PERCEPTIONS OF SOFTWARE ENGINEERS TOWARD KNOWLEDGE-SHARING BEHAVIOR BASED ON SOCIAL COGNITIVE THEORY AND SELF-REGULATED LEARNING

Tse-Ping Dong, Graduate Institute of Global Business and Strategy, College of Management, National Taiwan Normal University, 162, He-ping East Road, Section 1, Taipei 10610, Taiwan, R.O.C.
tpdong@ntnu.edu.tw, 886-2-7734-3310

Shang-En Yu, Dept. of Tourism, Ming Chuan University, 5 De Ming Rd., Gui Shan District, Taoyuan County 333, Taiwan, R.O.C.
yushine@mail.mcu.edu.tw, 886-3-3507001

Kun-Shiang Chen, Dept. of Optometry, Chung Hwa University of Medical Technology, No.89, Wenhwa 1st St., Rende Shiang, Tainan County 717, Taiwan, R.O.C.
yco168@gmail.com, 886-937343623

Nai-Chang Cheng, Graduate Institute of Global Business and Strategy, College of Management, National Taiwan Normal University, 162, He-ping East Road, Section 1, Taipei 10610, Taiwan, R.O.C.
chengnaichang@gmail.com, 886-919873513

ABSTRACT

This article focuses on the effects of knowledge sharing intention by examining the self-regulated learning processes of goal setting and self-efficacy. We adopt social cognitive theory to examine how extrinsic (learning environment and goal setting) and intrinsic (self-efficacy and self-regulation) motivation affect the knowledge sharing intention. Through a field survey of 230 software engineers, we confirm that there are significant relationships among goal-setting, self-efficacy and self-regulation, supporting Schunk’s model. Moreover, knowledge sharing intention can be achieved based on high self-regulation, since self-efficacy has little effect on it.

Keywords: knowledge sharing, social cognitive theory, self-regulation, self-efficacy

INTRODUCTION

The knowledge-based theory of the firm considers knowledge as the most strategically significant resource that a company possesses (Grant, 1996; Lee, 2001). Proponents of this view argue that because knowledge-based resources are usually difficult to imitate and socially complex, they are the major determinants of sustained competitive advantage and superior corporate performance.
Knowledge that resides within individuals is often referred to as tacit knowledge, and successful knowledge management requires converting this internalized tacit knowledge into explicit codified forms in order to share it with others (Nonaka & Konno, 1999; Nonaka & Takeuchi, 1995). Knowledge sharing is the behavior of disseminating acquired knowledge to other members of the organization (Ryu, Ho, & Han, 2003), and numerous studies have identified the many factors that affect this, such as organizational culture, trust, and incentives (Cabrera & Cabrera, 2002). Several recent studies also have examined how individual cognition can affect knowledge sharing behavior (Chiu, Hsu, & Wang, 2006; Yi, Jackson, Park, & Probst, 2006). Consequently, it is important to examine why individuals elect to share or not share knowledge with their colleagues, as identifying these motives would help both academics and practitioners gain more insights into how to foster greater knowledge sharing. To this end, two complementary social theories are applied in this study: social cognitive theory and self-regulated learning.

First, social cognitive theory (SCT) has been widely applied in the knowledge management literature, and has been shown to have significant validity (Bandura, 1986, 1991). The theory defines human behavior as a triadic, dynamic, and reciprocal interaction of personal factors, behavior, and the social network. The purpose of this study is to identify the antecedents that support or hinder an individual's knowledge sharing behavior by applying an SCT-based model that considers both environmental and personal cognition factors.

Second, self-regulation is attracting increasing attention in the psychological and educational literature (Zimmerman, 2000). Most theories of self-regulation emphasize its inherent link with goals. A goal reflects one's aim and refers to the quantity, quality, or rate of one's performance (Locke, Latham, & Smith, 1990). Goal-setting involves establishing a standard to serve as the aim of one's actions, and this is related to different phases of self-regulation, such as forethought, performance control, and self-reflection (Zimmerman, 1998). Managers are not able to constantly motivate and keep track of employees, and thus setting goals is an important tool for managers, as this can enable employees to engage in self-regulation and thus improve their own work performance.

Although a large theoretical corpus exists on the variables that influence knowledge sharing, little empirical research has adopted both social cognitive theory and self-regulated learning to examine the relationships among environment factors and personal cognition with regard to behavioral intention. This study aims to examine how goal-oriented learning environment factors affect knowledge sharing intention through their effects on individual self-regulation and self-efficacy.
The research model and hypothesized relationships were empirically tested using the structural equation modeling (SEM) approach. Furthermore, this study contributes to the existing literature on SCT and knowledge management. At a minimum, the findings of this study provide a theoretical basis and empirical evidence of likely directions for predicting and explaining knowledge sharing intention. From a managerial perspective, the findings of this study should enable business managers to undertake appropriate courses of action to ensure the effective creation of a knowledge sharing environment.

LITERATURE REVIEW

Social cognitive theory

In the social cognitive theory, environment influences, personal factors, and behavior are interacting determinants that influence each other bidirectionally (Wood & Bandura, 1989b). This model is also widely accepted for use in validating individual behavior, and a number of recent studies have examined the role of environment influences and personal factors in individual behavior (Chiu, et al., 2006; Lin & Huang, 2008). The relationships among goal-setting, self-efficacy and self-regulation are shown in Figure 1. This study proposes that people enter organizational activities with such goals as sharing knowledge, and solving problems. Self-efficacy for goal attainment is influenced by an individual’s abilities, prior experiences, attitude toward learning, instruction, and the social context. As employees work on tasks, they observe their own performance, evaluate goal progress, and adjust their task approach accordingly. Self-evaluation of goal progress as being satisfactory enhances feelings of efficacy, while goal attainment leads individuals to set new goals (Schunk, 1990, 2001).

Self-efficacy and behavioral intention

Within SCT, self-efficacy is hypothesized to influence the choice of activities, effort expended, and persistence. Furthermore, self-efficacy is posited to influence behavior directly and through the development and use of self-regulatory behaviors. Self-efficacy is seen as a predictor of
personal factors, since both are considered to be major influences on behavior (Bandura, 1982, 1986).

This paper discusses the effect of individuals’ beliefs about their abilities to competently share knowledge (perceived self-efficacy) on the actual knowledge sharing that takes place. Therefore, it can be assumed that perceived self-efficacy with regard to sharing knowledge would predict actual knowledge sharing activity. Accordingly, this study proposes the following hypothesis:

H1. Perceived self-efficacy has a positive effect on knowledge sharing intention.

Perceived self-efficacy

Self-regulated learning processes assume that self-regulation is a key variable affecting self-efficacy (Schunk, 2001; Zimmerman, 2001). Self-regulation refers to the individual’s ability to control learning through the exertion of will. In contemporary psychology it is sometimes referred to as self-control, and exerting self-control through the executive functions in decision making is thought to deplete the resources of the ego (Vohs et al., 2008). Moreover, self-regulated learners always exhibit a high sense of self-efficacy (Pintrich, 2002).

Self-regulation can also be used to describe personal behavior that is guided by metacognition, strategic learning action, and the motivation to behave (Butler & Winne, 1995; Winne & Perry, 2000; Zimmerman, 1990). Therefore, this study proposes that self-regulated learners not only exhibit a high sense of self-efficacy, but also have the motivation to actually carry out knowledge sharing behavior. The following hypotheses thus are proposed:

H2. Perceived self-efficacy has a positive effect on self-regulation.

H3. Self-regulation has a positive effect on knowledge sharing intention.

Self-regulation through goal setting

To elicit a specific behavior in an individual, it is important that the individual has a clear view of what is expected of them (Locke & Latham, 2002). A goal is thus of vital importance, because it helps the individual in focusing their efforts in a specific direction. In other words; goals canalize behavior (Cummings & Worley, 2004), and allow employees to see any progress they have made, enhancing their motivation, providing structure and focusing attention, thus having an informational function (Harris, Graham, Reid, Mcelroy, & Hamby, 1994). The concept of self-efficacy is important in goal-setting in several ways. Self-efficacy represents
an individual’s perceptions of their abilities to plan and take action to reach a particular goal. Individuals with high self-efficacy set higher ones than individuals with lower self-efficacy, and are also more committed to their assigned goals, and seek and use better strategies to attain them (Locke, et al., 1990; Seijts & Latham, 2001).

Goal setting is especially effective in enhancing self-efficacy and self-regulation (Maddux, 1995). Employees with appropriate goals will demonstrate high self-efficacy and greater skills (Appelbaum & Hare, 1996; Locke & Latham, 2002). Moreover, Latham (2002) proposed that assigned goals, personal goals, and self-efficacy interrelate to affect performance, and self-efficacy was identified as a proximal outcome of goal orientation in a meta-analysis carried out by (Payne, Youngcourt, & Beaubien, 2007). In light of this earlier research, this study proposes that specific goals are able to raise individual self-efficacy. The following hypothesis is thus presented:

\[ H4a: \text{Goal setting has a positive effect on Perceived self-efficacy.} \]

Most theories of self-regulation emphasize its inherent link with goals. A goal reflects an individual’s purpose, and refers to a quantity, quality, or rate of performance (Locke, et al., 1990). In an organization, employees who are self-regulated believe that opportunities to take on challenging goals, and exert efforts, will give rise to their own personal success. A self-regulated person requires that goals be realistically challenging but attainable. With realistic goals, progress can be monitored and different task approaches determined. Therefore, setting goals is an important tool for employees, since they have the ability to function as self-regulatory mechanisms. According to Schunk’s theory (2001), this study proposes the following hypothesis:

\[ H4b: \text{Goal setting has a positive effect on self-regulation.} \]

Supportive learning environment

In Bandura’s proposed model, organizational environment should have an influence on personal factors and behavior based on SCT. A supportive learning environment and goal setting are treated as major environment factors affecting individual cognition and behavior. Supportive learning environment refers to the perceptions and feelings of organizational members regarding their learning environment. Such an environment allows time for pauses in action, and encourages thoughtful reviews of the organization’s processes (Garvin, Edmondson, & Gino, 2008).
Organizations tend to foster knowledge sharing if they offer a supportive learning environment, and these have four distinguishing characteristics: psychological safety, appreciation of differences, openness to new ideas and time for reflection. A number of studies have found strong links between a supportive learning environment and positive employee reactions (Bock, Zmud, Kim, & Lee, 2005; Bondarouk & Sikkel, 2001; Davenport, De Long, & Beers, 1998). Therefore, examinations of supportive learning environments can provide concrete evidence of how such programs work in practice. This paper will explore how such an environment can affect behavior through personal factors, and thus the following hypotheses are proposed:

\( \text{H5a: Supportive learning environment has a positive effect on goal setting.} \)

\( \text{H5b: Supportive learning environment has a positive effect on self-efficacy.} \)

**RESEARCH MODEL**

In the research model, this study takes a supportive learning environment and goal-setting as exogenous factors, with self-efficacy and self-regulation as endogenous ones that affect knowledge sharing intention. Each of the model’s constructs and the related hypotheses are detailed below. Note that the model utilizes the SCT in recognizing that goal-setting influences self-regulation, which in turn affects knowledge sharing. A supportive learning environment and goal-setting are posited to directly influence self-efficacy and self-regulation.

**RESEARCH METHODOLOGY**

*Sampling and data collection*

The study population consisted of software engineers in Taiwanese companies. Software engineers, main knowledge workers in companies, were selected because they are likely to be
familiar with complex system design, knowledge related to the rapid update of technology, and strong competition for sustaining innovation (Assimakopoulos & Yan 2006). The differentiates software engineer from other forms of work is its primary task of "non-routine" problem solving that requires a combination of convergent, divergent, and creative thinking (Reinhardt et al., 2011). Knowledge sharing among software engineer is a key component of an organization’s knowledge management strategy, as it will significantly affect organizational effectiveness (Cabrera & Cabrera 2002).

A total of 300 software engineer from 10 organizations were invited to participate voluntarily in this research, with follow-up letters sent approximately two months after the first mailing. A total of 230 valid responses were returned, giving a response rate of about 76%. Table 1 shows the respondent characteristics.

<table>
<thead>
<tr>
<th>Demographic Items</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>113</td>
<td>49.2</td>
</tr>
<tr>
<td>Female</td>
<td>117</td>
<td>50.8</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21~25</td>
<td>84</td>
<td>36.5</td>
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<tr>
<td>26~30</td>
<td>64</td>
<td>27.9</td>
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<tr>
<td>31~35</td>
<td>34</td>
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<tr>
<td>36~40</td>
<td>34</td>
<td>14.8</td>
</tr>
<tr>
<td>&gt; 41</td>
<td>14</td>
<td>6.1</td>
</tr>
<tr>
<td>Education</td>
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<td></td>
</tr>
<tr>
<td>High school</td>
<td>62</td>
<td>27.0</td>
</tr>
<tr>
<td>University</td>
<td>143</td>
<td>62.3</td>
</tr>
<tr>
<td>Master</td>
<td>25</td>
<td>10.6</td>
</tr>
<tr>
<td>Position</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior engineer</td>
<td>188</td>
<td>81.6</td>
</tr>
<tr>
<td>Senior engineer</td>
<td>33</td>
<td>14.3</td>
</tr>
<tr>
<td>Manager</td>
<td>9</td>
<td>4.1</td>
</tr>
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Measures

Table 2 lists the definitions of the constructs used in this work. This paper developed the items in the questionnaire by adapting measures validated by other researchers. For example, the items measuring self-efficacy and self-regulation were adapted from Schwarzer’s research (Schwarzer, 1999, 2001; Schwarzer & Jerusalem, 1995). Moreover, the items for measuring a supportive learning environment were adapted from previous works, with the items altered to fit the knowledge sharing context. This study thus assesses a supportive learning environment by considering four distinguishing characteristics: (1) psychological safety; (2) appreciation of differences; (3) openness to new ideas; (4) time for reflection (Garvin, et al., 2008) The items for the dependent variable (knowledge sharing intention) were adapted from Fishbein and Ajzen (1975).

<table>
<thead>
<tr>
<th>Table 2. Definitions of the Constructs</th>
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</tr>
</thead>
</table>

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Supportive learning environment

An environment that supports learning has four distinguishing characteristics. (1) psychological safety; (2) appreciation of differences; (3) openness to new ideas; (4) time for reflection (Garvin, et al., 2008)

Goal setting

Most effective goals for an organization should be tangible, specific, realistic and have a time targeted for completion (Drucker, 2006; Latham & Locke, 1991; Schunk, 2001)

Self-efficacy

Self-efficacy in this context refers to a broad and stable sense of personal competence to deal efficiently and effectively with knowledge sharing (Schwarzer & Jerusalem, 1995; Stone & Bailey, 2007)

Self-regulation

Self-regulation is the ability to control one’s emotions and desires, and is sometimes called self-control (Schwarzer & Jerusalem, 1995)

Knowledge sharing intention

The degree to which IT professionals believe they will adopt knowledge sharing actions (Ajzen, 2002; Bock, et al., 2005)

The measurement model and structural relationships were assessed with regard to content validity, convergent validity and discriminant validity. To establish content validity, the questionnaire was refined through rigorous pre-testing, which focused on instrument clarity, question wording and validity. During the pre-testing, three professors were invited to comment on the items and the wording used. Their comments then provided a basis for revisions to the construct measures.

Statistical analysis

Confirmatory factor analysis (CFA) was applied to test the adequacy of the measurement model with AMOS 18. The adequacy of the measurement model was evaluated based on the criteria of reliability, convergent validity, and discriminant validity. Reliability was examined using the composite reliability (CR) values. Additionally, the convergent validity of the scales was verified using the following two criteria (Fornell & Larcker, 1981): (1) all indicator loadings should be significant and exceed 0.7, and (2) the average variance extracted (AVE) of each construct should exceed the variance due to measurement error for that construct (i.e., AVE should exceed 0.5). The discriminant validity of the scales was assessed using the guideline suggested by Fornell and Larcker (1981): the square root of the AVE from the construct should be greater than the correlation shared between the focal construct and other constructs in the model.

DATA ANALYSIS AND RESULTS

Measurement model
With an adequate measurement model, the proposed hypotheses were then tested using SEM, and the results are shown in Figure 3. This research aimed to investigate how social cognition affects individual knowledge sharing behavioral intention, by applying self-regulation to understand how the relevant factors affect this behavior. This study thus examines how extrinsic factors (e.g., supportive learning environment and goal setting) affect the intention to perform knowledge sharing through their effects on self-efficacy and self-regulation.

![Figure 3. Results of structural model](image)

Table 3 shows that all the CR values were above 0.7, which is the commonly accepted level for explanatory research. For the measurement model, all loadings were above the 0.7 threshold, while AVE ranged from 0.614 to 0.683. Therefore, both conditions for convergent validity were met. Table 4 lists the correlations among the constructs, with the square root of the AVE on the diagonal. All the diagonal values exceed the inter-construct correlations, and thus the results of the test of discriminant validity are acceptable.

<table>
<thead>
<tr>
<th>Latent variable</th>
<th>Item</th>
<th>Internal reliability</th>
<th>Convergent validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supportive learning environment</td>
<td>SLE1</td>
<td>0.607</td>
<td>0.744</td>
</tr>
<tr>
<td></td>
<td>SLE2</td>
<td>0.747</td>
<td>0.787</td>
</tr>
<tr>
<td></td>
<td>SLE3</td>
<td>0.705</td>
<td>0.853</td>
</tr>
<tr>
<td></td>
<td>SLE4</td>
<td>0.698</td>
<td>0.744</td>
</tr>
</tbody>
</table>

\[ R^2=0.68 \]
The results show that individual perceived self-efficacy (β = 0.20; p < 0.05) and self-regulation (β = 0.72; p < 0.001) are positively related to behavioral intention, providing support for H1 and H3. The results also reveal that self-efficacy is related to self-regulation (β = 0.60; p < 0.001), providing support for H2. Together, the two social cognitive factors explain 68% of the variance of the behavioral intention measure. H4a and H4b are supported, because goal setting is related to self-efficacy (β = 0.54; p < 0.001) and self-regulation (β = 0.36, p < 0.001). Finally, the results support H5a and H5b, as supportive learning environment is positively related to goal setting (β = 0.55; p < 0.001) and self-efficacy (β = 0.28; p < 0.05).

Structural model

Overall model fitness examines the fitness of the overall model and observed data, and the relevant indices from this research are shown in Table 5. The structural model analysis has good fit, as judged from the goodness of fit indices (GFI = 0.891; AGFI = 0.855; CFI = 0.963; RMSEA = 0.056), and the chi-square index is significant ($\chi^2$ = 302.908 d.f. = 177; $\chi^2$/d.f. =...
The values of the indices are all within the ideal range, and thus the overall fitness of model is excellent.

The results of this study show that goal setting, self-efficacy and self-regulation are important in self-regulated learning processes. Positive self-regulation has been found to lead positive knowledge sharing intention. These findings confirm the relationships among goal setting, self-efficacy and self-regulation, supporting Schunk’s model.

CONCLUSION

Findings and implications

This study has the following implications for individuals hoping to encourage knowledge sharing practices within their organizations. First, this study confirms that goals motivate people to exert the necessary efforts to meet task demands, and to persist in these efforts over time (Latham & Locke, 1991). Moreover, goals also encourage people to focus on the relevant tasks, select and apply appropriate strategies, and monitor goal progress (Schunk, 2001). By setting specific goals, managers are better able to work with employees so that they can acquire effective methods to achieve their targets.

Second, when employees adopt a goal, they may experience a sense of self-efficacy when they attain it, which motivates them to engage in appropriate self-regulatory activities (Wood & Bandura, 1989a). Individuals who are high in self-efficacy set more difficult goals, exert more efforts to achieve these, and seek to learn from the processes of pursuing those goals (Degeest & Brown, 2011). Since self-efficacy functions as a primary motivational mechanism by which goal orientation influences subsequent learning processes, employees with higher levels of self-efficacy will exert more efforts toward, and learn more from, task assignments. Managers should thus provide employees with opportunities for self-regulation. For example, they might periodically show employees sample tasks and ask them to evaluate how much progress they have made in sharing knowledge. Self-regulatory skills require that employees’ goals be challenging but attainable. With realistic goals, employees can monitor their own progress and decide on different approaches to the task if their present one is ineffective. Self-efficacy is then increased as employees note progress, attain goals, and set new challenges.

Third, knowledge must be shared in systematic and clearly defined ways, and can take place among individuals, groups, or whole organizations. Moreover, the knowledge-sharing process can be internally focused with an eye toward taking corrective action. This study recommends that managers set up knowledge sharing goals and provide feedback on the progress that is made. This can be done formally by managers and employees holding a conference at the start
of a unit, where goals are established, and then again at different times during the unit to assess what has been done. Once goals have been attained, new ones can be set. When combined with appropriate progress feedback, goals offer an important means to promote the use of self-regulation strategies, as well as for individuals to develop skills and beliefs in their own achievements.

Fourth, using this assessment tool, companies can pinpoint areas where they need to foster knowledge sharing and idea development (Garvin, et al., 2008). A supportive learning environment is likely to have benefits and foster positive beliefs that can further promote knowledge sharing (Lin & Lee, 2006). Additionally, goal setting is a powerful way of motivating people, and of motivating yourself. Managers should also build a goal-oriented learning environment that encourages knowledge sharing. Specifically, fostering a learning environment that emphasizes productivity and goal achievement is likely to encourage both managers and employees to socialize and interact more frequently with each other, thus driving knowledge sharing intentions.

Finally, this article focuses on self-regulation from goal setting and self-efficacy. Employees can work to increase three important characteristics of self-regulation: self-observation (monitoring one's activities), self-judgment (self-evaluation of one's performance) and self-reactions (reactions to performance outcomes) (Zimmerman, 2001). Employees can effectively self-regulate their own learning if they can accurately reflect on their progress towards a specific goal, and then adjust their actions if needed to maximize performance.

Limitations and suggestions for further research

As in most empirical research, this study has several limitations. First, the conclusions drawn from this work are based on cross-sectional data. As a result, the posited causal relationships could only be inferred rather than proven. A stricter test of the research model can use a longitudinal study to assess this in different time periods and make comparisons, thus providing greater insights into the knowledge sharing intention.

Second, in addition to the environmental and personal factors included in this study, there could still be other factors influencing behavioral intention about knowledge sharing. Knowledge sharing activities are generally supported by knowledge management systems. However, technology constitutes only one of the many factors that affect the sharing of knowledge in organizations, such as organizational culture, trust, and incentives (Cabrera & Cabrera, 2002). Further research considering these factors could enhance understanding of the determinants for successful knowledge sharing. Finally, future research efforts can explore alternate models and
social theories in the interests of understanding additional antecedents and constructs shaping knowledge sharing intentions.

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