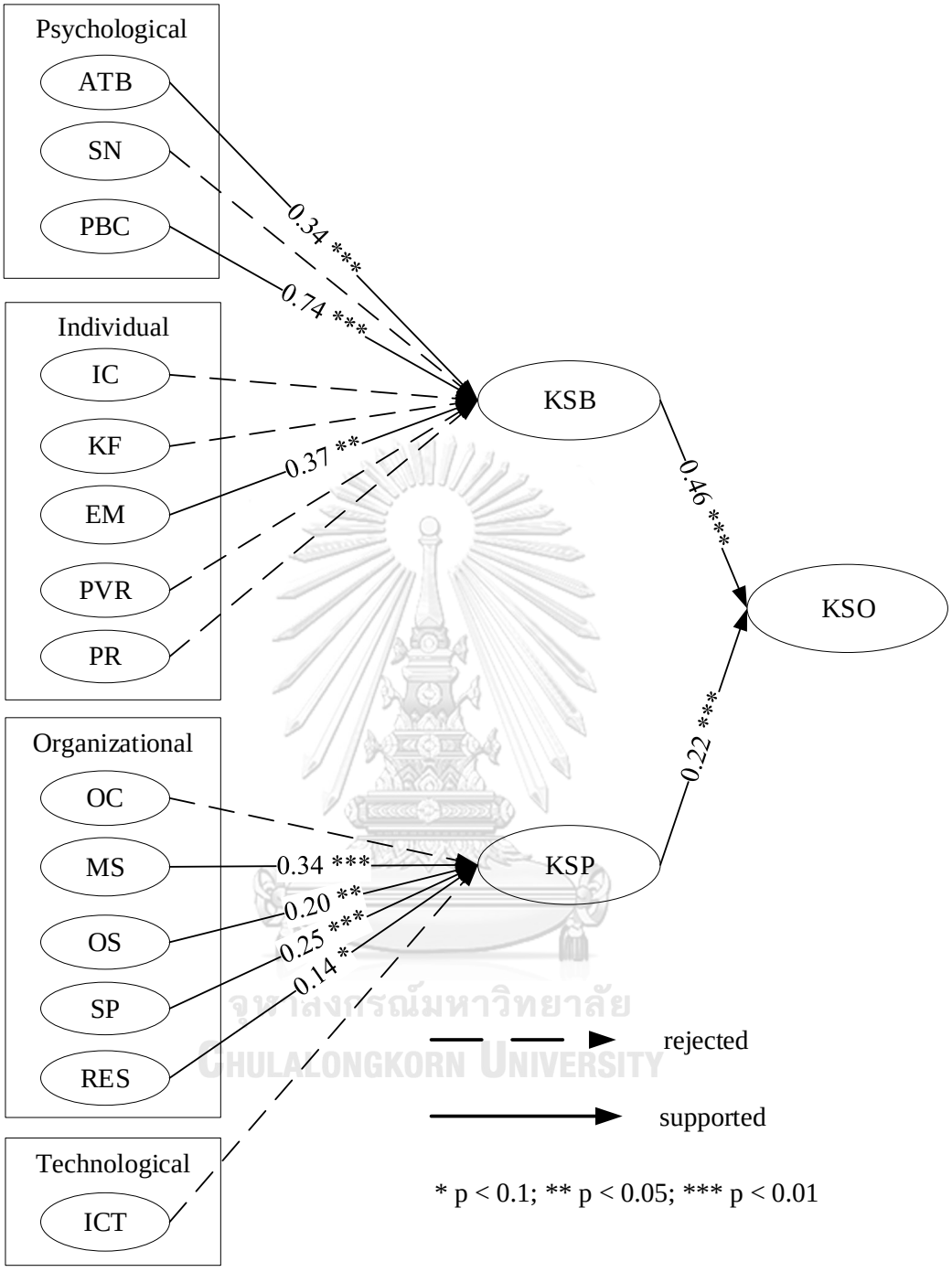
The results also show that four out of five paths of organizational factors were supported. Based on the empirical study, management support (MS=0.34***), organizational structure (OS=0.20**), strategy and planning (SP=0.25***), and resource (RES=0.14*) were looked for an important affirmative influence on knowledge sharing processes (KSP), supporting H5b to H5e, respectively. Based on these results, the processing of knowledge sharing relies much on organizational factors. One of them, management support (MS) was the highest effect on knowledge sharing processes (KSP). We can see that the management team or managers in the organization support their employees by training, and learning. When the employees discuss for problem-solving, the organization may provide the necessary resources in order to support for sharing as well as discussion. It is what the managers really want to see their employees perform knowledge sharing, especially when they have learned something new. In another support, managers also proactive to share their knowledge related to working with others as a model in the organization. In somehow, the way for sharing the knowledge may happen in the informal communication among employees. So, the management may support both ways of sharing – formal and informal interactions. In addition, strategy and planning (SP) was the second effect on knowledge sharing process. Its standardized coefficient is 0.25 at significant level 0.01. The effective of SP on KSP gives a meaning that there is a standardized program or regulations of training, learning, and discussion in the organization. Supporting that, the specific ways and means are the key points to implement knowledge sharing. Next, organizational structure (OS) is another affecting path in the model. The path coefficient is 0.20 with the significance at 0.05. The finding shows that having standardized operating in handling work tasks will be helpful to the

process of problem-solving. When the project organization opens for employees to participate for making a decesive procedure, we can have a good interaction with colleagues. Lastly, resource (RES) was the lowest significant in the organizational factors affect knowledge sharing processes. Even it is less efficient, but it is helpful in this model. It is shown that when the organization supports their employee with some kinds of a resource such as materials, room, and other necessary things for knowledge sharing, the professional training, organizational learning, discussion, expertise sharing will be implemented in that particular organization. Thus, the employees can request any resource from the organization in order to share something new to colleagues.

However, information and communication technology (ICT) support was not affected to knowledge sharing processes in this study. Regarding the path coefficient of ICT (0.07), it was insignificant; thus hypothesized relationship of H6 was rejected. Even ICT was found as a great infrastructure and tools for sharing information as well as knowledge; it still problematic in some cases. In this study, ICT does not fully function use for knowledge sharing processes at all. ICT may not use or less use for a particular action. As we can see, the discussion or informal interaction between colleagues may not need ICT to facilitate so much. In case of the training, the ICT may need but it would not often. According to Lin, H. F. (2007), the technology factor (ICT use) had an insignificant effect on knowledge sharing process (knowledge donation) as well. Even though ICT has been recognized as a great tool to implement the knowledge sharing, Issa and Haddad (2008) argued that information technology would assist but it did not motivate people in sharing their knowledge, and not all types of knowledge could be shared using information technology. The same as this study, ICT does not affect to the knowledge sharing processes maybe it is not functional use or the organization does not set up a good ICT regarding the extra cost that could affect to the construction business.

Regarding the knowledge sharing outcomes (KSO), two mediators were significantly influenced. Among those two, knowledge sharing behavior (KSB) was the highest influence on knowledge sharing outcomes (0.46***) with a significant level at 0.01 (Figure 5.4). This high influence means the sharing of technical skills,

managerial expertise, and project knowledge would benefit to reduce the errors, enrich work, and improve work performance in the construction project. Moreover, the knowledge sharing processes (KSP) also influence knowledge sharing outcomes. Its coefficient is 0.22 with a significant level at 0.01. The influence of KSP provides a clear insight of conducting the professional training or organizational learning, discussion, share new learning will help to improve the work performance, enrich work, and decrease the problem at working as well. Both mediators are significance influence on knowledge sharing outcomes. It provides a clear image on the thing that could benefit to the knowledge sharing.



ATB: Attitude toward the behavior; SN: Subjective norm; PBC: Perceived behavioral control; IC: Individual culture; KF: Knowledge feedback; EM: Employee motivation; PVR: Perceived value and recognition; PR: Personal relationship; OC: Organizational culture; MS: Management support; OS: Organizational structure; SP: Strategy and planning; RES: Resource; ICT: ICT support; KSB: Knowledge sharing behavior; KSP: Knowledge sharing processes; KSO: Knowledge sharing outcomes

Figure 5.4: The significant relationships

To the point, the practical outcomes have indicated that psychological, individual, and organizational factors have been looked for the influence on the two mediators of knowledge sharing behavior and knowledge sharing processes; then those two mediators also effect on the knowledge sharing outcomes in the construction projects. However, the technological factor has been found to insignificant effect in this study. The results support the seven out of fourteen independent variables (ATB, PBC, EM, MS, OS, SP, and RES) that have a significant positive effect direct hypothesized relationships on both mediators while the other seven independent variables (SN, IC, KF, PVR, PR, OC, and ICT) were rejected. In addition, this study reveals the highest affirmative affect the knowledge sharing outcomes (KSO) is knowledge sharing behavior (KSB). These useful results can be used to offer the valuable comprehension for the knowledge sharing with the textof construction projects.

5.7 Managerial Implications

The study must be referring to (1) developing the causal relationship model of factors that affect knowledge sharing behavior and knowledge sharing processes; and (2) evaluating the influence of knowledge sharing behavior and knowledge sharing processes on knowledge sharing outcomes in construction projects. The model in this study identified many factors, which has involved from the psychological, individual, organizational, and technological factors in order to lead to a causal model that discuss knowledge sharing outcomes. This model incorporates two mediators namely; knowledge sharing behavior (KSB) and knowledge sharing processes (KSP) in order to overcome the influence on knowledge sharing outcomes (KSO). The overall significant relationship of this model after analysis has shown in Figure 5.4. The empirical analyses have shown that some independent variables have a significant effect, but some not. Some have supported by the hypothesized testing, and some have rejected. In addition, these findings have managerial implications that relevant for managers to set up the policy in their organization.

Regarding the psychology, the attitude toward the behavior (ATB) and perceived behavioral control (PBC) were supported with the highly significant level at 0.01. As it was shown in Figure 5.4, ATB had the standardized regression weight 0.34. Based on this result, it was apparent that people had positive thinking to implement knowledge sharing. There is about the behaviour in performing knowledge sharing was perceived as beneficial for them. It was not happened by other people influence them such their boss or colleagues. In addition, this attitude also closely relevant with the perceived behavioral control (PBC) which is also strongly supported by this study as well. About 0.74 of the standardized regression weight was found in the structural modeling. It was shown that people can contribute the education with others or co-workers include the availability of their resources as well. These two factors showed clearly to the managers or someone else who want to create a better knowledge sharing behavior, they have to create the environment for their employees in which that they can perceive the benefit of sharing the knowledge. They have to make the work environment that allows their employee able to share the knowledge. It just wants to make sure that the managers are possible to allow their employees are having a positive thought about the performing of knowledge sharing in the organization.

Besides the psychological aspect, the individual is an essential influence on knowledge sharing as well, especially on knowledge sharing behavior (KSB). From this aspect, employee motivation (EM) was the only important which is perceived 0.37 of the standardized regression weight with a significant level of 0.05. Even though in the individual factors have several variables, but employee motivation (EM) is the only important that allow the individual aspect role in this studying model. It happened when the employee of the organization believes in what they are doing. They may think that further requests for consciousness provision might be answered once they contribute their consciousness to colleagues. Another motivation was made by convenience in the capacity for education provision which they think about the worth. It is so important when we have a group of people or employees that prefer giving co-workers a hand by contributing the qualification. Because in somehow, who share knowledge frequently may perceive respectful from their colleagues. Following

this situation, managers have to promote the workers to offer the comprehension by not thinking any scare or disability. They should create an environment that allows groupers to have the awareness about the interplay procedure can have the worth for the first education onset, profiting for all sides of the knowledge sharer and receiver. This motivation has to be encouraged to all of the employees in order to understand and reduce the fear from day to day. By keep doing that, the employees will definitely change their habit and familiar the knowledge sharing as a simple activity with strongly confident and enjoyable. So, in the individual aspect, managers would care about the way to promote the workers to have qualification offering. So that, managers should encourage the employees to enjoy performing knowledge sharing and build their capacity of confident.

Furthermore, organizational factors have a huge effect on knowledge sharing processes (KSP). Four out of five factors significantly affected in this model as you can see in Figure 5.4. Firstly, management support (MS) was the highest affirmative influence on the knowledge sharing processes under a significant level of 0.01. It showed clearly enough that managers were the most critical person to support, provide, practice, and pleasure for the employees in the organization. They have to help and motivate the workers to contribute the know- how delightedly. They have to offer the most significant ability to ensure awareness provision. Outstandingly, leaders are the essential sample which is about to share knowledge sharing as examples in the organization. Secondly, strategy and planning (SP) was the second rank effective on knowledge sharing processes after the management support. Its standardized regression weight is 0.25 with a highly significant level of 0.01. In order to receive good knowledge sharing processes, strategy and planning have to be created in advance. In the project management, managers should set up a standardized knowledge sharing programs or regulations. It would be a strategy to specify ways and means about knowledge sharing in the organization. When the strategy and planning were set up, the implementation must be performed. Thus, it will help to improve the knowledge sharing processes as recommended in the model. Thirdly, organizational structure (OS) also effect on knowledge sharing processes. There is a need for the approved manipulating prepares the hand-outs in the project organization.

Managers should show that the ranked order might be leisurely or rapidly the detail cascade, for usually training ought to be contributed as fast as possible. Regarding this issue, spelling out ways to handle work tasks in a standard procedure is recommended for managers to be implemented in the project management. Especially, inside the project organization, the employees should secure participation in the decision-making process. Lastly, resources (RES) was another critical factor that effects on knowledge sharing processes. The organization has to support the staffs such the room for discussion and other supporting materials for knowledge sharing. It is important that managers have to consider the employees' request in order to facilitate any activities of their knowledge sharing. Because when employees are willing to perform the activity, they are sure to be supported by their organization. So, managers have to be positively considered on their request that supports to perform the knowledge the sharing.

Importantly, knowledge sharing behavior (KSB) was a significant influence on knowledge sharing outcomes (KSO) as you can see in Figure 5.4. It strongly influenced and highly significant at level 0.01. In order to maintain this work, managers should pay more attention to the employees to make sure that they are sharing their technical skills, managerial expertise, and project knowledge with the colleagues. In term of knowledge sharing behavior, managers should promote experience sharing related to the management skill, technical skill, and best practice of project knowledge. In addition, knowledge sharing processes (KSP) also have to be cared as well. The organization should regularly train to the staffs. The discussion and share expertise for problem-solving in the organization is the most important that need to conduct regularly among project members. In somehow, the process of knowledge sharing may be better in the form of informal communication between colleagues in the organization. Managers should create some opportunities for employees to strengthen their communication and sharing the knowledge when they have learned something new and beneficial to the organization. Therefore, these two mediators such as knowledge sharing behavior (KSB) and knowledge sharing processes (KSP) should be considered together when promoting knowledge sharing in the construction

projects. Non-either of them, the knowledge sharing outcomes will not warranty to meet the specific goal.

CHAPTER 6
CONCLUSION AND FUTURE RESEARCH

6.1 Conclusion

For the hypothesized items of reality, the search provided some important contributions. The outcome of the research is to improve an intellectual study sample which let a deep comprehension of knowledge sharing outcomes in construction projects in Cambodia. The constructs in the conceptual sample tested in the recent searches were designed to study the impact of two mediators; namely, knowledge sharing behavior (KSB) and knowledge sharing processes (KSP); on the relationship between independent and dependent variables. The dependent variable was knowledge sharing outcomes (KSO) with 14 independent variables. The discourse mention has appeared to have an absence in the study of influence on psychological, personal, grouping, and technological elements on knowledge sharing.

For essential strategy, this study reveals the use of quantitative method to make sure and verify the research model that aims to reach the study goals as proposed above. The most commonly practical technique of the structural equation modeling used for examination the construct items and the whole models. Especially, this research was employed the two-step method which is including the factor analysis (confirmatory factor analysis) and the structural equation modelling (SEM). This research has a high confident which is one of the exploration of using structural equation modeling technique to investigate several crossing factors affecting knowledge sharing in construction projects.

The hypothesized relationships were tested by using AMOS 20. The hypotheses tests indicated that psychological, individual, and organizational were significantly affect the knowledge sharing behavior, and knowledge sharing processes while technological was not associated. The two out of three variables of psychological factors and one out of five variables of individual factors were statistically significant with knowledge sharing behavior. In addition, four out of five

variables of organizational factors were statistically significant with knowledge sharing processes. All in all, the constructs in the proposed intellectual sample except technological element (ICT support), proved to be statistically significant and positively influenced with the two mediators of knowledge sharing behavior and knowledge sharing processes. Then, these two mediators also proved to be statistically significant and positively influenced with knowledge sharing outcomes.

This research is absolutely contributing to a few study areas such as knowledge sharing, knowledge management, and construction projects. Moreover, it would be benefit indirectly contributed to the research areas of management's decision-making and problem-solving related to knowledge sharing and management. The results from the contribution will provide new insight related to how knowledge sharing is shared and the way that affected by dissimilar elements in the construction project organizations. According to Lin, H. F. and Lee (2006), the research of knowledge sharing is needed to increase that one may look for the elements which can influence or affect. Then, this research is responded with the previous argument in which that some factors from psychological, individual, organization, and technological influence knowledge sharing via the knowledge sharing behavior and knowledge sharing processes.

To sum up, the framework which is found in this study will able to allows some kind of people such as top management (managers), middle management (senior engineers), and young engineers with a clear understanding of factors from different aspects that could affect knowledge sharing behavior and knowledge sharing processes to adapt and perform the knowledge sharing in the construction project organizations.

6.2 Recommendation and Future Research

The result from this finding will be benefit and useful for both academicians and practitioners who lie down on a large rate of attention from a team of model one (N=299). Although, this is the study, there is always with not all implied restraint which is to be recognized, considered and recommended for future research.

Firstly, since this model was designed that one may examine like the projected conceptual model, thus this model is need to be tested in the future research. It can be tested with different kind of sampling and populations, fields, and countries as an empirical tested model.

Secondly, the recent job is only set to the regular of building construction project in private organizations. In addition, the respondents are targeted only project members as known as contractors such as project managers, site managers, senior engineers, and young engineers. Thus, the respondents' perception might have been different when using another group of engineers such as design, consultation of infrastructure, hydropower construction, etc. of public projects. Thus, for the further study might duplicate the research with dissimilar construction sites and a group of people.

Finally, the full proposed model can be tested again and confirm some rejection hypothesized with different dataset and applications. It may work and show different solution from the current study while the data source is collected in different location or culture. Thus, the comparison of those two different results may be considered as well.

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APPENDIXES

Appendix A: Cover Letter of Surveying

Cover Letter

Dear Sir/Madam,

I am Mr. Lambada Roeun, a master student in majoring of Construction Engineering and Management (CEM) at Chulalongkorn University, Thailand, and I am conducting a study of "Development of Causal Relationship Model of Knowledge Sharing in Construction Projects". This research aims to explore the significant factors that affect knowledge sharing and evaluate the influence level of each factor in order to improve knowledge sharing practiced in the construction project organizations in Cambodia. I have attached a survey about the supporting factors in different dimensions such as psychological, individual, organizational, and technological factors that affect the knowledge sharing which I am hoping that you will fill out and return it to me. It should take you approximately about thirty to forty minutes to complete.

You will see that I have enclosed a questionnaire which asks you to respond to a series of factors, the items in the questionnaire focus on the statement of how each factor affects on knowledge sharing behavior, knowledge sharing processes, and knowledge sharing outcomes among projects members. If you decide to participate in my study, please fill in your answers and give the survey back to me. You should not put your name on the questionnaire survey when you fill it out, and I want to stress that your participation in this study is voluntary and your identity will be kept confidential. I give you the undertaking that your identity will not be disclosed to anyone. After you have submitted your response to the questionnaire, the contents will be copied to an Excel spreadsheet without any mention of your identity. However, if you receive the hard copy of the questionnaire design, then it will be kept highly secure in the document folder.

There are no risks to you or your privacy if you decide to join in my study by filling out this survey. However, if you decide not to participate, that is fine. Anyway, if you have any questions about the survey or about being in this study, please feel free to contact me via email at lambada.chula@gmail.com.

Sincerely yours,

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Appendix B: Questionnaire Survey

Research Title

Development of Causal Relationship Model of Knowledge Sharing in Construction Projects

Abstract

Knowledge sharing among construction project members is very crucial for improving project success, sustainability, project performance, and reduce repetition of previous mistakes in the construction process. Project management has been growing more complicated and project members also need to learn best practice from others or previous projects. The study of knowledge sharing is focusing on the human resource capability in the organization. However, knowledge sharing is not well performed due to the attitude of project members and the support from their organization in somehow. Therefore, this study aims to explore the significant factors from psychological, individual, organizational, and technological then evaluate those factors that affect knowledge sharing.

Part One: General Information

Please state your general information: Please tick ***ONE*** box (√)

Gender: ☐ Male ☐ Female

Age: ☐ < 25 years old ☐ 26 – 30 ☐ 31 – 35
☐ 36 – 40 ☐ Above 40 years old

Position: ☐ Junior Engineer ☐ Senior Engineer
☐ Site Manager ☐ Project Manager

Education: ☐ High School ☐ Associate Degrees
☐ Bachelors ☐ Masters ☐ Doctorate

Work experience: ☐ 0 – 5 years ☐ 6 – 10
☐ 11 – 15 ☐ > 16 years

Part Two: Questionnaires

Please input (√) in the response best applicable below:

Measurement Scale:	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree

Code	Items	Scale				
Attitude toward the behaviour (ATB)						
ATB1	I think my knowledge sharing with colleagues is good					
ATB2	I think my knowledge sharing with colleagues is beneficial					
ATB3	I think my knowledge sharing with colleagues is harmful					
Subjective norm (SN)						
SN1	My seniors think that I should share knowledge with my colleagues					
SN2	My managers think that I should share knowledge with my colleagues					
Perceived behavioral control (PBC)						
PBC1	I am able to share knowledge with colleagues					
PBC2	Sharing my knowledge with colleagues is under my control					
PBC3	I have the resources to support my knowledge sharing with colleagues (e.g. documentations or manuals)					
Individual culture (IC)						
IC1	Managers make most decisions without sharing idea with employees					
IC2	Managers expect employees to closely follow instructions and procedures related to their working					
IC3	The helpful of employees' working is standardized work procedures					
IC4	Individuals stick with the group even through difficulties					
IC5	Men share the knowledge more effectively than women					
Knowledge feedback (KF)						
KF1	Through sharing my knowledge with colleagues, my mistakes could be corrected by them					
KF2	Through sharing my knowledge with colleagues, I could refine my thinking based on their response and comments					
KF3	Through sharing my knowledge with colleagues, I could develop new insights based on their response and comments					
KF4	Through sharing my knowledge with colleagues, I could learn new things from their response and comments					

Employee motivations (EM)						
EM1	When I share my knowledge with colleagues, I believe that my future requests for knowledge sharing will be responded					
EM2	I am confident in my ability to provide knowledge that others in my organization consider valuable					
EM3	I enjoy helping colleagues by sharing my knowledge					
EM4	When I share my knowledge with colleagues, they respect me					
Perceived value and recognition (PVR)						
PVR1	Recognition: My colleagues appreciate me for sharing my work-related expertise					
PVR2	Recognition of my sharing expertise motivates me to share it with others					
PVR3	Perceived value: Colleagues value highly on knowledge sharing depend on knowledge type					
PVR4	Knowledge sharing is reinforced as a valuable learning					
Personal relationship (PR)						
PR1	I share data and information with colleagues for those we have a close relationship					
PR2	I rarely reject my friend's request to share some idea related to work					
PR3	To me, sharing the knowledge with best friend is inevitable					
Organizational culture (OC)						
OC1	Sharing the knowledge in the organization is considered structured and systematic because the culture of the organization is based on control and power					
OC2	Organization working environment is to be perfectly suited for innovation and leadership, adventure, challenge, creativeness, and results-oriented					
Management support (MS)						
MS1	Managers always support and encourage employees to share their knowledge with colleagues					
MS2	Managers provide most of the necessary help and resources to enable employees to share knowledge					
MS3	Managers practice knowledge sharing as examples for employees					
MS4	Managers are keen to see that the employees are happy to share their knowledge with colleagues					
Organizational structure (OS)						
OS1	There is a standard operating procedure in handling work tasks					

	in my project organization					
OS2	A host of work rules spell out ways to handle work tasks in my project organization					
OS3	My project organization secures employee participation in decision-making process					
Strategy and planning (SP)						
SP1	In my project, there is a standardized knowledge sharing programs or regulations					
SP2	In my project, there are specific ways and means about knowledge sharing					
Resource (RES)						
RES1	In my project organization, all employees are having the same opportunity to share their knowledge with colleagues					
RES2	The organization supports me the discussion room and other supporting materials for knowledge sharing with colleagues					
RES3	Employees can request any resource from their organization in order to support their knowledge sharing					
ICT support (ICT)						
ICT1	ICT allows me to share knowledge with colleagues					
ICT2	ICT enables knowledge sharing more quickly					
ICT3	ICT enhance the effectiveness of knowledge sharing					
ICT4	ICT make knowledge sharing easier					
Knowledge sharing behaviour (KSB)						
KSB1	I share my technical skills with colleagues					
KSB2	I share my managerial expertise with colleagues					
KSB3	I share official documentation or manuals with colleagues					
KSB4	I share project knowledge with colleagues					
Knowledge sharing processes (KSP)						
KSP1	There are regular professional training or organizational learning in the project organization					
KSP2	There are regular discussion and share expertise for problem-solving in the project organization					
KSP3	There is good interaction by informal communication with colleagues for knowledge sharing					
KSP4	Employees usually share their knowledge with colleagues when they have learned something new					
Knowledge sharing outcomes (KSO)						
KSO1	Knowledge sharing helps me reduce errors at work					
KSO2	Knowledge sharing helps me enrich my work					
KSO3	Knowledge sharing helps me improve my work performance					

Thank you so much for the cooperation!

ការសិក្សាអំពី

ការបង្កើតគំរូទំនាក់ទំនងសិក្សាអំពីសកម្មភាពចែករំលែកចំណេះដឹងនៅក្នុងគម្រោងសាងសង់

Development of Causal Relationship Model of Knowledge Sharing in Construction Projects

សេចក្តីសង្ខេប

ការចែករំលែកចំណេះដឹង រវាងវិស្វករក្នុងគម្រោងសាងសង់ គឺជារឿងដ៏សំខាន់សម្រាប់បង្កើនភាពជោគជ័យរបស់គម្រោង ស្ថេរភាពរបស់អង្គភាព ប្រសិទ្ធិភាពការងារ និងកាត់បន្ថយកំហុសដដែលៗ ក្នុងដំណើរការសាងសង់។ យ៉ាងណាមិញ នៅក្នុងការងារគ្រប់គ្រងគម្រោងសាងសង់ ភាពស្មុគស្មាញ ឬមួយបញ្ហា តែងតែវិវត្តន៍ និងកើតមានឥតឈប់ឈរ ដែលទាមទារអោយវិស្វករនៅក្នុងគម្រោង ត្រូវការសិក្សាស្វែងយល់អំពីការអនុវត្តន៍ល្អៗពីអ្នកដទៃ និងពីគម្រោងមុនៗ។ ការសិក្សាអំពីកត្តា នៃការចែករំលែកចំណេះដឹង គឺជាការសិក្សាដើម្បីជំរុញ និងបង្កើនសមត្ថភាពបុគ្គលិក ឬអាចនិយាយបានថា ជាការសិក្សាដើម្បីពង្រឹងធនធានមនុស្សនៅក្នុងអង្គភាពការងារ។ ទោះបីជាយ៉ាងណាក៏ដោយ ការប្រតិបត្តិនូវការចែករំលែកចំណេះដឹង គឺនៅតែមិនទាន់មានភាពល្អប្រសើរ ដោយសារតែកត្តាមនុស្ស និងការគាំទ្រពីអង្គភាពរបស់ពួកគេផងដែរ។ អាស្រ័យហេតុនេះ ការសិក្សាស្រាវជ្រាវនេះ គឺមានគោលដៅដើម្បីស្វែងរកកត្តាជាច្រើនទៀត ដូចជាកត្តាមនុស្ស កត្តាចិត្តសាស្ត្រ កត្តាអង្គភាព និងកត្តាបច្ចេកវិទ្យាជាដើម ដែលជះឥទ្ធិពលដ៏ខ្លាំងក្លាដល់ការប្រតិបត្តិនូវការចែករំលែកចំណេះដឹង ក៏ដូចជាបទពិសោធន៍ និងធ្វើការវាយតម្លៃលើកត្តាទាំងនោះ។

ផ្នែកទី១: ព័ត៌មានទូទៅ

សូមបញ្ជាក់អំពីព័ត៌មានទូទៅរបស់អ្នក ដោយគូសសញ្ញា (√) ក្នុងប្រអប់ណាមួយដូចខាងក្រោម៖

ភេទ: ☐ ប្រុស ☐ ស្រី

អាយុ: ☐ តិចជាង ២៥ឆ្នាំ ☐ ចាប់ពី ២៦-៣០ឆ្នាំ

☐ ចាប់ពី ៣១-៣៥ឆ្នាំ ☐ ចាប់ពី ៣៦-៤០ឆ្នាំ

☐ ចាប់ពី ៤០ឆ្នាំ ឡើងទៅ

កម្រិតវប្បធម៌: ☐ វិទ្យាល័យ ☐ បរិញ្ញាបត្ររង
☐ បរិញ្ញាបត្រ ☐ បរិញ្ញាបត្រជាន់ខ្ពស់
☐ បណ្ឌិត

តួនាទី: ☐ វិស្វករ ☐ វិស្វកររៀមច្បង
☐ ប្រធានការដ្ឋាន ☐ ប្រធានគម្រោង

បទពិសោធន៍ការងារ: ☐ ចាប់ពី ០-៥ ឆ្នាំ ☐ ចាប់ពី ៦-១០ ឆ្នាំ
☐ ចាប់ពី ១១-១៥ ឆ្នាំ ☐ ចាប់ពី ១៦ ឆ្នាំ ឡើងទៅ

ផ្នែកទី២: កម្រងសំណួរ

សូមគូសសញ្ញា (√) ដែលជាការឆ្លើយតបដ៏ល្អបំផុតចំពោះការប្រតិបត្តិនូវការចែករំលែកចំណេះដឹងក្នុងគម្រោងសាងសង់របស់អ្នក ដូចខាងក្រោម៖

មាត្រដ្ឋានវ៉ាស់	**១**	**២**	**៣**	**៤**	**៥**
	មិនយល់ស្របខ្លាំង	**មិនយល់ស្រប**	**មិនច្បាស់**	**យល់ស្រប**	**យល់ស្របខ្លាំង**

កត្តា	**មាត្រដ្ឋាន**				
	១	**២**	**៣**	**៤**	**៥**
អាកប្បកិរិយាចំពោះឥរិយាបថ (Attitude toward the behaviour)	-	-	-	-	-
1. ខ្ញុំគិតថាការចែករំលែកចំណេះដឹងជាមួយមិត្តរួមការងាររបស់ខ្ញុំ គឺល្អ					
2. ខ្ញុំគិតថាការចែករំលែកចំណេះដឹងរបស់ខ្ញុំជាមួយមិត្តរួមការងារ គឺមានប្រយោជន៍					
3. ខ្ញុំគិតថាការចែករំលែកចំណេះដឹងរបស់ខ្ញុំជាមួយមិត្តរួមការងារ គឺនាំទុក្ខទោស					
បទដ្ឋានអត្តនោម័តិ (Subjective norm)	-	-	-	-	-
4. វិស្វកររៀមច្បងរបស់ខ្ញុំគិតថា ខ្ញុំគួរតែចែករំលែកចំណេះដឹងជាមួយមិត្តរួមការងាររបស់ខ្ញុំ					
5. អ្នកគ្រប់គ្រងរបស់ខ្ញុំគិតថា ខ្ញុំគួរតែចែករំលែកចំណេះដឹងជាមួយមិត្តរួមការងាររបស់ខ្ញុំ					
ការទទួលនូវការត្រួតពិនិត្យឥរិយាបថ (Perceived behavioral control)	-	-	-	-	-

6. ខ្ញុំអាចចែករំលែកចំណេះដឹងជាមួយមិត្តរួមការងារបាន					
7. ការចែករំលែកចំណេះដឹងរបស់ខ្ញុំជាមួយមិត្តរួមការងារគឺស្ថិតនៅក្រោមការគ្រប់គ្រងរបស់ខ្ញុំ					
8. ខ្ញុំមានធនធានដើម្បីគាំពារការចែករំលែកចំណេះដឹងរបស់ខ្ញុំជាមួយមិត្តរួមការងារ (ឧទាហរណ៍៖ ឯកសារ ឬ សៀវភៅ)					
វប្បធម៌បុគ្គល (Individual culture)	-	-	-	-	-
9. អ្នកគ្រប់គ្រងធ្វើការសម្រេចចិត្តភាគច្រើនដោយមិនចាំបាច់ចែករំលែកគំនិតជាមួយនិយោជិត					
10. អ្នកគ្រប់គ្រងរំពឹងថានិយោជិតត្រូវធ្វើតាមការណែនាំ និងនីតិវិធីនានាដែលទាក់ទងនឹងការងាររបស់ពួកគេ					
11. អត្ថប្រយោជន៍នៃការងាររបស់និយោជិត គឺនីតិវិធីការងារដែលមានលក្ខណៈស្តង់ដារ					
12. បុគ្គលម្នាក់ៗដែលនៅជាក្រុមជាមួយគ្នាត្រូវតែលំបាកជាមួយគ្នា					
13. បុរសៗចែករំលែកចំណេះដឹង មានប្រសិទ្ធភាពខ្ពស់ជាងស្ត្រីៗ					
មតិយោបល់លើចំណេះដឹង (Knowledge feedback)	-	-	-	-	-
14. តាមរយៈការចែករំលែកចំណេះដឹងរបស់ខ្ញុំជាមួយមិត្តរួមការងារ កំហុសរបស់ខ្ញុំអាចធ្វើការកែតម្រូវបានពីសំណាក់ពួកគេ					
15. តាមរយៈការចែករំលែកចំណេះដឹងរបស់ខ្ញុំជាមួយមិត្តរួមការងារ ខ្ញុំអាចកែលម្អគំនិតរបស់ខ្ញុំដោយផ្អែកលើការឆ្លើយតបនិងយោបល់របស់ពួកគេ					
16. តាមរយៈការចែករំលែកចំណេះដឹងរបស់ខ្ញុំជាមួយមិត្តរួមការងារ ខ្ញុំអាចបង្កើតការយល់ដឹងថ្មីដោយផ្អែកលើការឆ្លើយតប និងយោបល់របស់ពួកគេ					
17. តាមរយៈការចែករំលែកចំណេះដឹងរបស់ខ្ញុំជាមួយមិត្តរួមការងារ ខ្ញុំអាចរៀនសូត្រអ្វីថ្មីៗពីការឆ្លើយតប និងយោបល់របស់ពួកគេ					
ការជម្រុញរបស់និយោជិត (Employee motivations)	-	-	-	-	-
18. នៅពេលខ្ញុំចែករំលែកចំណេះដឹងរបស់ខ្ញុំជាមួយមិត្តរួមការងារ ខ្ញុំជឿជាក់ថាការស្នើសុំ ចែករំលែកចំណេះដឹងនាពេលអនាគតនឹងមានការឆ្លើយតប					
19. ខ្ញុំមានទំនុកចិត្តលើសមត្ថភាពរបស់ខ្ញុំក្នុងការផ្តល់ចំណេះដឹងដែលអ្នកដទៃនៅក្នុង ស្ថាប័នចាត់ទុកថាមានតម្លៃ					

20. ខ្ញុំចូលចិត្តជួយមិត្តរួមការងារ ដោយការចែករំលែកចំណេះដឹងរបស់ខ្ញុំ					
21. នៅពេលដែលខ្ញុំចែករំលែកចំណេះដឹងជាមួយមិត្តរួមការងារ ពួកគេគោរពខ្ញុំ					
ការទទួលបានតម្លៃ និងការទទួលស្គាល់ (Perceived value and recognition)	-	-	-	-	-
22. មិត្តរួមការងារពេញចិត្តខ្ញុំចំពោះការចែករំលែកបទពិសោធន៍ជំនាញដែលទាក់ទងទៅនឹងការងាររបស់ខ្ញុំ					
23. ការទទួលស្គាល់លើការចែករំលែកបទពិសោធន៍របស់ខ្ញុំ បានជម្រុញឲ្យខ្ញុំបន្តចែករំលែកជាមួយអ្នកដទៃ					
24. មិត្តរួមការងារឲ្យតម្លៃខ្ពស់លើការចែករំលែកចំណេះដឹង គឺអាស្រ័យលើប្រភេទនៃចំណេះដឹង					
25. ការចែករំលែកចំណេះដឹងគឺត្រូវបានពង្រឹងដូចជាការសិក្សាដ៏មានតម្លៃ					
ទំនាក់ទំនងផ្ទាល់ខ្លួន (Personal relationship)	-	-	-	-	-
26. ខ្ញុំចែករំលែកទិន្នន័យ និងព័ត៌មានជាមួយមិត្តរួមការងារណាដែលយើងមានទំនាក់ទំនងយ៉ាងជិតស្និទ្ធ					
27. ខ្ញុំកម្របដិសេធសំណូមពររបស់មិត្តភក្តិខ្ញុំក្នុងការចែករំលែកគំនិតដែលទាក់ទងទៅនឹងការងារណាស់					
28. ចំពោះខ្ញុំ ការចែករំលែកចំណេះដឹងជាមួយមិត្តភក្តិជិតស្និទ្ធ គឺមិនអាចជៀសរួចទេ					
វប្បធម៌របស់ស្ថាប័ន (Organizational culture)	-	-	-	-	-
29. ការចែករំលែកចំណេះដឹងនៅក្នុងស្ថាប័នត្រូវបានគេពិចារណាលើរចនាសម្ព័ន្ធនិងប្រព័ន្ធ ព្រោះវប្បធម៌របស់ស្ថាប័ន គឺពឹងផ្អែកទៅលើការគ្រប់គ្រង និងអំណាច					
30. បរិយាកាសការងាររបស់ស្ថាប័នត្រូវមានភាពល្អឥតខ្ចោះសម្រាប់ការបង្កើតថ្មី និងភាពជាអ្នកដឹកនាំ ការផ្សងព្រេង ការប្រឈម ការច្នៃប្រឌិត និងការឆ្ពោះទៅរកលទ្ធផល					
ការគាំទ្រពីគណៈគ្រប់គ្រង (Management support)	-	-	-	-	-
31. អ្នកគ្រប់គ្រងតែងតែគាំទ្រ និងលើកទឹកចិត្តនិយោជិតឲ្យចែករំលែកចំណេះដឹងរបស់ពួកគេជាមួយមិត្តរួមការងារ					
32. អ្នកគ្រប់គ្រងផ្តល់នូវជំនួយ និងធនធានចាំបាច់បំផុតដើម្បីឲ្យនិយោជិត					

អាចចែករំលែកចំណេះដឹង					
33. អ្នកគ្រប់គ្រងអនុវត្តសកម្មភាពចែករំលែកចំណេះដឹងធ្វើជាគំរូ និងជាឧទាហរណ៍ឲ្យនិយោជិតមើល					
34. អ្នកគ្រប់គ្រងចង់ឃើញថានិយោជិតទាំងអស់រីករាយនឹងចែករំលែកចំណេះដឹងរបស់ពួកគេជាមួយមិត្តរួមការងារ					
រចនាសម្ព័ន្ធរបស់ស្ថាប័ន (Organizational structure)	-	-	-	-	-
35. មាននីតិវិធីដំណើរការស្តង់ដារក្នុងការទទួលភារកិច្ចការងារនៅក្នុងស្ថាប័នគម្រោងរបស់ខ្ញុំ					
36. មានក្បួនច្បាប់ការងារជាច្រើនចែងអំពីវិធីដោះស្រាយភារកិច្ចការងារនៅក្នុងស្ថាប័នគម្រោងរបស់ខ្ញុំ					
37. ស្ថាប័នគម្រោងរបស់ខ្ញុំធានាដល់ការចូលរួមរបស់និយោជិតក្នុងដំណើរការធ្វើសេចក្តីសម្រេចចិត្ត					
យុទ្ធសាស្ត្រ និងផែនការ (Strategy and planning)	-	-	-	-	-
38. នៅក្នុងគម្រោងរបស់ខ្ញុំ គឺមានកម្មវិធីបទដ្ឋានចែករំលែកចំណេះដឹង ឬបទបញ្ជាផ្សេងៗ					
39. នៅក្នុងគម្រោងរបស់ខ្ញុំ គឺមានវិធី និងមធ្យោបាយច្បាស់លាស់អំពីការចែករំលែកចំណេះដឹង					
ធនធាន (Resource)	-	-	-	-	-
40. នៅក្នុងស្ថាប័នគម្រោងរបស់ខ្ញុំ និយោជិតទាំងអស់មានឱកាសដូចគ្នាដើម្បីចែករំលែកចំណេះដឹងរបស់ពួកគេជាមួយមិត្តរួមការងារ					
41. ស្ថាប័នផ្តល់ជូនខ្ញុំនូវបន្ទប់ពិភាក្សា និងសម្ភារៈផ្សេងៗទៀតសម្រាប់ចែករំលែកចំណេះដឹងជាមួយមិត្តរួមការងារ					
42. និយោជិតអាចស្នើសុំធនធានណាមួយពីស្ថាប័នរបស់ពួកគេដើម្បីគាំពារដល់ការចែករំលែកចំណេះដឹងរបស់ពួកគេ					
ការប្រើប្រាស់បច្ចេកវិទ្យា ព័ត៌មាន និងសារគមនាគមន៍ (ICT support)	-	-	-	-	-
43. ICT អនុញ្ញាតិឲ្យខ្ញុំចែករំលែកចំណេះដឹងជាមួយមិត្តរួមការងារ					
44. ICT ជួយដល់ការចែករំលែកចំណេះដឹងឲ្យបានលឿនរហ័ស					
45. ICT បង្កើនប្រសិទ្ធភាពនៃការចែករំលែកចំណេះដឹង					
46. ICT ធ្វើឲ្យការចែករំលែកចំណេះដឹងកាន់តែមានភាពងាយស្រួល					
ឥរិយាបថចែករំលែកចំណេះដឹង (Knowledge sharing behaviour)	-	-	-	-	-
47. ខ្ញុំចែករំលែកជំនាញបច្ចេកទេសរបស់ខ្ញុំជាមួយមិត្តរួមការងារ					

48. ខ្ញុំចែករំលែកជំនាញគ្រប់គ្រងរបស់ខ្ញុំជាមួយមិត្តរួមការងារ					
49. ខ្ញុំចែករំលែកឯកសារផ្លូវការ ឬសៀវភៅផ្សេងៗជាមួយមិត្តរួមការងារ					
50. ខ្ញុំចែករំលែកចំណេះដឹងនៃគម្រោងជាមួយមិត្តរួមការងារ					
ដំណើរការចែករំលែកចំណេះដឹង (Knowledge sharing processes)	-	-	-	-	-
51. មានការបណ្តុះបណ្តាលជំនាញវិជ្ជាជីវៈយ៉ាងទៀងទាត់ ឬការរៀបចំការសិក្សានៅក្នុងស្ថាប័នគម្រោង					
52. មានការពិភាក្សាយ៉ាងទៀងទាត់ និងការចែករំលែកជំនាញសម្រាប់ការដោះស្រាយបញ្ហានៅក្នុងស្ថាប័នគម្រោង					
53. មានការទំនាក់ទំនងក្រៅផ្លូវការល្អជាមួយមិត្តរួមការងារសម្រាប់ការចែករំលែកចំណេះដឹង					
54. ជាធម្មតា និយោជិតចែករំលែកចំណេះដឹងរបស់ពួកគេជាមួយមិត្តរួមការងារនៅពេលដែលពួកគេបានរៀនអ្វីថ្មីៗ					
សមទ្ធិផលនៃការចែករំលែកចំណេះដឹង (Knowledge sharing outcomes)	-	-	-	-	-
55. ការចែករំលែកចំណេះដឹងជួយខ្ញុំកាត់បន្ថយកំហុសពេលធ្វើការងារ					
56. ការចែករំលែកចំណេះដឹងជួយឲ្យការងាររបស់ខ្ញុំមានការលូតលាស់					
57. ការចែករំលែកចំណេះដឹងជួយឲ្យខ្ញុំបង្កើនការអនុវត្តការងាររបស់ខ្ញុំ					

សូមថ្លែងអំណរគុណយ៉ាងជ្រាលជ្រៅបំផុត
ចំពោះកិច្ចសហប្រតិបត្តិការ

Appendix C : Preliminary Analysis

Missing Data

Variables	N	Mean	Std. Deviation	Missing Data	
				Count	Percent
Gender	319	1.09	.288	1	.3
Age	319	1.54	.738	1	.3
Education	317	3.25	.440	3	.9
Position	317	1.44	.875	3	.9
Experience	317	1.21	.510	3	.9
ATB1	320	4.21	.696	0	.0
ATB2	320	4.21	.646	0	.0
ATB3	318	2.24	1.168	2	.6
SN1	320	4.03	.719	0	.0
SN2	320	4.11	.618	0	.0
PBC1	320	4.08	.571	0	.0
PBC2	320	3.44	.948	0	.0
PBC3	319	3.86	.691	1	.3
IC1	319	2.70	1.051	1	.3
IC2	319	3.55	.849	1	.3
IC3	319	3.86	.708	1	.3
IC4	318	3.77	.834	2	.6
IC5	318	2.56	1.110	2	.6
KF1	320	4.02	.717	0	.0
KF2	318	4.04	.639	2	.6
KF3	317	4.09	.652	3	.9
KF4	316	4.12	.646	4	1.2
EM1	317	3.83	.694	3	.9
EM2	318	3.92	.594	2	.6
EM3	318	4.11	.594	2	.6
EM4	318	3.73	.785	2	.6
PVR1	316	3.90	.661	4	1.2
PVR2	316	3.99	.607	4	1.2
PVR3	317	3.69	.814	3	.9
PVR4	317	4.00	.677	3	.9
PR1	317	3.46	1.001	3	.9
PR2	318	3.83	.843	2	.6

Variables	N	Mean	Std. Deviation	Missing Data	
				Count	Count
PR3	318	3.83	.862	2	.6
OC1	317	3.32	.877	3	.9
OC2	316	3.56	.858	4	1.2
MS1	319	3.99	.687	1	.3
MS2	319	3.65	.778	1	.3
MS3	319	3.85	.717	1	.3
MS4	318	3.96	.729	2	.6
OS1	319	3.67	.714	1	.3
OS2	319	3.62	.783	1	.3
OS3	319	3.66	.735	1	.3
SP1	319	3.61	.794	1	.3
SP2	319	3.59	.823	1	.3
RES1	319	3.92	.711	1	.3
RES2	319	3.57	.840	1	.3
RES3	318	3.56	.860	2	.6
ICT1	319	3.93	.685	1	.3
ICT2	318	3.99	.676	2	.6
ICT3	319	3.95	.666	1	.3
ICT4	318	4.01	.676	2	.6
KSB1	319	4.08	.538	1	.3
KSB2	319	4.02	.593	1	.3
KSB3	319	3.84	.779	1	.3
KSB4	319	3.97	.621	1	.3
KSP1	320	3.54	.826	0	.0
KSP2	320	3.78	.791	0	.0
KSP3	320	3.87	.673	0	.0
KSP4	320	3.77	.760	0	.0
KSO1	320	4.10	.677	0	.0
KSO2	320	4.18	.586	0	.0
KSO3	320	4.16	.629	0	.0

Case of Missing Data

Cases	Missing Data	
	# Missing	% Missing
3	22	34.92
6	20	31.75
10	7	11.11
196	8	12.70
199	7	11.11
207	19	30.16
219	10	15.87

Multivariate Outliers

Observation number	Mahalanobis D^2	p1
112	**127.79**	**0.00**
251	**121.71**	**0.00**
197	**120.48**	**0.00**
215	**119.09**	**0.00**
151	**112.80**	**0.00**
174	**112.73**	**0.00**
144	**110.61**	**0.00**
202	**106.95**	**0.00**
176	**106.53**	**0.00**
55	**106.03**	**0.00**
127	**102.34**	**0.00**
227	**101.39**	**0.00**
160	**100.35**	**0.00**
241	**100.24**	**0.00**
179	99.42	0.00
300	99.09	0.00
89	95.47	0.00
170	94.97	0.00
273	94.45	0.00
248	94.09	0.00
67	92.90	0.00
4	92.73	0.00
71	91.11	0.00

Observation number	Mahalanobis D^2	p1
305	90.32	0.00
308	90.17	0.00
50	89.29	0.001
60	88.10	0.001
177	85.80	0.001
101	85.71	0.001
205	85.59	0.001
218	83.76	0.002
114	82.76	0.002
272	82.59	0.003
204	82.15	0.003
59	81.93	0.003
116	81.01	0.004
63	79.87	0.005
168	79.70	0.005
222	77.11	0.008
51	76.61	0.009
32	76.29	0.01
104	75.86	0.011
7	75.40	0.012
118	75.07	0.012
290	74.95	0.013
169	74.93	0.013
242	74.76	0.013
22	74.68	0.013
123	74.39	0.014
159	74.32	0.014
237	74.22	0.015
258	73.91	0.016
240	73.78	0.016
250	73.62	0.016
130	72.11	0.022
137	71.62	0.024
254	71.62	0.024
158	71.45	0.025
39	71.43	0.025
107	70.58	0.029
111	70.02	0.032
180	69.56	0.035

Observation number	Mahalanobis D^2	p1
287	68.89	0.039
74	68.88	0.039
57	68.61	0.041
8	68.56	0.042
26	67.18	0.053
28	66.84	0.056
219	66.59	0.058
1	66.55	0.059
265	66.31	0.061
142	66.16	0.063
276	66.10	0.063
298	65.76	0.067
200	65.75	0.067
61	64.73	0.079
96	64.57	0.081
15	64.01	0.088
64	63.77	0.091
77	63.50	0.095
233	63.42	0.096
29	63.21	0.099
296	63.04	0.102
207	62.80	0.106
208	62.76	0.106
286	62.39	0.112
173	62.27	0.114
138	62.15	0.116
249	61.30	0.131
31	61.14	0.134
88	61.10	0.135
195	61.05	0.136
187	60.12	0.155
24	59.78	0.162
56	59.60	0.166
10	59.58	0.166
92	59.51	0.168
239	59.04	0.179
255	59.00	0.18
12	58.93	0.181

Normality

Items	N	Mean	Std. Deviation	Skewness	Kurtosis
ATB1	299	4.21	.675	-.677	.868
ATB2	299	4.21	.635	-.608	1.168
SN1	299	4.03	.690	-.529	.643
SN2	299	4.10	.614	-.233	.323
PBC1	299	4.06	.561	-.324	1.568
PBC3	299	3.87	.677	-.810	1.715
IC1	299	2.68	1.035	.217	-.771
IC2	299	3.54	.828	-.616	-.064
IC3	299	3.84	.704	-.409	.296
IC4	299	3.76	.816	-.871	1.120
IC5	299	2.54	1.097	.417	-.627
KF2	299	4.05	.630	-.606	2.063
KF3	299	4.09	.636	-.707	2.336
KF4	299	4.13	.613	-.609	2.386
EM1	299	3.83	.670	-.400	.435
EM2	299	3.91	.581	-.302	.810
EM3	299	4.11	.577	-.216	.823
EM4	299	3.74	.763	-.386	.203
PVR1	299	3.90	.639	-.295	.407
PVR2	299	3.99	.591	-.490	1.558
PVR4	299	3.99	.658	-.701	1.915
PR1	299	3.46	.991	-.434	-.583
PR2	299	3.84	.799	-.855	1.214
PR3	299	3.82	.831	-.684	.492
OC1	299	3.34	.862	-.276	-.192
OC2	299	3.56	.847	-.674	.371
MS1	299	4.00	.673	-.802	2.441
MS2	299	3.64	.783	-.416	.276
MS3	299	3.85	.710	-.738	1.569
MS4	299	3.95	.722	-.845	1.862
OS1	299	3.66	.704	-.624	.618
OS2	299	3.62	.782	-.665	.413
OS3	299	3.66	.722	-.502	.424
SP1	299	3.59	.778	-.396	.001
SP2	299	3.58	.829	-.466	-.034
RES2	299	3.54	.832	-.521	-.104

Items	N	Mean	Std. Deviation	Skewness	Kurtosis
RES3	299	3.55	.836	-.647	.250
ICT1	299	3.95	.653	-.310	.362
ICT2	299	3.99	.675	-.379	.359
ICT3	299	3.96	.662	-.233	.080
ICT4	299	4.02	.655	-.309	.275
KSB1	299	4.07	.532	-.196	1.659
KSB2	299	4.02	.582	-.310	1.107
KSB4	299	3.99	.599	-.562	1.686
KSP1	299	3.53	.816	-.401	-.068
KSP2	299	3.77	.781	-.672	.295
KSP3	299	3.88	.653	-.607	1.069
KSO1	299	4.09	.664	-.729	1.527
KSO2	299	4.19	.556	-.074	.458
KSO3	299	4.15	.619	-.621	2.273

Appendix D: Measurement Model

Covariances

			Estimate	S.E.	C.R.	P	Label
ATB	<-->	SN	.135	.024	5.567	***	
ATB	<-->	PBC	.095	.019	5.151	***	
ATB	<-->	IC	.054	.020	2.654	.008	
ATB	<-->	KF	.139	.023	6.159	***	
ATB	<-->	EM	.111	.021	5.340	***	
ATB	<-->	PVR	.133	.021	6.288	***	
ATB	<-->	PR	.101	.024	4.221	***	
ATB	<-->	OC	.054	.024	2.296	.022	
ATB	<-->	MS	.107	.021	5.141	***	
ATB	<-->	OS	.082	.022	3.776	***	
ATB	<-->	SP	.058	.025	2.341	.019	
ATB	**<-->**	**RES**	**.032**	**.025**	**1.282**	**.200**	
ATB	<-->	ICT	.133	.022	6.129	***	
ATB	<-->	KSP	.115	.025	4.521	***	
ATB	<-->	KSB	.118	.019	6.241	***	
ATB	<-->	KSO	.140	.022	6.443	***	
PBC	<-->	SN	.112	.020	5.703	***	
IC	<-->	SN	.080	.023	3.414	***	
KF	<-->	SN	.137	.023	6.044	***	
EM	<-->	SN	.109	.021	5.227	***	
PVR	<-->	SN	.116	.020	5.730	***	
PR	<-->	SN	.062	.021	2.935	.003	
OC	<-->	SN	.060	.024	2.507	.012	
MS	<-->	SN	.132	.022	5.912	***	
OS	<-->	SN	.126	.024	5.326	***	
SP	<-->	SN	.130	.027	4.827	***	
RES	<-->	SN	.090	.026	3.398	***	
SN	<-->	ICT	.125	.022	5.819	***	
SN	<-->	KSP	.138	.027	5.189	***	
SN	<-->	KSB	.101	.018	5.506	***	
SN	<-->	KSO	.128	.022	5.923	***	
PBC	<-->	IC	.064	.018	3.479	***	
PBC	<-->	KF	.105	.018	5.881	***	

			Estimate	S.E.	C.R.	P	Label
PBC	<-->	EM	.105	.018	5.958	***	
PBC	<-->	PVR	.089	.016	5.633	***	
PBC	<-->	PR	.084	.019	4.344	***	
PBC	<-->	OC	.029	.018	1.659	.097	
PBC	<-->	MS	.070	.016	4.405	***	
PBC	<-->	OS	.086	.018	4.825	***	
PBC	<-->	SP	.088	.020	4.311	***	
PBC	<-->	RES	.055	.020	2.743	.006	
PBC	<-->	ICT	.109	.018	6.187	***	
PBC	<-->	KSP	.102	.021	4.958	***	
PBC	<-->	KSB	.099	.016	6.357	***	
PBC	<-->	KSO	.091	.017	5.482	***	
IC	<-->	KF	.067	.021	3.243	.001	
IC	<-->	EM	.080	.022	3.701	***	
IC	<-->	PVR	.063	.018	3.447	***	
IC	<-->	PR	.075	.023	3.229	.001	
IC	<-->	OC	.096	.028	3.412	***	
IC	<-->	MS	.053	.019	2.857	.004	
IC	<-->	OS	.083	.023	3.529	***	
IC	<-->	SP	.073	.025	2.947	.003	
IC	<-->	RES	.085	.027	3.176	.001	
IC	<-->	ICT	.063	.019	3.223	.001	
IC	<-->	KSP	.082	.025	3.268	.001	
IC	<-->	KSB	.064	.018	3.554	***	
IC	<-->	KSO	.051	.019	2.755	.006	
KF	<-->	EM	.130	.020	6.350	***	
KF	<-->	PVR	.121	.019	6.293	***	
KF	<-->	PR	.107	.023	4.610	***	
KF	<-->	OC	.091	.024	3.800	***	
KF	<-->	MS	.082	.018	4.412	***	
KF	<-->	OS	.099	.021	4.766	***	
KF	<-->	SP	.091	.024	3.855	***	
KF	<-->	RES	.070	.024	2.915	.004	
KF	<-->	ICT	.128	.020	6.395	***	
KF	<-->	KSP	.111	.023	4.746	***	
KF	<-->	KSB	.110	.017	6.353	***	
KF	<-->	KSO	.144	.020	7.077	***	
EM	<-->	PVR	.127	.020	6.411	***	
EM	<-->	PR	.122	.024	4.975	***	
EM	<-->	OC	.067	.021	3.156	.002	
EM	<-->	MS	.073	.017	4.208	***	

			Estimate	S.E.	C.R.	P	Label
EM	<-->	OS	.100	.020	5.000	***	
EM	<-->	SP	.086	.022	3.909	***	
EM	<-->	RES	.106	.024	4.477	***	
EM	<-->	ICT	.133	.020	6.549	***	
EM	<-->	KSP	.117	.023	5.112	***	
EM	<-->	KSB	.113	.017	6.492	***	
EM	<-->	KSO	.123	.019	6.348	***	
PVR	<-->	PR	.093	.020	4.542	***	
PVR	<-->	OC	.064	.019	3.295	***	
PVR	<-->	MS	.073	.016	4.528	***	
PVR	<-->	OS	.098	.019	5.247	***	
PVR	<-->	SP	.081	.020	4.009	***	
PVR	<-->	RES	.084	.021	4.006	***	
PVR	<-->	ICT	.120	.019	6.390	***	
PVR	<-->	KSP	.120	.022	5.482	***	
PVR	<-->	KSB	.086	.015	5.709	***	
PVR	<-->	KSO	.088	.017	5.298	***	
PR	<-->	OC	.042	.022	1.906	.057	
PR	<-->	MS	.057	.019	3.019	.003	
PR	<-->	OS	.094	.023	4.070	***	
PR	<-->	SP	.050	.023	2.150	.032	
PR	<-->	RES	.044	.024	1.848	.065	
PR	<-->	ICT	.122	.024	5.028	***	
PR	<-->	KSP	.080	.024	3.307	***	
PR	<-->	KSB	.066	.017	3.821	***	
PR	<-->	KSO	.087	.021	4.128	***	
OC	<-->	MS	.066	.022	3.034	.002	
OC	<-->	OS	.117	.027	4.314	***	
OC	<-->	SP	.142	.032	4.427	***	
OC	<-->	RES	.117	.031	3.735	***	
OC	<-->	ICT	.047	.021	2.288	.022	
OC	<-->	KSP	.073	.027	2.725	.006	
OC	<-->	KSB	.044	.018	2.417	.016	
OC	<-->	KSO	.045	.021	2.125	.034	
MS	<-->	OS	.121	.021	5.671	***	
MS	<-->	SP	.159	.026	6.195	***	
MS	<-->	RES	.156	.027	5.842	***	
MS	<-->	ICT	.096	.018	5.214	***	
MS	<-->	KSP	.181	.027	6.741	***	
MS	<-->	KSB	.094	.016	5.742	***	
MS	<-->	KSO	.085	.018	4.721	***	

			Estimate	S.E.	C.R.	P	Label
OS	<-->	SP	.205	.030	6.900	***	
OS	<-->	RES	.162	.029	5.610	***	
OS	<-->	ICT	.100	.020	5.027	***	
OS	<-->	KSP	.170	.028	6.142	***	
OS	<-->	KSB	.068	.017	4.079	***	
OS	<-->	KSO	.072	.019	3.702	***	
SP	<-->	RES	.248	.037	6.760	***	
SP	<-->	ICT	.088	.022	3.950	***	
SP	<-->	KSP	.234	.034	6.858	***	
SP	<-->	KSB	.100	.020	4.938	***	
SP	<-->	KSO	.049	.022	2.204	.028	
RES	<-->	ICT	.086	.023	3.711	***	
RES	<-->	KSP	.205	.034	6.024	***	
RES	<-->	KSB	.081	.020	3.984	***	
RES	<-->	KSO	.052	.023	2.238	.025	
ICT	<-->	KSP	.099	.022	4.477	***	
ICT	<-->	KSB	.088	.016	5.561	***	
ICT	<-->	KSO	.119	.019	6.293	***	
KSP	<-->	KSB	.114	.020	5.581	***	
KSP	<-->	KSO	.134	.024	5.674	***	
KSB	<-->	KSO	.091	.016	5.730	***	

Appendix E: Structural Model

Standardized Regression Weights

			Estimate	S.E.	C.R.	P	Label
KSB	<---	ATB	0.34	0.08	3.08	0	H3a
KSB	<---	SN	-0.12	0.1	-0.88	0.37	H3b
KSB	<---	PBC	0.74	0.32	2.82	0	H3c
KSB	<---	IC	0.08	0.11	0.71	0.46	H4a
KSB	<---	KF	0.10	0.08	0.95	0.33	H4b
KSB	<---	EM	0.37	0.16	2.14	0.04	H4c
KSB	<---	PVR	-0.35	0.19	-1.79	0.07	H4d
KSB	<---	PR	-0.29	0.11	-2.15	0.03	H4e
KSP	<---	OC	-0.07	0.1	-0.84	0.42	H5a
KSP	<---	MS	0.34	0.09	4.3	***	H5b
KSP	<---	OS	0.20	0.1	2.25	0.03	H5c
KSP	<---	SP	0.25	0.09	2.73	0.01	H5d
KSP	<---	RES	0.14	0.08	1.72	0.09	H5e
KSP	<---	ICT	0.07	0.08	1.13	0.24	H6
KSO	<---	KSB	0.46	0.09	6.29	***	H1
KSO	<---	KSP	0.22	0.06	2.92	0	H2

VITA

NAME	LAMBADA ROEUN
DATE OF BIRTH	23 December 1990
PLACE OF BIRTH	Pursat Province, Cambodia
INSTITUTIONS ATTENDED	Norton University
HOME ADDRESS	Sangkat Chaktomuk, Khan Daun Penh, Phnom Penh, Cambodia