

Research Article

A Study on Knowledge Sharing Behavior among IT Engineers: An Extended Theory of Planned Behavior

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With the rapid development of information technology (IT) and the advent of globalization, enterprises have entered the knowledge economy era. Thus, knowledge has become a power for future enterprises to win. In practice, the more actively the employees in the organization share knowledge, the more they can exert the value of knowledge. This study adopted the theory of planned behavior (TPB) as the basic theory in the research model. Besides, by reviewing previous studies on knowledge management and knowledge sharing (KS), we found nine exogenous variables and examined their relationships with KS attitude, subjective norm, and perceived behavior control. With a sample of 325 IT engineers in Vietnam, the study used Structural Equation Modeling (SEM) to test the hypotheses. The findings showed that the exogenous variables affecting KS attitude are expected relationship, expected loss, altruism, and task interdependence. The exogenous variables affecting the subjective norm are affect-based trust and task interdependence. An exogenous variable affecting perceived behavioral control is the adequacy of personal resources. In the relationships among endogenous variables in the TPB model, only the causal relationship of subjective norm influencing intention is not supported, and the rest of the causal relationships are supported. In the influence relationship between endogenous variables in the theoretical model of planned behavior, only the causal relationship of subjective norm influencing intention does not exist, and the rest of the causal relationships are established. Finally, findings can serve as references and suggestions for subsequent KS research in academic and practical aspects.

1. Introduction

Many enterprises, facing the pressure of industrial competition and globalization, are engaged in knowledge management activities and actively explore how knowledge management can be promoted within the company. Knowledge management comprises seven phases: creation, definition, collection, adoption, organization, utilization, and sharing [1]. Knowledge sharing (KS) is the most difficult of these activities [2], and, in practice, KS is the most critical and central issue in knowledge management. In other words, the most crucial point in implementing knowledge management is KS.

The importance of KS is because knowledge is different from other assets. After all, knowledge does not have the phenomenon of diminishing returns for general products. The more active sharing within the organization among

employees, the more valuable the knowledge can be. In addition, sharing knowledge leads to linear growth of both parties' information and experience (for example, Arthur Anderson's formula $K = (I + P)^S$. K is knowledge, I is information, $+$ is technology, P is people, and S is sharing) [3]. If you continue to exchange knowledge with others, feedback, and extend the problem, you will get exponentially growing information and experience. This exponential growth strategy has become a core capability and an increasing intangible asset for organizations. On the other hand, the current trend of globalization and internationalization has enhanced the necessity of communication and KS, and continuous and rapid learning is required at both the individual and the organizational levels [4].

However, about 94% of CEOs believe that personal knowledge should be shared within the organization [5]. However, in the logic of organizational and economic

thinking of “what is rare is precious,” it seems that people are accustomed to hoarding. Therefore, once the members of the organization regard knowledge and information as materialized assets, their reluctance to share them with their colleagues becomes more apparent [6].

The traditional organizational economy assumes that the organization’s members are concerned about the power and interests of individuals, and their work focuses on whether the final output can maximize personal interests [7]. Davenport and Prusak [8] argued that sharing knowledge is unnatural because people consider their knowledge a valuable and essential competing resource and therefore are unwilling to share it easily. Thus, asking individuals to share is equivalent to giving away some of themselves. It is common sense for individuals to hide their knowledge and doubt the knowledge of others, so it is pretty challenging to change common sense. Similarly, the most significant difficulty in promoting knowledge management in the United States and Europe is changing people’s behavior to share knowledge [9]. It is also the most significant difficulty that enterprises encounter in implementing knowledge management. Therefore, it is essential to understand the behavior of individual KS in promoting knowledge management.

In a knowledge-oriented society, the proportion of knowledge workers will be higher and higher [10]. IT engineers’ responsibilities are based on professional knowledge, performing maintenance, planning, and developing information systems. The value of their work depends on the creativity of professional expertise [11]. Due to the increasingly frequent use of information technology in business operations and the rapid changes in the technological environment, today’s IT engineers can no longer handle changes in information technology alone. IT engineers in different areas of expertise need to cooperate and share professional knowledge to respond to rapid information technology changes effectively. In other words, from the perspective of business operation, the higher the frequency of KS among IT engineers, the more the organization’s ability to deal with information problems will be increased. When members are willing to share knowledge, members of the organization will learn from each other and continuously enrich the knowledge in their brains and then improve work efficiency to achieve the performance required by the organization. Therefore, the target population is IT engineers. Understanding the management factors that influence how willing IT engineers are to communicate with each other and share knowledge is vital. Furthermore, IT engineers may be hesitant to share knowledge because Vietnamese culture is strongly influenced by Confucian values such as harmony, modesty, and respect for senior individuals. Besides social/emotional conflicts include the fear of losing face when sharing wrong knowledge (J. [12]). Hence, the study on Vietnamese IT engineers can make valuable scientific contributions to the existing literature.

Therefore, this study adopts the most widely used theory in social psychology to study human behavior: the theory of planned behavior (TPB) [13]. Many empirical studies showed that the TPB effectively predicts various behaviors in the real world. Therefore, this study uses the TPB to mea-

sure the KS behavior among IT engineers. Specifically, this study takes the TPB as the core part of the research model. Besides, we proposed the exogenous variables [14] corresponding to the internal variables in the TPB, such as beliefs and attitudes (expected reward, expected relationship, expected contribution, and expected loss), personality traits (altruism), situational variables (cognitive and affective trust), and job characteristics (job-task interdependence and personal resource adequacy). Combining with the relevant literature on KS to construct a comprehensive theoretical model of KS behavior of IT engineers, we can also understand those exogenous variables that affect attitudes, subjective norms, and perceived behavioral control of KS. Thus, the research questions are as follows: (1) Explore which core variable in the TPB model (attitude, subjective norm, and perceived behavioral control) has a more significant impact on KS intention. (2) Discuss the role of the subjective norm in the TPB model to influence the intention of KS through attitude. (3) Combine the literature on KS to construct a comprehensive theoretical model of KS behavior among IT engineers. It is also possible to understand which exogenous variables influence attitude, subjective norm, and perceived behavioral control of KS.

2. Theoretical Background

There are two research directions to explore the factors affecting KS behavior. One is to explore the leading factors of KS directly and the relationships between these leading factors and KS behavior [15, 16]. The other is to explain the influencing factors of KS behavior using a theory ([5, 17, 18]; Y. [19]). The first type is suitable for researching new fields because many factors cannot be integrated with no theoretical basis. Meanwhile, most second-type studies on the influencing factors used the theory of reasoned action (TRA) and the theory of planned behavior (TPB) as the theoretical background. However, recent studies showed that the explainability of the TPB is higher than that of the TRA [20, 21]. Therefore, this study would like to use TPB as the theoretical basis to explore the leading factors that affect KS behavior (Figure 1).

2.1. Theory of Planned Behavior. The intention model holds that the measure of behavioral intention is a state closer to the actual behavior than factors such as attitudes, beliefs, and feelings. In the intention model, the TRA is very important [21], highlighting that behavioral intention is the leading factor of behavior. However, although the TRA is a well-developed intention model, it does not have sufficient explanatory power for certain behaviors [20]. Therefore, the TPB was used in this study instead of the TRA. The TPB analyzes the formation process of behavioral patterns in three stages: (1) behavior is determined by the individual’s behavioral intention; (2) the behavioral intention is determined by the behavioral attitude, the subjective norm of the behavior, or perceived behavioral control; (3) attitude, subjective norm, and perceived behavioral control are determined by exogenous factors such as demographic variables,

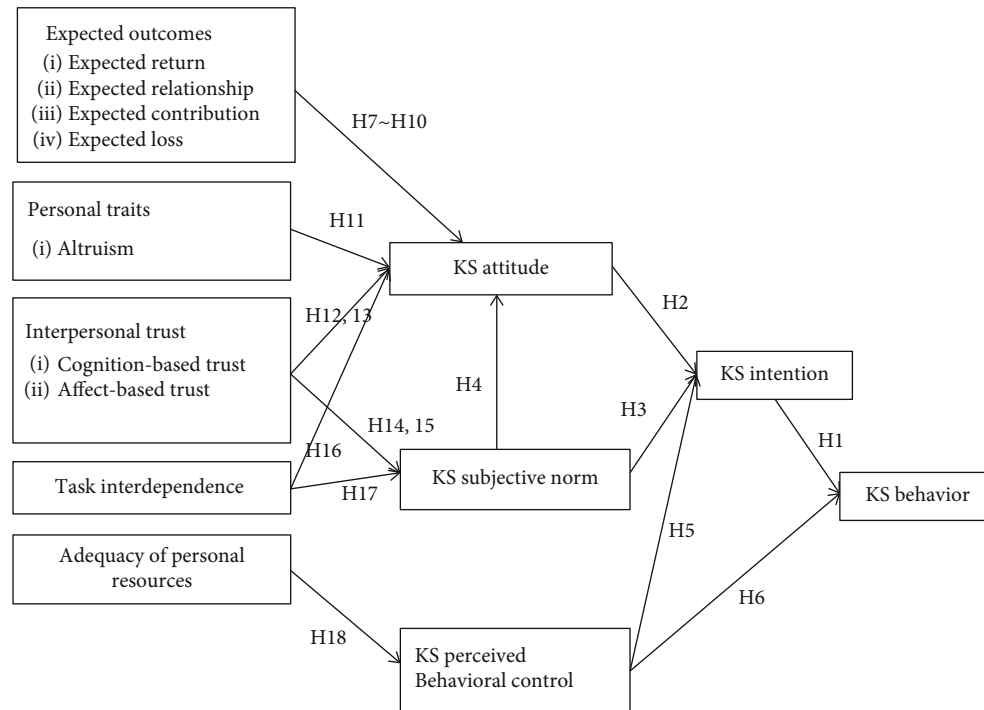


FIGURE 1: Conceptual model.

personality traits, beliefs about things, attitudes toward things, job characteristics, and situations.

2.1.1. KS Behavioral Intention. The TPB assumes that behavioral intentions affect actual behaviors. Previous findings showed a strong causal relationship between behavioral intention and actual behavior (S.-H. [22, 23]). Moreover, in Management Information Systems, the strong relationship between behavioral intention and actual behavior has been confirmed [24, 25]. Finally, in Bock and Kim [5], the TRA is used to explore KS behavior, and the findings also showed that behavior intentions directly affect actual behavior.

H1: The KS intention of IT engineers directly influences their KS behavior.

2.1.2. Behavioral Attitudes. In the TPB, an attitude is an individual's belief in an act and is an essential factor in determining intentional behavior. In empirical studies of Management Information Systems, users' attitudes toward system use affect their intention to use the system [26]. In related research on information KS, an individual's attitude toward behavior affects behavioral intention [5, 27]

H2: The KS attitude of IT engineers directly influences their KS intention.

2.1.3. Subjective Norm. According to Ajzen [13], one's subjective norm will be directly or indirectly affected by other individuals. For example, when the user's subjective norm of computer system users is more substantial, the intention to use the system is more significant [26]. In the related research on KS, Bock and Kim [5] found that personal subjective norms can affect behavioral intentions. Besides, previous studies of the TPB showed that the subjective norm

of behavior directly and positively affects behavioral attitude [28, 29].

H3: KS subjective norm of IT engineers directly influences their KS intention.

H4: KS subjective norm of IT engineers directly influences their KS attitude.

2.1.4. Perceived Behavioral Control. Perceived behavioral control represents the extent to which a person believes he/she can control the execution of behaviors [13]. According to the TPB, perceived behavioral control affects behavioral intention. However, it also directly affects actual behavior because even if a person wants to do something, he cannot do it without actual behavioral control [21]. Ryu et al. [30] studied KS behavior among doctors and found that perceived behavioral control directly affects behavioral intentions and actual behaviors.

H5: KS perceived behavioral control of IT engineers directly affects their KS intention.

H6: KS perceived behavioral control of IT engineers directly affects their KS behavior.

2.2. Exogenous Variables of KS Behavior. In KS-related studies, there are two directions: (1) technical aspect is how to design new technologies to facilitate KS among members of the organization, for example, knowledge management system; (2) what factors affect KS among members of an organization. Focusing on management, we aimed to explore the exogenous factors that affect individuals' decision-making behavior in KS. Therefore, based on the relevant studies on the factors that affected KS, this study proposed nine exogenous factors: expected outcome (expected return, expected relationship, expected contribution, and

expected loss), altruism, trust (cognition-based trust and affect-based trust), task interdependence, and adequacy of personal resources.

2.3. Expected Outcome. In the TPB model, one of the exogenous variables is a belief in things [21]. Behavioral attitudes are influenced by possible consequences of the behavior and the evaluation of the results of the behavior, which belongs to personal belief. In Bock and Kim [5], the exogenous variables influencing KS attitudes are expected return, expected relationship, and expected contribution. Besides, employees in the organization perceive that sharing knowledge with others poses a threat to themselves and their competitive advantage ([8]; H.-H. [31]). Therefore, if employees share knowledge with others, they can cause harm to themselves. Therefore, this study proposed expected loss as an exogenous variable. Expected outcomes thereby include personal gains and losses (expected return and expected loss), expected relationships with colleagues (expected relationship), and the relationship with the organization (expected contribution).

Behavioral attitudes are influenced by an individual's perception of the likely outcome and the evaluation of the outcome of the action [13]. The desired outcomes in this study include three levels: individuals themselves (expected return and expected loss), individuals and colleagues (expected relationships), and individuals and organizations (expected contribution). KS is a social interaction behavior among people, which can be explained by Economic Exchange Theory and Social Exchange Theory. According to Economic Exchange Theory, individual behavior is wholly based on the fact that they can get the greatest reward for themselves. Besides, for individuals to share their knowledge, the rewards must be greater than the costs they pay (H.-H. [31]). Previous studies indicated that the organization must be smart enough to create systems that can benefit individuals to encourage employees to share knowledge, such as reward systems, which are conducive to promoting KS within the organization [23]. Because sharing will bring rewards, it will motivate employees to share their knowledge and skills [32]. Davenport and Prusak [8] believed that the success of knowledge management is closely related to whether the company provides long-term incentives for employees. Rewards can be divided into two categories: (1) tangible rewards such as salary increases and promotion and (2) intangible rewards: increasing reputation and personal satisfaction. If employees believe that sharing knowledge will get tangible and intangible rewards, there will be more positive attitudes toward sharing knowledge [5]. Nguyen et al. [23] believed the reward system is vital in encouraging employees to share knowledge with colleagues.

H7: Expected return related to KS behavior directly affects IT engineers' KS attitude.

Social Exchange Theory is analogous to economic exchange relations. Social Exchange Theory explores the exchange of intangible social costs and benefits (e.g., respect, reputation, friendship, and concern). Economic Exchange Theory focuses on external benefits, while Social Exchange Theory focuses on internal rewards [33]. The main differ-

ence between economic and social exchange is that social exchange does not guarantee that the cost of investment will be paid the same because there are no clear rules and treaties to govern the interaction between the two parties. There are no specific rights and obligations. Therefore, employees will share knowledge with newcomers when they have good friendships with the newcomers or they have received help and feel obligated to reciprocate. If newcomers return in due time, they will prove trustworthy, and an exchange relationship will be established [5]. Therefore, building good interpersonal relationships is also an essential factor in determining KS. Expected relationships assume that if individuals believe that providing their knowledge will improve relationships with colleagues, they should have more positive attitudes toward KS.

H8: Expected relationship related to KS behavior directly influences IT engineers' KS attitude. Individuals believe sharing knowledge within an organization will improve organizational performance and affect individuals' KS attitudes [5]. In addition, employees pointed out the importance of feedback because the organization provides many resources for employees to use and prompts them to help the organization improve performance. Therefore, expecting an individual to contribute affects the KS attitude.

H9: Expected contribution related to KS behavior directly influences IT engineers' KS attitude.

However, employees widely sharing their knowledge with others will diminish the value of knowledge and then lose their advantages [8]. Besides, employees believe that knowledge is the source of power. Therefore, sharing knowledge with others will cause the loss of their power, which makes them unable to own resources and hinders individuals from promotion. Individual concern focuses on whether to maximize their interests [34]. Therefore, a personal loss will make an individual seriously consider sharing knowledge.

H10: Expected loss related to KS behavior directly influences IT engineers' KS attitude.

2.3.1. Personality Traits: Altruism. According to the TPB, personal traits are a significant exogenous factor and quite valuable for explaining individual behavior. This study proposed altruism as a personal trait. An individual with the personality trait of sharing will trust others easily, be willing to help others, and exchange information with others. Therefore, individuals with altruism will be positive, altruistic tendencies when sharing personal knowledge with others. Davenport and Prusak [8] argued that some people are born good and are willing to share knowledge with others without asking for any reward. An individual is possibly so passionate about his knowledge that he is ready to share it with others whether or not he has the opportunity. Whether for the good of the company or out of a willingness to help others, an individual will share knowledge more or less due to his passion for his profession and altruism. It is the helpful nature or altruistic behavior, which refers to the act of automatically helping others without the expectation of any form of reward in addition to feeling that a good deed has been done [8, 35].

Therefore, altruism will affect KS behavior, a kind of prosocial behavior.

H11: Altruistic tendency of IT engineers directly influences their KS attitude.

2.3.2. Interpersonal Trust. According to the TPB, one of the exogenous variables is contextual [21]. Deutsch [36] regarded trust as an individual's decision-making behavior in different situations; thus, the context variable in this study is interpersonal trust. For organizational members to share knowledge, they must be full of solid love, care, trust, and commitment to each other so that members of the organization can be induced to share knowledge [37]. If the two sides lack trust, they will hide information or knowledge from each other, and sharing will become impossible. Davenport and Prusak [8] believed that trust is essential in promoting knowledge transfer because the KS in an organization depends on whether the knowledge receiver is trustworthy. Therefore, trust will be at the heart of KS [38].

Trusts can be distinguished into different types. From the viewpoint of Social Exchange Theory, trust can be divided into cognition-based trust and affect-based trust [39]. The current study mainly focuses on KS. KS is a kind of exchange behavior among members and a social interaction behavior among people. Therefore, this study adopts the viewpoint of social exchange and divides trust into cognition-based and affect-based trust [39].

Cognition-based trust is based on trustworthiness and reliability. Affect-based trust emphasizes the emotional connection of individuals in the trust relationship [39], expresses concern for the other party, and pays attention to the intrinsic value of the trust relationship. In the process of interaction, the feeling of interpersonal care is also significant for establishing affect-based trust [2]. Trust is viewed as one of the attitude beliefs in the TPB, and trust in others directly affects behavioral attitudes [40, 41].

H12: Cognition-based trust of IT engineers directly influences their KS attitude.

H13: Affect-based trust of IT engineers directly influences their KS attitude.

Trust is based on information obtained from past interactions between the two parties, and it is also a process involving the interaction between the two parties. Therefore, I trust my colleagues in the organization, and they will agree with or support my KS [42]. In addition, the connotation of trust has the characteristic of dependence, and the generation of trust needs to be based on the interdependencies between two parties.

H14: Cognition-based trust of IT engineers directly influences their KS subjective norm.

H15: Affect-based trust of IT engineers directly influences their KS subjective norm.

2.3.3. Task Interdependence. In the TPB model, one of the exogenous variables is the work characteristic [21]. In this study, we proposed work-task interdependence. Nelson and Coopridge [43] indicated that the factors that affect KS are trust and interinfluence. However, interdependence and interinfluence are two sides of the same coin, and there is a

positive relationship between interdependence and interinfluence. If team members have a common goal, they often rely on each other to achieve the goal [44]. If one's work task has a close relationship with others and requires frequent communication, the sharing behavior in the whole process will increase [45]. Therefore, the degree of interdependence of work tasks will affect the KS behavior. In an organization, the degree of interdependence between colleagues in work tasks will increase the number of communication, and people will be more willing to share their knowledge [44].

H16: Task interdependence of IT engineers directly influences their KS attitude.

H17: Task interdependence of IT engineers directly influences their KS subjective norm.

2.3.4. Adequacy of Personal Resources. KS behavior must be accompanied by sufficient resources, such as time and space, between knowledge providers and knowledge-demanders to exploit the benefits of KS fully. Davenport and Prusak [8] indicated that a lack of time and resources could affect the KS within the organization. Ajzen and Madden [21] argued that perceived behavioral control represents the extent to which a person believes he/she can control the execution of behaviors. However, engaging in a particular behavior must also depend on whether an individual has enough knowledge, time, and ability to decide whether he has confidence and control. If the individual has enough time, skills, and knowledge, he has considerable control over whether or not he wants to engage in KS behavior [46].

H18: Adequacy of personal resources of IT engineers directly influences their perceived behavioral control over KS behavior.

3. Method

3.1. Participants. This study is aimed at understanding how members of an organization are willing to share knowledge. This study's target participants are IT engineers with working experience in IT companies or departments with various positions such as heads of information departments, project managers, systems analysts, systems engineers, database managers, programmers. They all have professional knowledge in information technology. A common problem within organizations is that professional staff have significant barriers to KS. Most professionals are reluctant to share their most important intellectual assets with others. As a result, the knowledge within the organization cannot be transferred and optimally utilized and configured. Because IT engineers' work is creative and technically intensive, it often requires collaborative development of projects and intensive communication, and thus, KS is necessary during the development process [43]. Therefore, understanding the factors that affect how willing IT engineers are to communicate and share knowledge becomes even more critical.

3.2. Research Design and Procedures. The measurement items for all the constructs in this study are based on previous studies. The measurement scale adopts the Likert 7-point scale, and the participants answer their degree of

agreement with the range from 1: strongly disagree to 7: strongly agree. A pilot test was conducted to revise the questionnaire's content to avoid ambiguous words and inappropriate questioning methods and improve the questionnaire's content validity [47]. This questionnaire was tested by IT students in a university in Vietnam for one week. The test was conducted in an open-ended manner. A total of 50 participants went to the classroom to fill in paper questionnaires in person.

The reliability analysis was carried out using the Cronbach alpha value of the internal consistency method. The results showed that the Cronbach alpha is greater than 7 for all the constructs, ranging from 0.7107 to 0.9585 (>0.7), which indicates good internal consistency [48].

This study mainly explores the KS behavior among IT engineers in Ho Chi Minh City, Vietnam. The process of delivering the questionnaire in this study is two-stage. In the first stage, the willingness to fill in the questionnaire was determined through a telephone interview to increase the recovery rate. In the second stage, the questionnaire was sent by mail according to the address provided by the respondents. IT employees of 26 companies (including 16 information-related companies and 10 non-information-related companies) were willing to complete the questionnaire. All the participants must have experience working in information departments/companies. A total of 460 questionnaires were sent out to 24 companies, and 349 were returned, with a recovery rate of 76%. For the screening procedure, the questionnaires with missing values or with all the items filled in the same option (for example, all are checked strongly disagree or strongly agree) were considered invalid questionnaires. After deducting 24 invalid questionnaires, a total of 325 valid questionnaires remained.

3.3. Constructs' Definitions and Measures

3.3.1. KS Behavior. A measure of the actual KS behavior of IT engineers is the extent to which individuals provide knowledge of various styles. Because exact data cannot be obtained, we conducted a self-report study. The study used the scale items by Bock and Kim [5] with a total of seven items: (1) documents, manuals, reports, and other documents; (2) best practices within the enterprise; (3) knowledge gained from the mass media; (4) where the knowledge is (5) who knows; (6) his own work experience; and (7) knowledge acquired from training courses.

3.3.2. KS Intention. Behavioral intention refers to the subjective probability that an individual wants to engage in a specific behavior [21], that is, to measure the degree to which an individual intends to perform a particular behavior. Therefore, KS intention in this study is defined as follows: "the subjective probability that IT engineers will engage in KS behavior." There are a total of three items developed by Ajzen [49]. For example, I am often willing to try or plan to provide my knowledge to colleagues in need in the organization.

3.3.3. KS Attitude. Individuals' attitudes toward actions are determined by their preferences for the consequences of

actions [21]. Therefore, the KS attitude in this study is defined as follows: "how much positive or negative evaluation does IT engineers have about KS behavior." There are four items developed by Ajzen [49]. For example, I think KS is good, pleasant, valuable, and beneficial.

3.3.4. KS Subject Norm. A subjective norm is defined as a measure of the pressure individuals feel when they engage in a specific behavior [21]. Therefore, a subjective norm of KS behavior in this study is defined as follows: when information engineers share knowledge, they feel the pressure of supervisors and colleagues. There are six items developed by Ajzen [49]. For example, supervisors/colleagues will approve or like my KS behavior.

3.3.5. KS Perceived Behavioral Control. Perceived behavioral control is measured by two dimensions: (1) perceived self-efficacy, that is, understanding the ease and difficulty of individuals in sharing knowledge and (2) perceived control ability, which is the degree to which individuals are aware of whether they have voluntary control or decide to share knowledge [21]. There are four items developed by Ajzen [49]. Each dimension has two scale items. For example, I can give my knowledge to my colleagues in the organization. Or in an organization, I believe that I can decide whether I want to provide my knowledge to my colleagues.

3.3.6. Expected Return. Expected return is the belief that individuals believe sharing knowledge with others will get the returns they deserve [5]. Expected returns are divided into two types: (1) tangible returns such as bonuses or promotions and (2) intangible returns such as increasing personal reputation or winning the respect of colleagues. Return in this study refers to a tangible one. There are three scale items by Bock and Kim [5] to measure tangible returns; for example, by providing knowledge to other colleagues, the organization will give substantial bonuses, promotions, or good performance appraisal.

3.3.7. Expected Relationship. According to Bock and Kim [5], the expected relationship is the belief that individuals believe that sharing knowledge with others will improve their relationship with colleagues. There are five items developed by Bock and Kim [5]. For example, providing my knowledge to those in need in the organization (1) will strengthen my relationship with colleagues, (2) will allow me to gain a better understanding of unfamiliar colleagues, and (3) will allow me to expand my relationship network.

3.3.8. Expected Contribution. Expected contribution is the belief that individuals believe that sharing knowledge with others will improve the performance of the organization's operations [5]. There are five items developed by Bock and Kim [5]. For example, providing knowledge to those in need in the organization will effectively help the organization (1) create new business opportunities, (2) improve work processes, (3) increase productivity, and (4) achieve desired goals.

3.3.9. Expected Loss. Employees in general organizations will reduce the value of knowledge and lose their advantages if they share their knowledge widely with others [8]. Therefore, this study designed five scale items to measure expected loss, which is defined as an individual's loss due to sharing knowledge with colleagues, for example, reducing one's competitiveness, losing expert power, and affecting one's job security.

3.3.10. Altruism. Altruism is a personal trait that is not easy to change, like helping others without asking for returns [35]. Altruistic behavior is defined as self-sacrificing and oriented behavior for the benefit of others and helping others because of the needs of others [50]. Therefore, altruism is defined in this study as "individuals naturally like to help others without expecting anything in return." There are ten scale items developed by Kopfman and Smith [50]. For example, "I can help others," "I like to benefit others," "I agree that it is more blessed to give than to receive," and "Helping others is an important part of my life."

3.3.11. Interpersonal Trust. Interpersonal trust is divided into cognition-based trust and affect-based trust [39]. There are ten scale items developed by McAllister [51], five items for each dimension. For example, "I believe that colleagues can assist each other in performing their work," "I have no doubts about each other's ability based on the experience of working with colleagues," and "I believe that colleagues can freely share each other's thoughts and feelings."

3.3.12. Task Interdependence. Task interdependence refers to the degree of interdependence between an individual's work tasks and colleagues [44]. There are four scale items developed by Staples and Jarvenpaa [52]. For example, "My work often needs the assistance of other colleagues to complete," "My work often needs to exchange some information with other colleagues," "My work often uses the information of other colleagues," and "My work results need to rely on the efforts of other colleagues."

3.3.13. Adequacy of Personal Resources. Conventional measures of perceived behavioral control represent the degree to which an individual believes he can control the execution of behaviors [21], which is determined by three factors: ability, resources, and opportunity. Also, the performance of a behavior is not only determined by a person's motivation but also includes some nonmotivation factors, such as time, skills, and personal knowledge. Therefore, three scale items [13] are used to measure the degree of resource cooperation. For example, I think I have enough "communication skills, time, valuable knowledge" to supply people in need in the organization.

4. Results

4.1. Descriptive Statistics. In this study, 325 valid questionnaires were recovered. The questionnaire contains basic information in 4 categories: gender, age, education level, and years of working experience. In terms of gender, male = 250 (42.69%) and female = 75 (57.31%). In terms of age,

ranging from 23-54 years old, most of the participants are 26-36 (60%), 28-30 (25%), and others (15%). In terms of educational level, master and above = 60 (18.4%), bachelor 264 (81%), and the others (0.6%). In terms of working years, 1-5 years and more than ten years account for 108 (33.5%) and 105 (32.3%), respectively, under one year is 10 (0.03%), and 6-10 years is 102 (34.17%).

4.2. Reliability and Validity Analysis. In terms of reliability, this study used the internal consistency method to test the reliability of the questionnaire. Cronbach's alpha measures internal consistency. The study's Cronbach's value for each dimension in the questionnaire ranged from 0.95 to 0.75 (>0.7), indicating good reliability [48] (Table 1).

In terms of validity, convergent and discriminatory validity are regarded as the two most crucial validity testing items [53]. In terms of validity, confirmatory factor analysis (CFA) was used to test the degree to which all measurement items are consistent with each other. Since the number of scale items in this study is 65, compared to the sample size of only 325, it is impossible to incorporate all measurement items into the same measurement model. If the full model is used to estimate the validity, the required sample must be about 2112 ($65 * 65/2$), or the number of samples should be ten times the number of items as the standard [54]. Therefore, this study adopts the analysis method of limited information and divides the research model into several smaller measurement models [55], such as exogenous and endogenous variables, to ensure that the validity analysis is sufficient factor stability.

4.2.1. Convergent Validity. According to Fornell and Larcker [56], there are three criteria for evaluating validity. (1) All standardized factor loadings should be greater than 5 and reach a significant level ($p < 0.05$ or $p < 0.01$). In terms of endogenous variables, the standardized factor loadings ranged from 0.49 to 0.99 with $p < 0.001$; in terms of exogenous variables, the standardized factor loadings ranged from 0.43 to 0.99 with $p < 0.001$. (2) The composite reliability (CR) value should be greater than 0.8. In terms of endogenous variables, the CR value was between 0.81 and 0.93; in terms of exogenous variables, the CR value was between 0.72 and 0.96. (3) Average Variance Extracted (AVE) should be greater than 0.5. Regarding exogenous variables, the AVE value is between 0.5 and 0.93; the CR value is between 0.61 and 0.96. Additionally, in terms of endogenous variables, the model fit index is as follows: $\chi^2 = 717.44$, $df = 238$, $\chi^2/df = 2.9$, $GFI = 0.84$, $NFI = 0.86$, $CFI = 0.90$, $IFI = 0.90$, and $RMR = 0.086$. As for exogenous variables, the model fit index is as follows: $\chi^2 = 2031.96$, $df = 885$, $\chi^2/df = 2.33$, $GFI = 0.81$, $NFI = 0.82$, $NNFI = 0.88$, $CFI = 0.89$, $IFI = 0.89$, and $RMSEA = 0.061$. Therefore, the questionnaire has good convergent validity.

4.2.2. Discriminant Validity. To ensure that the latent variables in this study can be effectively distinguished and have sufficient discriminant validity, we used the square root of AVE to explore the degree of dissimilarity between each latent variable and other potential variables. Tables 2 and 3

TABLE 1: Reliability analysis.

Constructs	Cronbach's alpha	Constructs	Cronbach's alpha
KS behavior	0.82	Expected contribution	0.90
KS intention	0.84	Expected loss	0.94
KS attitude	0.91	Altruism	0.84
KS subjective norm	0.92	Cognition-based trust	0.87
KS perceived behavioral control	0.85	Affect-based trust	0.85
Expected return	0.91	Task interdependence	0.91
Expected relationship	0.92	Adequacy of personal resources	0.74

TABLE 2: Correlation analysis among endogenous variables.

	Mean	SD	KS behavior	KS intention	KS attitude	Subjective norm of KS
KS behavior	4.12	0.92				
KS intention	5.50	0.94	.344**			
KS attitude	6.05	0.82	.180**	.634**		
KS subjective norm	5.65	0.95	.138*	.426**	.495**	
KS perceived behavioral control	5.55	0.97	.198**	.363**	.350**	.357**

AVE: KS behavior = .05; KS intention = .86, KS attitude = .93; subjective norm = .80; perceived behavioral control = .76. * $p < .05$; ** $p < .01$.

TABLE 3: Correlation analysis among exogenous variables.

	Mean	SD	ER	ES	EC	EL	AL	TI	CT	AT
ER	.341	1.44								
ES	5.70	0.84	.238**							
EC	5.30	0.96	.315**	.638**						
EL	2.95	0.13	.015	-.144**	-.007					
AL	5.45	0.76	.128*	.437**	.438**	-.238**				
TI	4.76	1.21	.223**	.313**	.295**	-.098	.195**			
CT	4.96	0.97	.353**	.345**	.388**	-.192**	.373**	.364**		
AT	4.92	0.87	.326**	.453**	.452**	-.145**	.428**	.284**	.585**	
PR	4.64	0.91	.175**	.295**	.338**	-.074	.385**	.019	.191**	.346**

AVE: ER = .93; ES = .93; EC = .85; EL = .95; AL = .61; TI = .88; CT = .76; AT = .68; PR = .60. * $p < .05$; ** $p < .01$. Note: ER: expected return; ES: expected relationship; EC: expected contribution; EL: expected loss; AL: altruism; TI: task interdependence; CT: cognition-based trust; AT: affect-based trust; PR: adequacy of personal resources.

show that the square root of the AVE of each variable is greater than the correlation coefficient with other potential variables. Thus, all latent variables have sufficient discriminant validity [54].

4.3. *Hypothesis Testing.* This study used Structural Equation Modeling (SEM) for hypothesis testing (Figure 2). Since there are too many items to be estimated in this research model, the number of samples in this research cannot be used to test the full model. The limited information approach and the model were reduced (Sethirraer, 9). Based on the AMOS analysis results, the model fit index is in line with the standard values (Har et al. (1998)), for example, $\chi^2/df = 1.80 (<3)$, NFI = 0.91(>0.9), CFI = 0.95(>0.9), IFI = 0.95(>0.9), GFI = 0.89(>0.8), and RMSEA = 0.06 (0.05 to 0.08), indicating that the measurement model has a good

model fit. Therefore, further understanding of the substantive relationship between the variables is possible.

4.4. *The Relationships between Endogenous Variables.* KS behavior is directly and positively influenced by individuals' KS intention and perceived behavioral control over KS, and the influence of KS intention ($r = 0.26$) is greater than that of perceived behavioral control ($r = 0.19$). Therefore, Hypothesis 1 and Hypothesis 6 are supported and consistent with the relationships in the TPB [21].

KS intention is directly and positively influenced by KS attitude and perceived behavioral control over KS. The influence of KS attitude ($r = 0.57$) is more significant than perceived behavioral control over KS ($r = 0.25$). The impact of the KS subjective norm on KS intention is statistically insignificant, which is inconsistent with past research [5].

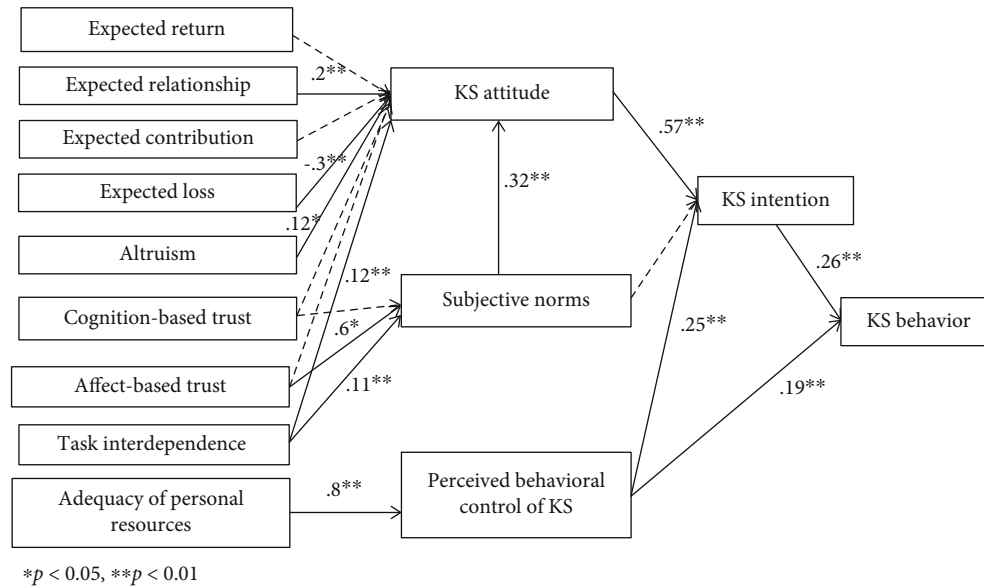


FIGURE 2: Structural equation modeling.

Therefore, Hypothesis 2 and Hypothesis 5 are supported and consistent with the relationships in the TPB [21]. However, Hypothesis 3 is not supported. Hsu and Kuo [57] used the TPB model to research information ethics and revised the TPB model to delete the causal relationship between subjective norm and intention. The finding showed that subjective norm affects intention through attitude.

Subjective norm of KS directly and positively influences KS attitude ($r = 0.32$). Therefore, Hypothesis 4 is supported. After sorting out the relationships between Hypothesis 2, Hypothesis 3, and Hypothesis 4, we can see that the KS subjective norm indirectly influences KS intention through KS attitude. The finding is consistent with Hsiao and Tseng [26], Hsu and Kuo [57], and Mousa et al. [29].

4.5. Influence of Exogenous Variables on TPB. Five variables directly influence KS attitude. According to the degree of influence on KS attitude, they are ranked as expected loss ($r = -0.3$), expected relationship ($r = 0.2$), altruism ($r = 0.12$), and task interdependence ($r = 0.12$). The findings indicated that when individuals want to engage in KS behaviors, they will first consider whether engaging in KS behaviors will cause loss to themselves. Secondly, they will consider whether engaging in KS behaviors will improve their relationship with others and establish a good contact network. Finally, they will consider personal traits and tasks at the end. In contrast, expected return, contribution, cognition-based trust, and affect-based trust do not directly affect KS attitude. Thus, Hypothesis 8, Hypothesis 10, Hypothesis 11, and Hypothesis 16 are supported; Hypothesis 7, Hypothesis 9, Hypothesis 12, and Hypothesis 13 are not supported.

Two variables directly influence KS subjective norms. According to the degree of influence, they are ranked as affect-based trust ($r = 0.6$) and task interdependence ($r = 0.11$). In addition, cognition-based trust does not directly affect KS subjective norm. Therefore, Hypothesis

15 and Hypothesis 17 are supported, but Hypothesis 14 is not supported.

The variable that directly affects perceived behavioral control over KS is the adequacy of personal resources ($r = 0.8$), which means that the availability of their resources influences an individual's confidence and control over engaging in KS behavior.

Finally, according to the standardized coefficients between the variables, each variable's direct and indirect effect on KS behavior can be calculated (Table 4). By that, we can compare the effects of both endogenous and exogenous variables on KS behavior. According to the total effect of all the variables affecting KS behavior, the most influential variable is KS intention, then KS perceived behavior control, adequacy of personal resources, KS attitude, KS subjective norm, expected loss, expected relationship, affect-based trust, task interdependence, and altruism. Thus, KS intention and perceived behavior control are dominant factors of KS behavior.

5. Discussions

According to the findings of this study, KS behavior of IT engineers is directly affected by KS intention and perceived behavioral control over KS, among which the influence of KS intention is the largest, followed by perceived behavioral control over KS. Therefore, if IT engineers are more willing to share knowledge, there will be a higher probability of actual sharing behavior. Consequently, they will engage in KS behavior. The findings are consistent with Nguyen et al. [23] and Han et al. [22], highlighting that the relationship between behavioral intention and behavior is constant, and the role of perceived behavioral control over behavior is essential.

KS intention of IT engineers is directly and positively influenced by KS attitude and the perceived behavioral control over KS. Among them, KS attitude has the most

TABLE 4: The effect of each variable on KS behavior.

Variables	Direct effect	Indirect effect	Total effect
KS intention	.26	None	.26
KS attitude	None	$0.57 * 0.26 =$	0.148
KS subjective norm	None	$0.32 * 0.57 * 0.26 =$	0.047
KS perceived behavioral control	None	$0.25 * 0.26 + 0.19$	0.25
Expected return	None	None	None
Expected relationship	None	$0.2 * 0.57 * 0.26 =$	0.029
Expected contribution	None	None	None
Expected loss	None	$-0.3 * 0.57 * 0.26 =$	-0.044
Altruism	None	$0.12 * 0.57 * 0.26 =$	0.017
Cognition-based trust	None	None	None
Affect-based trust	None	$0.6 * 0.32 * 0.57 * 0.26 =$	0.028
Task interdependence	None	$0.12 * 0.57 * 0.26 + 0.11 * 0.32 * 0.57 * 0.26 =$	0.023
Adequacy of personal resources	None	$0.8 * 0.25 * 0.26 + 0.8 * 0.19 =$	0.204

significant influence, followed by perceived behavioral control of KS. Therefore, IT engineers think that the inner feelings of sharing knowledge with colleagues are pleasant and valuable; individuals will have higher sharing intentions and confidence and control, which will also promote the willingness to share. The findings are consistent with Hsiao and Tseng [26] and Seba et al. [27], pointing out that the influence of subjective norms on intention is less than that of attitude and perceived behavioral control. Knowledge is a resource deeply rooted in people's minds; therefore, KS should be led by guidance rather than strong dominance [5]. In addition, the relationship between KS subjective norms and KS intention is not statistically significant. The possible explanation is that KS subjective norm indirectly influences KS intention through KS attitude. This result is consistent with the revised TPB model [28, 58].

KS subjective norm directly and positively influences KS attitude. KS subjective norm then indirectly affects KS intention through KS attitude [59], which means that if supervisors or colleagues like or agree with KS behavior, it will affect their KS attitude, such as having a good and pleasant inner feeling. Therefore, the findings showed that the KS attitude, subjective norm, and perceived behavioral control are interdependent [60]. Furthermore, the empirical result in this study indicated that KS subjective norm serves as an external variable.

To sum up, behavioral intention still has a certain degree of explanatory power for actual behaviors. In addition, behavioral attitude has a strong influence on behavioral intention. The subjective norm should be regarded as an external variable in the TPB model. Finally, perceived behavioral control also plays an essential role in the model of KS behavior.

Exogenous variables affecting KS attitude are expected relationship, loss, altruism, and task interdependence. Among them, the influence of expected loss is the largest, followed by expected relationship, altruism, and task interdependence have the same impact. Expected relationship affects KS attitude, which means that if IT employees share

their knowledge with colleagues, they will improve or expand their relationships, and their KS attitude will be positive. This relationship shows that social exchange relationships can manifest in helping behaviors, and KS behavior is much like organizational citizenship behaviors, which can be used to cultivate social exchange relationships [61].

When the relationship between expected loss and attitude is established, it means that if they share their knowledge with colleagues, they will reduce their competitiveness in the workplace and affect their negative inner feelings about KS [8]. This relationship shows that individuals will show self-protection awareness about sharing their knowledge [62]. If individuals think sharing knowledge will damage their power or benefits, the self-protection mechanism will be activated.

When the relationship between altruism and KS attitude is established, employees' willingness to help others directly affects their KS attitude. Therefore, personal traits still influence individual behavior, just as Davenport and Prusak [8] stated that some people are naturally good people and like to help others, so they tend to have a positive attitude to KS behavior. In addition, the findings are similar to Wu [31] stated that if individuals tend to be self-interested, their attitudes toward KS behaviors will be negative.

When the relationship between task interdependence and KS attitude is established, it means that the help and cooperation of other colleagues are often needed at work, which will affect one's attitude towards KS. Therefore, the higher the degree of interdependence at work, the more positive IT employees will have KS attitude. Because only by sharing what each other knows can we do our job well, and work performance will be better. Thus, working as a team in an organization will improve the sharing effect [44, 63].

In addition, the effect of other factors on KS attitude cannot reach a statistically significant impact, such as expected return, expected contribution, cognition-based trust, and affect-based trust. The possible explanations are as follows:

In terms of expected return, the possible reasons why expected return does not affect KS attitude include the following: the mean of expected return is 3.42, which shows that IT employees do not expect to get a due return by sharing knowledge. It is because, in the actual organization, employees do not think sharing knowledge can get actual rewards. In the real environment, the organization will not provide rewards at all; therefore, employees do not expect to get rewards when sharing knowledge. However, past studies pointed out that giving rewards will enhance KS behavior [23, 32]. Still, in this study, the expected return has no impact on KS attitude, so studying the effects of different reward systems is necessary.

Besides, there may be two reasons why the expected contribution does not significantly influence KS attitude. First, IT employees are not high up in the organizational structure and do not feel that sharing their knowledge will contribute to the organization. In addition, employees will only pay attention to their related work or affairs, focusing on a small scope, and will not think about the entire organization's operations. Finally, IT engineers have been in the organization for a while; they know their capabilities and when they need to share their knowledge. Therefore, they have a preexisting attitude towards KS, so they do not readily change [5, 46].

Regarding trust, cognition-based and affect-based trust have no significant impact on KS attitude. The establishment of cognition-based trust among colleagues is based on each other's affirmation of workability. The findings showed that employees in the organization believe that even if they trust their colleagues' abilities and work decisions, their KS attitudes will not be affected. As for affect-based trust, even if employees in an organization can freely share their thoughts and feelings with their colleagues, it will not affect their KS attitude. The findings are somewhat different from those of previous studies [40, 41], which pointed out that interpersonal trust has a positive and direct impact on attitude. The possible explanation is that a lack of organizational KS cultures in Vietnamese organizations, social fear of exclusion, or the fear of losing face negatively influences employees' attitudes.

The KS subjective norm is directly influenced by affection-based trust and task interdependence. Affect-based trust has the most significant influence and has a strong causal relationship. It may be because members in the organization have deep feelings for each other, which will produce a harmonious and friendly culture, and the more they will encourage each other to share and help each other [64]. However, cognition-based trust does not directly impact the KS subjective norm. Therefore, regarding trust, affect-based trust, not cognition-based trust, plays a vital role in KS behavior. That is to say, the trust among colleagues is mainly based on affective connection, and colleagues will also agree with KS behavior [65].

The adequacy of personal resources directly influences perceived behavioral control of KS, and there is a strong causal relationship. Therefore, individuals who engage in KS behaviors must consider whether they have sufficient knowledge, time, and ability because having these resources

will enhance their confidence and control over the behaviors. Many scholars also pointed out the importance of time and resources in sharing behavior [8].

6. Managerial Implications

Empirical data in this study showed that IT employees in the organization lose confidence in its reward system. As a result, most IT employees think the organization cannot or will not provide rewards to encourage KS. Thus, the organization should strengthen the employees' confidence in the policies and improve the reward system. Besides, the findings of expected relationship and expected loss showed that employees in the organization attach importance to interpersonal relationships, so the organization needs to hold activities frequently to promote harmony among colleagues, which is helpful for KS activities. Organizations should actively promote the culture of KS. Only through the mechanism of culture can KS be deeply rooted in employees' hearts as the highest guiding principle for each employee's behavior.

This study found that task interdependence significantly impacts the attitude and the KS subjective norm. Therefore, we suggest the organization take a team or group as the main body in the work allocation. The nature of work should be interdependent and auxiliary. Only this way of working can inspire KS among colleagues. Furthermore, due to the influence of personal traits (altruism) on KS, organizations can conduct individual trait tests when recruiting new employees, which helps promote KS in the organization. Moreover, the findings indicated that the adequacy of personal resources is very important for the confidence and control of KS. Therefore, in the organization, it is necessary to provide employees with the resources on time. With sufficient resources, employees will be more willing to share their knowledge. For example, setting a particular time in the afternoon as coffee time, allowing employees to relax, and providing enough places or spacious pantries to rest comfortably, temporarily, and communicate with their colleagues, we can enhance the effect of KS. Finally, due to Confucian values in Vietnamese culture driven by social and emotional factors (J. [12]), employees may be reluctant to share knowledge. Therefore, building an organizational KS culture in which employees are willing to share their knowledge is essential.

7. Limitations and Future Research

This study assumes that KS is planned behavior that is performed after thinking and reasoning. Under this assumption, this research model cannot explain some ad hoc behaviors. Future studies should be conducted to address this issue.

This study used a cross-sectional method to observe the behavior of individuals. Thus, only the cause of the problem can be found. As for how these factors affect individual behavior, it is necessary to understand the entire behavior

process. Therefore, we should use a longitudinal method in future research.

Since many variables are estimated in the model, the samples are limited. Therefore, it is not possible to test the whole model. Thus, the model test can only be performed using the limited information, which is just a workaround, and the model estimates will be less efficient.

The participants in this study are IT engineers; thus, the conclusions and findings may not be inferred and applied to other types of workers. Future research should focus on workers in different roles or organizations to improve the generalizability and stability of the research model.

Data Availability

The collected data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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