SOCIAL INFLUENCE ON KNOWLEDGE WORKER’S ADOPTION OF INNOVATIVE INFORMATION TECHNOLOGY

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ABSTRACT

User perceptions toward information technology (IT) are crucial to its successful implementation. The purpose of our study is to improve the understanding of the impact of social influences on different types of users’ perceptions and adoption of IT. To do this, the study refines and expands the operationalization of the social influence construct to include four components: subjective norm, image, visibility, and voluntariness. This is used to examine influences by type of user (knowledge worker versus university student) and IT (innovative versus mature). The key finding is that when knowledge workers consider adopting innovative IT they are sensitive to general perceptions of its usefulness. The results have implications for management enquiry and practice.

Keywords: IT, users, social influence, subjective norm, knowledge workers

1. INTRODUCTION

The purpose of this study is to improve understanding of the impact of social influence on different types of users’ perceptions and adoption of information technology (IT). To do this, the study refines and expands the operationalization of the social influence construct to include four components: subjective norm, image, visibility, and voluntariness. This is used to examine influences by type of IT (innovative versus mature) and user (knowledge worker versus university student). This is an important topic as IT is crucial to business and user perceptions towards IT are crucial to its successful implementation. Also, in recent years much economic growth has occurred in fields in which knowledge workers are the key factor of production (Drucker, 1997; Cohen & Levinthal, 1990; Prahalad & Hamel, 1990; Amit & Schoemaker, 1993; Hall, 1992).

The paper is organized as follows. In the next section issues and problems in the area are outlined and the importance of social influence is discussed in light of IT adoption. The definition of knowledge workers and their characteristics in task execution and innovative IT is also discussed. The third section presents the research model and hypotheses. The next section introduces the research methodology, including data sampling, collection and analysis methods. Tests of the research hypotheses are given in the subsequent section. The last section summarizes the research findings and discusses implications of the results and concludes the paper.

2. PROBLEMS IN STUDIES ABOUT SOCIAL INFLUENCE ON IT ADOPTION

Research on the adoption and implementation of organizational IT shows user attitudes toward the innovation are important to success (Lucas, 1981). According to Innovation-Diffusion Theory the rate at which an innovation is adopted is highly dependent not only on the user’s beliefs toward that innovation (Rogers, 1983), but also on social influence (Fulk, Steinfield, & Power, 1987). However, empirical tests of social influence (the subjective norm) on attitudes toward IT have produced mixed results. While Svenning (1982) found positive influences from the subjective norm on user attitudes to use, Pease (1988) found no influence (using the same video conferencing system). These controversies are noticeable in the Technology Acceptance model. Debates continue on the effect of the subjective norm on intention to use IT, finding it either positive (e.g., Cheung, Chang & Lai, 2000; Taylor & Todd, 1995; Thomson, Higgins & Howell, 1991) or negative (e.g., Chau & Hu, 2002; Davis, Bagozzi, & Warshaw, 1989; Mathieson, 1991).

The reasons for these contradictory results include the following. First, social influence theories in IT research fail to provide explicit and exact definitions of social influence (Rice & Aydin, 1991). For example, the subjective norm (the representative concept of social influence) can cover both the injunctive norm (meaning “what significant others think the person ought to do”) and the descriptive norm (meaning “what significant others themselves do”) (Rivis & Sheeran, 2003), and studies are not consistent in their choice.

Second, the referents of social influence are not clearly defined. Social influence means that socially referent others can influence workers’ perceptions of, and reactions to, jobs (Shaw, 1980). However, in this definition it is not clear who the socially referent others are.

Third, the confusing results about social influence on intention to use imply that various conditions or mechanisms are at work (Davis et al, 1989). One of the possible conditions concerns user characteristics such as demographics, job characteristics, IT experiences, etc. Thus, this study looks at knowledge workers to investigate whether they are sensitive to social influence in their internalization process of IT adoption. According to the Technology Acceptance model the internalization process of IT undergoes perceived usefulness (PU) and perceived ease-of-use (PEU) that eventually lead to intention to adopt. Thus, to investigate the internalization process of knowledge worker’s IT adoption two comparative studies are conducted. First, the internalization processes of knowledge and non-knowledge workers are compared. Second, the adoption of innovative IT versus mature IT are compared. With these comparisons it can be identified more clearly how knowledge workers, who are anxious to enhance the productivity of their ad hoc and unstructured tasks, intend to adopt innovative IT for the sake of task productivity.

In summary, the objective of this study is to identify the
role of social influence and the internalization process of users in adopting innovative IT. Specifically, this paper answers three questions based on this objective:

1) What components make up the construct of social influence?
2) Will social influence have a significant effect on intention to use through PU and PEU?
3) Do user characteristics (i.e., knowledge workers versus non-knowledge workers) have a moderation effect among social influence, PEU and PU?
4) Do IT characteristics (i.e., innovative IT versus mature IT) have a moderation effect among social influence, PEU and PU?

The investigation of such moderation effects can identify the effect of social influence on knowledge worker’s perception and behavior as well as different internalization processes by different user characteristics in adopting innovative IT. The findings will contribute to the formation of IT strategies to align IT with knowledge workers’ productivity.

3. THEORETICAL BACKGROUND

3.1 Social Influence

Perceptions of IT are likely to be influenced by the objective characteristics of the system, individual differences (such as past experiences with similar systems), extent of use of the system and occupational demands (e.g., Lucas, 1981; Rice & Shook, 1990). However, social influence theories argue that individual perceptions are also likely to be influenced by the opinions, information and behaviors of salient others (Salancik & Pfeffer, 1978) and socially referent others (the people whose opinions can influence others’ opinions and behaviors). From this perspective several structural contexts influence an individual’s perceptions, actions and experiences. The literature review shows that individual beliefs and intentions to use IT are vulnerable to the following four kinds of social influence: subjective norm, image, visibility, and voluntariness.

First, subjective norm is the most popularly measured construct of social influence in IT acceptance theories such as the Technology Acceptance model, Reasoned Action theory (Fishbein & Ajzen, 1975) and Planned Behavior theory (Ajzen, 1985). Individuals allow themselves to be influenced by observing others and/or seeking information from others, particularly for uncertainty reduction. However, the actual source of greatest influence remains vague because there is no definitive way of establishing the referent. Social Information Processing theory postulates that the influence of socially constructed meanings is affected by factors such as the other’s credibility, status (Shaw, 1980) and perceived and/or informal power (Brass, 1984). From these factors it can be inferred that the referent is a person who has some power by virtue of some specific status and whose trustworthiness has been proven through their past relationships. Proximity is also a criterion for the referent and their significance. Proximity is the extent to which one could be exposed to social information in a given social system and includes three elements: relational, positional and spatial proximity (Rice & Aydin, 1991).

Hence, the referent of the subjective norm should be the person with a professional reputation for trustworthiness and a history of close relationships.

Second, image is the degree to which adoption of the innovation is perceived to enhance one’s image or status in one’s social system (Moore & Benbasat, 1991). The subjective norm positively influences image because if important members of a person’s social group at work believe they should perform a behavior, execution of such performance can elevate their standing within the group. Increased status within the group is a basis of power and influence, which in turn provides a general basis for greater productivity. Thus, an individual may perceive that using IT will lead to improved job performance, even though benefits result from image enhancement rather than the attributes of the IT (Venkatesh & Davis, 2000; Pfeffer, 1982). Chau (1996) also shows that the long-term usefulness of adopting IT socially contributes to the elevation of individual status.

Third, visibility is the degree to which the innovation is visible in the organization, so the more familiar a potential adopter is with an innovation the more likely they are to adopt it (Moore & Benbasat, 1991). Visibility is a closely related concept to observability (Rogers, 1983) and critical mass (Markus, 1990). These concepts denote that the dominant number of users in an organization influences a user’s perception and usage of IT. Finally, voluntariness is the extent to which potential adopters perceive the adoption decision to be non-mandatory (Rogers, 1983; Moore & Benbasat, 1991; Venkatesh & Davis, 2000). Voluntariness makes the assumption that external pressure affects IT adoption.

Further, this paper regards four social influence components as the formative indicators rather than reflective indicators. According to Jarvis, Mackenzie, & Podsakoff (2003), a construct should be modeled as having formative indicators if the following conditions prevail: (a) the indicators are viewed as defining characteristics of the construct, (b) the indicators do not necessarily share a common theme, (c) eliminating an indicator may alter the conceptual domain of the construct and (d) a change in the value of one of the indicators is not necessarily expected to be associated with a change in all of the other indicators. Four social influence components – subjective norm, image, visibility and voluntariness – are used in combination to define the social influence construct. In other words, each indicator is needed to define characteristics of the social influence construct, not to manifest social influence. Also, each indicator does not have the same/similar content and dropping one of the indicators would alter the conceptual domain of the social influence construct. Moreover, a change in one of the indicators would not be associated with changes in the other three indicators. Considering theses conditions, therefore, the social influence construct should be modeled as having formative indicators.

3.2 Knowledge Workers

Knowledge workers quickly identify the value of knowledge and apply it in the interest of productivity (Nonaka, Toyama, & Konno, 2000). A knowledge worker is a different kind of employee, characterized by being paid not to create, produce or manage a tangible product and/or service, but rather to gather, develop, process and apply information that generates profitability to the enterprise (Smith & Rupp, 2004). As Amar (2002) suggests, typical knowledge workers are complex individuals who bring unique skills, intelligence and work methods to the workplace. Knowledge work is also cognitive rather than physical and constitutes a high mental activity with specific work characteristics (Davis, 2002; Pradip & Sahu, 1989). On the one hand, knowledge
workers are typically assumed to require some kind of experiences which reinforce new ways of working and to keep learning from (Ribière & Sitar, 2003). Evers & Menkhoff (2004) propose that knowledge workers tend to distance themselves from academics as the producers of innovative knowledge, but stress their own experience. Taken together, the scope of knowledge workers are likely to be determined by their specific task characteristics (e.g., cognitive, self-decisive etc.) and certain level of work experiences.

As a contrast to knowledge workers with such characteristics we used university students. While they are involved with knowledge work and will eventually turn into knowledge workers in enterprises (Drucker, 1997), the major difference lies in different task characteristics and work experiences. University students are required to complete assignments whose solutions or answers are already defined in very structured ways whereas knowledge workers are required to make improvised and ad hoc decisions in competition for unstructured future objectives. The tasks of university students lack creativity and nimble judgment and require them to find out the expected right solutions (Johnson & Levenberg, 1994). Regarding work experience, most university students aged between 20~23 in South Korea usually have no employment experience because of various reasons such as military service and education policy. Although university students would not be adequate as a non-knowledge group in all contexts, it seems to be valid in this study.

Compared to university students, knowledge workers proactively look forward to innovative IT that help increase their productivity, enhance the quality of their work lives and improve decision-making skills (Farhoomand & Drury, 2000). Knowledge workers also create and share knowledge about IT usage to perform their cognitive work. Knowledge workers demand easy and rapid access to critical information to cope with dynamic changes of business environments. Davis (2002) uses wireless internet service as an innovative IT that satisfies such demands of knowledge workers and insisted that they could successfully enhance productivity by access to real-time transaction data and management information.

4. RESEARCH AND HYPOTHESES

Bandura’s (1986) Social Learning theory and Salancik & Pfeffer’s (1978) Social Processing theory propose that interactions with social agents control the effects of IT and that diverse beliefs about, and uses of, IT converge in social systems (Fulk, 1993). Social Learning theory predicts that coordinated behaviors and meanings arise through social processes. Observational learning occurs when individuals acquire cognitive skills or technologies by observing the behavior of others. The observers then experience an emotional reaction by receiving stimuli in processes and then elicit similar behavior from others. This behavioral pattern is not simply imitation, but considerable cognitive processing of stimuli. Similar behavior and attitudes can be acquired through social learning and the complex interplay with others (Fulk, 1993). Based on Social Processing theory, the conceptual model was developed (see Figure 1).

4.1 Social Influence versus PU, PEU and Intention

Davis et al. (1989) focus on two beliefs (PU and PEU) because they represent the process and mechanism of internalization of the characteristics of IT. All external variables must influence PU and PEU before they can lead to intention to use. External variables include both the technical and non-technical characteristics of IT, such as social influence (Davis et. al., 1989). The subjective norm has an indirect effect on intention to use IT through PU and PEU (Warshaw, 1980). The subjective norm affects internalization of IT because when one perceives that an important referent thinks one should use a system, one incorporates the referent’s belief into one’s own belief structure (Warshaw, 1980). From the perspective of image one recognizes usefulness if IT usage is believed to enhance social status (Venkatesh & Davis, 2000). The argument that late adopters’ PU and PEU are influenced by surrounding early adopters indicates the influence of visibility (Fisher & Price, 1992). Voluntariness has a direct effect on user’s beliefs of IT (Agarwal & Prasad, 1997). Therefore, the following hypotheses are made.

H1: Social influence has a significant impact on the PU of both innovative and mature IT in both knowledge and non-knowledge groups.

H2: Social influence has a significant impact on the PEU of both innovative and mature IT in both knowledge and non-knowledge groups.

Some Technology Acceptance model studies include the social influence construct as an exogenous variable in the model even though the path structure around social influence has not been uniform (Lucas & Spitler, 1999; Venkatesh & Davis, 2000). Technology Acceptance model, Reasoned Action theory and
Planned Behavior theory propose a direct relationship between the subjective norm and intention to use. The fundamental reason for the subjective norm is compliance (Fishbein & Ajzen, 1975). Though individuals have positive attitudes towards IT, they can accept the referent’s perspective. Also, when the expected results of using IT are uncertain, users use IT in compliance with their referent. Visibility influences the diffusion of innovations (Moore & Benbasat, 1991). Harris (1992) proposes that the more that organizational culture accepts individual voluntariness, the greater the intention to use IT. In this context it seems that the social influence of the subjective norm, image, visibility and voluntariness influence the intention to use IT. However, university students lack the internalization of IT qualities and characteristics compared to that of knowledge workers. Knowledge workers are mature enough to be less likely to follow others blindly in using IT whereas university students are more likely to be more easily influenced in their IT-using behavior. Therefore:

**H3:** Social influence will positively influence the intention to use innovative and mature IT only in the non-knowledge group.

### 4.2 Moderators of Social Influence: Knowledge Workers and IT Maturity

When knowledge workers adopt IT, environmental and cultural elements tend to exert substantial influence (Sviokla, 1996). These elements include training and education, organizational structure, relationships with co-workers and co-workers’ and supervisors’ perceived worth of the system and voluntariness of IT adoption (Charan, 2001; Etillie, 1983). Beliefs about IT are influenced through informal, verbal communication and personal training, rather than solely through direct experience or formal channels. This fact is associated with the proximity of the referent’s influential power.

Gefen & Straub (2000) contend that the influential factors on intention to use IT can be different according to the usage objective of IT. For instance, PEU is important in using the Internet for the purpose of communication or entertainment whereas PU is important for work (Etillie, 1983; Gefen & Straub, 2000). Knowledge workers must consider more of the relevancy to their tasks in making the intention to use IT. Instead of promptly forging use intention, they seriously consider the usefulness and relevancy of IT to their tasks and also welcome opinions of others in this regard. Meanwhile, university students are more sensitive to ease-of-use of the IT characteristics and opinions of others in this respect.

Wireless internet service is the service that transmits voice, data and multi-media wirelessly and has recently added mobility by mobile internet technology. The number of registered users of this service had reached 1.5 billion people globally in 2005 (i.e., one-fourth of the total population of the world). In enterprise operations and processes, field-oriented functions, such as sales and marketing, logistics, distribution and insurance businesses, have been very proactive in adopting wireless internet service. It can be regarded as an innovative IT. Indeed, wireless internet service interviews with three consultants in the area agreed it fitted the profile of a less mature and innovative IT. Although wireless internet service is in the immature phase and has an uncertain future, the use of wireless internet service is a hot topic. Social pressure may influence non-users of wireless internet service to believe that they have been left behind (Cheung et al., 2000). Therefore, the following hypotheses specifically in the context of wireless internet service are developed.

**H4:** Social influence will have a more significant impact on knowledge workers’ PU of innovative IT than upon non-knowledge workers.

**H5:** Social influence will have a more significant impact on a non-knowledge workers’ PEU of innovative IT than upon knowledge workers.

In contrast, spreadsheets are used to represent a mature IT for several reasons. According to the Technology Acceptance model (McFarlan, McKenny, & Pyburn, 1983) there are four levels of IT maturity: 1) technology identification and investment; 2) technology learning and adaptation; 3) rationalization and management control; 4) widespread technology transfer. Knowledge workers have considerable experiences with spreadsheets. IT means the technology corresponds to the Technology Acceptance Model’s fourth phase. Perceptions about, as well as diffusion of, spreadsheets are higher than for wireless internet service.

Technology innovation studies insist that technical utility is the major concern in early stages of innovative technology, whereas complementary features (mainly related to ease-of-use) come afterwards (Anderson & Tushman, 1990; Schilling, 2005; Utterback & Abernathy, 1975). This argument is actually opposite to that of the Technology Acceptance model where PU matters first and leads to PU afterwards. However, it is naive to insist that PEU always matters prior to PU in every context because when relevancy to tasks is the major concern (as for knowledge workers), the sequence of priority between PU and PEU can be the reverse of the Technology Acceptance Model argument. For instance, according to IDC and Delphi Group their knowledge workers spend about 25% of their daily working hours on knowledge or information retrieval (Business Wire, 2001). Within such functions, knowledge workers would put up with uncomfortable or inconvenient IT qualities only if it can enhance task performances. Therefore:

**H6:** Social influence will have a more significant impact on knowledge workers’ PU of immature IT than of mature IT.

**H7:** Social influence will have a more significant impact on knowledge workers’ PEU of mature IT than immature IT.

### 5. RESEARCH METHOD

#### 5.1 Data Collection

In recent empirical studies knowledge workers have been defined and measured in two ways. First, by job category, and then compared with people in non-knowledge working jobs (Tam, Maret, & Stephen, 2002) However, this method lacks reliability in job categories. For example, Elkjaer (2000) categorizes medical doctors as general experts who do not need creativity whereas Flood, Turner, Ramamoorthy, & Pearson (2001) include doctors as knowledge workers. Second, Sahraoui (2001) suggests selecting knowledge workers by self-perception (self-awareness) because it is hard to define the profile of the knowledge worker population. There is no professional list that would ensure that knowledge workers would be particularly targeted. Therefore,
convenience sampling through self-perception proved to be a satisfactory alternative in this study.

In order to measure self-awareness as knowledge workers we developed the following four measurement items were developed: 1) “I am free from any interference in making decisions in my job”; 2) “I have my own methodology or specific knowledge to solve problems related to my work”; 3) “I perform more cognitive and mental work than physical work”; 4) “My productivity makes a large contribution to my organization’s competitive advantage”. Workers were asked for their self-perception on these. Only the samples of knowledge workers whose scores were beyond the average were included.

The target population was any organization across various industries using wireless internet service wireless internet service at work in South Korea. The list of the Korea Information Society Development Institute and IT Research and Consulting (A white book on IT, 2004) were consulted first. These two organizations survey annual IT investment and usage of enterprises listed on the Korean Stock Exchange. The survey contains a list of organizations using wireless internet service at work in Korea and shows that wireless internet service is predominantly used in sales and logistics departments. For example, sales persons can gain access to data stored on the server computers of headquarters and employees can measure the payment or usage records of facilities and automatically report or identify the current location of vehicle drivers.

Before distributing questionnaires a pilot test was conducted by randomly selecting five firms representative of five industries (telecommunications, mobile, finance/insurance, logistics, manufacturing) and contacting employees in their sales or logistics departments by telephone. Employees were asked if they used wireless internet service in such activities as mobile offices, telemetry and mobile tracking. This allowed the content validity of the survey questionnaire to be verified.

From these five industries 100 firms listed on the Korean Stock Exchange were randomly selected. Questionnaires to 250 of their employees in sales and logistics departments were randomly distributed by e-mail. Some 162 responses from 42 firms (a response rate of 64.8%) were received. Following elimination of 9 responses that had below average scores in four questions related to knowledge workers’ self-perception on the degree of their work expertise, 154 replies were left for statistical analysis. Of these 31.2% were in telecommunications, 22.1% in finance/insurance, 16.9% in logistics, 11.7% in manufacturing, 9.7% in mobile, and 8.4% in others. The majority of respondents were assistant managers (34.4%), followed by managers (28.6%), IT technicians (20.1%), executives (11.0%), CEOs (1.3%), with a few missing their titles (4.5%). The majority of respondents’ job tenure fell within the range of 6-10 years (46.8%), with a few under 5 years (N = 38, 24.7%).

Next the non-knowledge workers (university students) were surveyed. The authors asked class students and students’ alumni in college (Yonsei University and Ewha Womans University) in Seoul, South Korea to fill out the survey. The authors collected the survey data. The faculty explained the purpose of the study and gave instructions on how to fill out the questionnaire in their class. Some 197 questionnaires were returned out of the 250 sample. Most of students were majoring in MIS, engineering and other computer-related disciplines. The students had already taken, or were taking, courses related to computers, database and programming languages and were quite familiar with wireless internet service. Most students were between the ages of 20-23. Students who were older had completed their military service. As is typical in South Korea, no students in our sample had a job. In sum, the university student sample is quite different from knowledge workers in terms of employment status and age.

### TABLE 1: Demographic Characteristics of Samples

<table>
<thead>
<tr>
<th>Industry</th>
<th>Knowledge worker</th>
<th>University Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telecommunication</td>
<td>48</td>
<td>MIS</td>
</tr>
<tr>
<td>Finance/Insurance</td>
<td>34</td>
<td>Engineering</td>
</tr>
<tr>
<td>Logistics</td>
<td>26</td>
<td>Other computer-related</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Mobile</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td></td>
<td>Age</td>
</tr>
<tr>
<td>CEO</td>
<td>2</td>
<td>20-21 years</td>
</tr>
<tr>
<td>Executives</td>
<td>17</td>
<td>22-23 years</td>
</tr>
<tr>
<td>Managers</td>
<td>44</td>
<td>24-25 years</td>
</tr>
<tr>
<td>Assistant managers</td>
<td>53</td>
<td>Above 25 years</td>
</tr>
<tr>
<td>IT technicians</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Tenure</td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>Under 5 years</td>
<td>38</td>
<td>197</td>
</tr>
<tr>
<td>6-10 years</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>11-15 years</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Above 15 years</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>9</td>
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<tr>
<td>Total</td>
<td>154</td>
<td>100</td>
</tr>
</tbody>
</table>

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5.2 Questionnaires

Most of the measurement items relating to social influence (subjective norm, image, visibility, voluntariness) were taken from relevant studies. First, criteria of the referent for the subjective norm are via Shaw (1980), Brass (1984) and Rice & Aydin (1991). These criteria included: credibility (i.e. trust), status (i.e., equal or higher position), informal power, and relational proximity (i.e. past experience). For each question respondents were asked to indicate the extent of their agreement on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The item for credibility is: “I trust the person who is significant or influential to me.” Status is measured by: “The person who is significant or influential to me has the position similar to or beyond mine.” Informal power is measured by: “The person who is significant or influential to me is acknowledged of authority and prestige in my professional community and society.” Relational proximity is measured by the perceived frequency of official task-related meetings in a week with the person who is significant or influential to the respondent.

The measurement items of the subjective norm were adopted from Mathieson (1991) and Taylor & Todd (1995). These items relate to the injunctive norm that has been popularly stressed in studies. Measurement items of visibility, image and voluntariness came from Moore & Benbasat (1991). The measurement items of PU, PEU and intention to use were taken from Davis (1980) and Venkatesh & Davis (2000).

### 6. RESULTS

In testing the hypotheses four different models were run by PLS-Graph (version 3.0) and compared: two models (wireless internet service and spreadsheet) of knowledge workers and students. PLS was chosen because unlike other structural equation modeling tools, such as EQS, AMOS and LISREL, PLS does not require a large sample size (Barclay, Higgins, & Thomson, 1995; Chin, 1998). In order to ensure that the referent is indeed the person who has power and specific status, only the surveys whose average scores for the five questions on the referent in a questionnaire exceed 2.5 (the median of the 5 point scale) were included. Finally, 23 invalid cases were excluded from the knowledge worker samples, so 130 valid questionnaires were analyzed. In the student samples 183 valid questionnaires out of the 197 submitted were used.

#### 6.1 Test of Measurement Model

The measurement model for each sample (knowledge workers and university students) was tested separately by examining (1) internal consistency, (2) convergent validity, (3) discriminant validity. Internal consistency is examined using the composite scale reliability index developed by Fornell & Larcker (1981), which is similar to Cronbach’s alpha. Fornell & Larcker recommend using a criterion cut-off of .7 or .6. An examination of internal consistency shows that all items in both groups satisfy this criterion.

Convergent validity was addressed by examining the loadings of the measures on their corresponding construct. In this case the estimates of loadings for our four indicators (subjective norm, image, visibility, and voluntariness) are the regression weights (or coefficients). In the formative model the corresponding constructs are estimated by the linear aggregates of their observed indicators. Thus, the regression weights (or coefficients) can be used for the judgment of convergent validity, in contrast to the component loadings in the reflective model (Chin, 1998).

A rule of thumb is to accept items with regression weights of .7 or more (Barclay et al., 1995; Chin, 1998; Carmines & Zeller, 1979). However, it is also important to retain as many original items as possible to preserve the original research design and to compare the results with other studies that used the same scales. Six items in the knowledge worker group model show weights below 0.7. However, such low weights may also be the result of the small sample size (Barclay et al., 1995; Yoo & Alavi, 2001). Because these items exhibited the acceptable factor loading

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1. Measurement items are listed in the Appendix.
scores in the other studies, these six items were included in the final analysis.

In PLS the discriminant validity of items is assessed by criteria similar to multi-trait/multi-method analysis (Barclay et al., 1995). One criterion is that the construct should share more variance with its measure than with other constructs in a model. To assess discriminant validity Fornell & Larcker suggest using the measure of Average Variance Extracted. Table 2 shows the correlation matrix of all the constructs. For adequate discriminant validity the diagonals should be greater than the off-diagonals in the corresponding rows and columns and exceed .5 (Chin, 1998). Table 2 indicates that both samples meet these criteria.

Another criterion for discriminant validity is that no measurement item should load more highly on other constructs than the construct it intends to measure. An examination of factor and cross-factor loadings (Table 3) shows that all the items except voluntariness satisfy this criterion for both samples. So, voluntariness was dropped because it failed to meet this condition.

Tests for moderation using PLS require separating samples into groups where membership is based on some level of the hypothesized moderator variable. Separate analyses are run for each group and path coefficients are generated for each sub-sample. Problems occur when PLS derives new factor loadings and weights in separate analyses conducted in each sub-sample. The construct-level scores are subsequently estimated using different item weights in each sub-sample (Carte & Russell, 2003). The matching constructs between two sub-samples should consist of identical item weights. So, Carte & Russell (2003) proposed Box’s M test to verify this concern. If the two groups reflected in the dummy coded Z variable (e.g., knowledge worker and university students in our study) are independent, investigators should test the null hypothesis that inter-item covariance matrices within scales are equal using Box’s M test of equal covariance matrices between knowledge worker and university students are equal for both wireless internet service (Box’s M = 2.610, p = .459) and spreadsheet technology (Box’s M = 5.680, p = .131).

6.2 Test of Structural Model

Figure 2 presents the results of the structural model for both samples (knowledge workers and university students). To assess the statistical significance of the loadings and the path coefficients, which are the standardized $b$’s, a bootstrap analysis was used (Chin, 1998).

The results provide support for social influence on user beliefs on PU and PEU. For both groups it is hypothesized that social influence would have a positive impact on PU and PEU of both knowledge and non-knowledge groups (H1 and H2). The results of the PLS analysis show that social influence significantly affects PU and PEU in both groups. The direct path from social influence to intention to use is significant only for students (H3). As such, H1, H2 and H3 are supported. These findings suggest that the indirect impact of social influence on intention to use through internalization processes (i.e., PU and PEU) is explicit for knowledge workers whereas the direct impact on intention to use is not significant for knowledge workers.

It is hypothesized that social influence affects knowledge workers’ PU more strongly than that of students in regards to innovative IT, whereas PEU demonstrates the opposite situation. To test these hypotheses two unpaired t-tests, as in Keil, Tan, Wei & Saarinen (2000), were conducted (Table 4). Hypotheses on social influence (H4, H5) could be tested by statistically comparing the corresponding path coefficients in these structural models. Hence, H4 and H5 were tested by statistically comparing the path coefficients from social influence to PU and PEU in the structural model for knowledge workers with the corresponding path coefficients in the structural model for students. This statistical comparison was carried out using the following procedure (suggested by Keil et al., 2000).
Where \( S_{\text{pooled}} = \sqrt{\frac{[(N_i - 1)/(N_i + N_j - 2)] \times SE_i^2 + [(N_j - 1)/(N_i + N_j - 2)] \times SE_j^2}{N_i + N_j - 2}} \)

\[ t = \frac{(PC_i - PC_j)}{S_{\text{pooled}}} \times \sqrt{\left(\frac{1}{N_i} + \frac{1}{N_j}\right)} \]

Results showed that the path coefficient from social influence to PU for wireless internet service in the structural model for knowledge workers was significantly stronger than the corresponding path coefficient in the structural model for university students, supporting H4 (\( t = 31.96, p < 0.01 \)). Also, as hypothesized, social influence of knowledge workers on PEU yielded a significantly stronger inverse relationship. The paths from social influence to PEU demonstrated that the path coefficient from social influence to PEU of wireless internet service (\( t = -13.228, p < .001 \)) for university students was significantly stronger than the corresponding path coefficient for knowledge workers. Social influence has a more profound influence on university students' PEU than as knowledge workers, supporting H5.

Moreover, to examine whether the effects of social influence on knowledge workers’ beliefs (PU and PEU) are moderated by IT maturity, another round of unpaired t-tests was conducted. The beta coefficients from social influence to PU (H6) and PEU (H7) between the two ITs in the knowledge worker group were compared. The results support H6. Social influence has a more significant impact on the PU of wireless internet service than spreadsheets for knowledge workers (\( t = 21.237, p < 0.01 \)). Hence, the social influence of knowledge workers on PEU yielded a significantly stronger inverse relationship. Social influence has a more profound influence on knowledge workers' PEU about mature IT (\( t = -21.187, p < .001 \)) than innovative IT, supporting H7.

7. DISCUSSION

This study investigated the role of social influence on innovative IT adoption by knowledge workers with reference to the Technology Acceptance model. Most Technology Acceptance model studies use social influence interchangeably as the subjective norm. However, the definition of social influence is expanded to include three more constructs: image, visibility, and voluntariness. Refining the components of social influence is a prior step to identifying the genuine role of social influence on IT adoption. Besides, the criterion of referent for the subjective norm is set so that only influential people’s opinions can be reflected in the assessment of the subjective norm. Also, a contingency approach (Woodward, 1958; Fiedler, 1967; Lawrence & Lorsch, 1967; Thompson, 1967) is taken regarding the role of social influence on IT adoption.
of social influence, challenging the now traditional perspective of whether social influence makes an absolute impact on an individual’s IT adoption. So, whether social influence is subject to moderators (knowledge work and IT maturity) on the route to impact on PU, PEU and intention to adopt IT was investigated.

It can be concluded that only the subjective norm, image and visibility are appropriate operators of social influence, whereas voluntariness is not. The representative component of social influence, the subjective norm, can be measured more objectively with four criteria of referent: credibility, status, informal power, and relational proximity. It is also found that social influence is subject to user characteristics and IT maturity. User characteristics can be further broken down to the purpose of IT usage (Gefen & Straub, 2000) and to the user’s task characteristics.

Regarding task characteristics, knowledge workers are required more to make nimble judgment, discern the value of overloaded information and make decisions against unstructured business problems. For example, the financial consultants in insurance companies in the sample acquire information on product options by using mobile technology to access the organization’s database, compare those options, and make suggestions to fit the client’s circumstances during the initial contacts with clients.

Contrary to this situation and characteristics of users, university students tend to use spreadsheet software to solve the questions assigned by lecturers. The right solutions and processes already exist for such questions and students need to apply them to solve other or similar questions after getting familiar with such software. Students use wireless internet service only for simple retrieval of information that helps in assignment or communication with team mates to arrange meetings to conduct projects.

In short, these two groups of people are quite different in terms of task characteristics, such as structuredness and creativity. These differences may be related to some unique characteristics of the national culture of our research context (South Korea). However, due to such different task characteristics, knowledge workers and university students have different requirements for IT. Knowledge workers look to PU of innovative IT for the sake of effective decision making, whereas students concerned with PEU because they want to learn and use innovative IT more easily because they know the right solutions already exist. As knowledge

<table>
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<tr>
<th>Path</th>
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<th>Students</th>
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<tbody>
<tr>
<td>From</td>
<td>To</td>
<td>Mean</td>
</tr>
<tr>
<td>H4</td>
<td>SI PU</td>
<td>0.66</td>
</tr>
<tr>
<td>H5</td>
<td>SI PEU</td>
<td>0.37</td>
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* Note: More Than 5 Year Knowledge Workers vs. Students

<table>
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<tr>
<th>Path</th>
<th>More than 5 year tenure worker</th>
<th>Students</th>
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<tbody>
<tr>
<td>From</td>
<td>To</td>
<td>Mean</td>
</tr>
<tr>
<td>H4</td>
<td>SI PU</td>
<td>0.63</td>
</tr>
<tr>
<td>H5</td>
<td>SI PEU</td>
<td>0.41</td>
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(b) The Differences of Social Influence on IT Maturity in Knowledge Workers

<table>
<thead>
<tr>
<th>Path</th>
<th>WIS</th>
<th>Spreadsheet</th>
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<tr>
<td>From</td>
<td>To</td>
<td>mean</td>
</tr>
<tr>
<td>H6</td>
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<tr>
<td>H7</td>
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<td>0.37</td>
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</table>
workers are concerned more about PU in adopting innovative ITs, they are also more sensitive to social influence in regards to PU rather than to PEU.

Besides, as Gefen & Straub insist (2000) note, the purpose of IT usage is found to be another critical context where social influence matters in IT adoption. In this study, knowledge workers are likely to use wireless internet service for business purposes, not for mere exchange of information or for entertainment, as used for by university students. Therefore, knowledge workers prudently consider the usefulness of IT for their own tasks rather than blindly adopting and are open minded to others’ opinions in regard to the usefulness of IT. IT maturity does matter for knowledge workers’ adoption of IT. Thus, immature IT is not well proven in terms of usefulness. Therefore, knowledge workers must look for others’ opinions on the usefulness of immature IT with the focus on whether such new IT can enhance current task performance.

While social influence is a notable factor in understanding an individual’s adoption of IT, intense discussion of the operationalization of social influence has been omitted from the Technology Acceptance Model and related research. Specifically, no investigation has been conducted on the condition and mechanism governing the impact of social influence on usage behavior (Venkatesh & Davis, 2000). The proposition here to integrate image, visibility, subject norms and voluntariness for social influence addresses this gap in the literature.

Furthermore, the major mitigating factors on the effects of social influence on PU, PEU and intention to adopt IT were investigated. As knowledge becomes a core asset in organizations, firms should understand the effects of knowledge workers’ decision to adopt innovative IT. Such understanding can help improve the productivity of knowledge workers because IT should be adopted prior to realizing its promised value. Indeed, such an understanding may well be reflected in IT training programs or diffusion strategies of innovative IT in organizations. These all have practical implications for management.

Several directions for future research emerge from this study (which may be seen as current limitations i.e., its single location context). According to OECD reports in 2004, South Korea continues to take the lead in broadband network development and is ranked very high among OECD countries in regard to high-speed web access. Therefore, we assume that most knowledge workers and university students in South Korea have a similar familiarity with the Internet or wireless internet service. The difference between the groups lied in their reasons for using wireless internet service. However, people (especially knowledge workers) do not listen to all of the others’ voices. Identifying what are the sensitive opinions is the key to taking advantage of people’s psychology to allude to social influence in their decision-making. In short, this research provides useful implications for audiences in the conceptual (theoretical developments and empirical data) and practical aspects (for a range of groups, from workers to their employers and IT developers and providers).

REFERENCES


Fornell, C., & Lacker, D. 1981. Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18, 921-950.


APPENDIX 1: Questionnaire Items

<table>
<thead>
<tr>
<th>Social influence: ξ1</th>
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<tbody>
<tr>
<td>X1 Subject norm</td>
</tr>
<tr>
<td>1. People who influence my behavior would think that I should use WIS (or Spreadsheet software).</td>
</tr>
<tr>
<td>2. People who are important to me think that I should use WIS (or Spreadsheet software).</td>
</tr>
<tr>
<td>X2 Visibility</td>
</tr>
<tr>
<td>a. In my organization, I see WIS (or Spreadsheet software) on many computers.</td>
</tr>
<tr>
<td>b. WIS (or Spreadsheet software) is very commonly used in my organization.</td>
</tr>
<tr>
<td>c. It is easy for me to observe others using WIS (or Spreadsheet software) my organization.</td>
</tr>
<tr>
<td>X3 Image</td>
</tr>
<tr>
<td>a. People in my organization who use WIS (or Spreadsheet software) are more desirable than those who do not.</td>
</tr>
<tr>
<td>b. People in my organization who use WIS (or Spreadsheet software) have a high capability than those who do not.</td>
</tr>
<tr>
<td>c. Using WIS (or Spreadsheet software) is an indicator of advanced level in MIS.</td>
</tr>
<tr>
<td>d. Because of my use of WIS (or Spreadsheet software), others in my organization see me a more valuable man than those of others.</td>
</tr>
<tr>
<td>X4 Voluntaries</td>
</tr>
<tr>
<td>a. My use of WIS (or Spreadsheet software) is voluntary.</td>
</tr>
<tr>
<td>b. My supervisor does not require me to use WIS (or Spreadsheet software).</td>
</tr>
<tr>
<td>c. Although it might be helpful, using WIS (or Spreadsheet software) is certainly not compulsory in my job.</td>
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Perceived Usefulness: η1

y 1 Using WIS (or Spreadsheet software) would increase my productivity in my job.

y 2 Using WIS (or Spreadsheet software) would improve my performance in my job.

y 3 Using WIS (or Spreadsheet software) would enhance my effectiveness in my job.

y 4 I would find WIS (or Spreadsheet software) useful in my job.

Perceived Ease of use: η2

y 5 Learning to operate WIS (or Spreadsheet software) is easy for me.

y 6 I find it easy to get WIS (or Spreadsheet software) to do what I want to do.

y 7 It would be easy for me to become skillful at using WIS (or Spreadsheet software).

y 8 I would find WIS (or Spreadsheet software) easy to use.

Intention to Use: η3

y 9 Assuming I have access to WIS (or Spreadsheet software), I predict that I would use it.

Note: All items were measured on a 5-point Likert scale, where 1 = strongly disagree, 2 = somewhat disagree, 3 = neutral (neither disagree nor agree), 4 = somewhat agree, and 5 = strongly agree.