11-25-2011

# Towards a Theory of Information Systems User Competency

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芽|Sprouts Working Papers on Information Systems ISSN 1535-6078

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Individuals differ in their abilities to use information systems (IS) effectively, with some achieving exceptional performance in IS use. Various constructs have been identified in the literature to describe usage intentions of IS users and actual usage of IS, but studies to describe IS user competency or the ability to achieve proficiency in IS usage are lacking. This research develops a grounded model of IS User Competency (IUC) by using the Repertory Grid Technique in an inductive approach to identify a set of user factors associated with IS user competency. Based on the findings, a deductive approach using the survey method was undertaken to validate a subset of the model that focused on IS-specific factors - domain knowledge of and skills in IS, willingness to try and to explore IS, and capability of perceiving IS value. The overall framework of IUC also comprises Personal Disposition and Traits, General Learning and Cognitive Factors, Communication and Collaboration Skills and Tendencies, Job Experience, Formal Education, Generation Factors, and Exposure to Technology. The survey findings suggest that all three IS-specific factors in the model are relevant and important to IS user competency, with willingness to try and to explore IS being the most significant factor. The results not only highlight important factors that can be fostered in IS users to improve their performance with IS use but also present research opportunities for IS training and potential hiring criteria for IS users in organizations.

**Keywords:** IS User Competency, Repertory Grid, Grounded Theory

**Permanent URL:** http://sprouts.aisnet.org/11-143



**Reference:** Eschenbrenner, B., Nah, F. (2011). "Towards a Theory of Information Systems User Competency," Proceedings > Proceedings of JAIS Theory Development Workshop . *Sprouts: Working Papers on Information Systems*, 11(143). http://sprouts.aisnet.org/11-143

# TOWARDS A THEORY OF INFORMATION SYSTEMS USER COMPETENCY


## Abstract

Individuals differ in their abilities to use information systems (IS) effectively, with some achieving exceptional performance in IS use. Various constructs have been identified in the literature to describe usage intentions of IS users and actual usage of IS, but studies to describe IS user competency or the ability to achieve proficiency in IS usage are lacking. This research develops a grounded model of IS User Competency (IUC) by using the Repertory Grid Technique in an inductive approach to identify a set of user factors associated with IS user competency. Based on the findings, a deductive approach using the survey method was undertaken to validate a subset of the model that focused on IS-specific factors – domain knowledge of and skills in IS, willingness to try and to explore IS, and capability of perceiving IS value. The overall framework of IUC also comprises Personal Disposition and Traits, General Learning and Cognitive Factors, Communication and Collaboration Skills and Tendencies, Job Experience, Formal Education, Generation Factors, and Exposure to Technology. The survey findings suggest that all three IS-specific factors in the model are relevant and important to IS user competency, with willingness to try and to explore IS being the most significant factor. The results not only highlight important factors that can be fostered in IS users to improve their performance with IS use but also present research opportunities for IS training and potential hiring criteria for IS users in organizations.



**Keywords**: IS User Competency, Repertory Grid, Grounded Theory

## 1. **Introduction**

The ability to utilize information systems (IS) varies among individuals. Some users are able to utilize IS in an effective manner and capitalize on the opportunities that IS can provide. Others, however, are less likely to experience such benefits from using IS. For example, Jasperson et al. (2005) found that "users employ quite narrow feature breadths, operate at low levels of feature use, and rarely initiate technology- or task-related extensions of the available features" (p. 526). This variation in usage can lead to lower efficiency in completing a task or lower quality of decision making. Boudreau (2003) studied a state institution's successful implementation of an enterprise system and found different degrees of usage, with some employees struggling with using the new system. Poor quality of IS usage can hinder an IS user's ability to utilize an IS effectively or discover new utilizations of an IS.

The questions of interest are: Why are some individuals better able to utilize IS than others? How are these individuals different? This research focuses on identifying factors associated with IS user competency, defined as the *ability to realize the fullest potential and greatest performance from IS use* (Boudreau, 2003; Marcolin et al., 2000). Competency refers to "skills, behaviors, and capabilities that allow employees to perform specific functions" (Levy, 2006, p. 78). However, it is not clear what set of skills, behaviors and capabilities are associated specifically with IS user competency.

Hence, the specific research question is: *What are the relevant factors of IS user competency?* Answering this question can provide insights into potential training interventions or hiring criteria that can be employed to achieve greater IS proficiency in organizations. The contribution of this research is in developing a grounded understanding of IS user competency and validating the IS-specific factors to enhance the theoretical model development of IS user competency.

## 2. Review of Related Works

In reviewing previous research in IS competency, we found studies that focus on other related aspects such as IT competence in business managers and its outcomes (Bassellier et al., 2001). Bassellier et al.'s (2001) research categorized "competence as a skill" (p. 162), "competence as a personality trait" (p. 163), and "competence as knowledge" (p. 164). All three dimensions are examined inclusively in our research. For example, they conceptualized IT competence to include knowledge about existing technologies in a given business area and the value that it brings to an organization. Unlike their research which focuses on the outcomes of IT competency, we focus on factors associated with IS user competency. Our review of the MIS literature also entailed identifying existing constructs that may be associated with IS user competency. Table 1 presents these constructs. Most of these constructs have been utilized to describe IS users and to explain intentions to use IS and actual IS usage, but not in the context of achieving proficient IS usage by highly competent IS users. In short, there has been no cohesive or integrative effort to identify factors associated with IS user competency.

In summary, the literature seems to suggest that desirable IS users are not only creative, innovative, playful, willing to accept and use technology, unafraid of technology, and willing to explore technology, but they also have high self-efficacy and positive computer attitudes. However, the various constructs identified from the literature review have been utilized mainly to describe IS users with regard to their intentions to use IS and their actual IS usage rather than to explain or address IS user competency. It is not clear if these identified constructs are also associated with IS user competency and if there are new constructs associated with IS user competency that may not have been previously explored in the MIS literature.

| TABLE 1: CONSTRUCTS IDENTIFIED IN THE LITERATURE | | | |
|---|---|---|---|
| **Source** | **Construct** | **Description** | **Findings** |
| Agarwal & Prasad, 1998 | Personal Innovativeness in the Domain of IT (PIIT) | "The willingness of an individual to try out any new IT" (p. 206) | Validated scale for measuring PIIT. Found significant moderation for perception of compatibility and usage intentions. |
| Ahuja & Thatcher, 2005 | Trying to Innovate with IT | "An individual's goal of finding novel uses of information technologies" (p. 435) | Developed a measure for examining post-adoption IT use; Found that work environment factors (overload and autonomy) are antecedents to trying to innovate with IT; overload and autonomy interact, and the interactions vary by gender |
| Amabile, 1983, 1996 | Components of Creativity | A novel and appropriate, useful, correct or valuable response to the task at hand | Identifies Components of Creativity: domain-relevant skills (or expertise), creativity-relevant skills (or creative thinking), and task motivation |
| Bandura, 1997; Compeau & Higgins, 1995; Thatcher & Perrewé, 2002 | Perceived Self-efficacy; Computer Self-efficacy | Beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments or a judgment of one's capability to use a computer | Development and validation of measurement. Compeau & Higgins (1995) found computer self-efficacy to influence affect (or liking), computer anxiety, outcome expectations, and actual usage. Self-efficacy positively influenced by work group associates and their usage. Thatcher & Perrewé (2002) found computer self-efficacy to be influenced by computer anxiety and personal innovativeness in IT. |
| Burger & Blignaut, 2004; Loyd & Gressard, 1984 | Computer Attitude | Computer attitude is a mental state of mind which influences the way a person reacts towards computers… Computer attitude is composed of Computer Liking, Computer Anxiety, and Computer Confidence | Found negative relationship between computer attitude and computer experience; examined reliability and validity of Computer Attitude Scale |
| Butler & Gray, 2006 | Mindfulness | Individual mindfulness includes reasoning about new phenomena (openness to novelty), viewing situations from multiple perspectives (awareness of multiple perspectives), evaluating similarities and differences (alertness to distinction), recognizing the features of the present issue (sensitivity to different contexts), and orienting in the current situation (orientation in the present) | Suggest including individual and collective mindfulness in studies of design, use, and management of IS in realizing reliable work performance |
| Chung & Tan, 2004 | Focused attention/control (antecedents of perceived playfulness) | Focused attention is a user's attention being completely absorbed in the interaction, and control is perception of being in charge of a given activity | Studied the antecedents of perceived playfulness and found focused attention and control to be important cognitive dimensions |

| TABLE 1: CONSTRUCTS IDENTIFIED IN THE LITERATURE | | | |
|---|---|---|---|
| **Source** | **Construct** | **Description** | **Findings** |
| Fagan et al., 2003-2004; Torkzadeh & Angulo, 1992; Thatcher & Perrewé, 2002 | Computer Anxiety | Anxiety or fear experienced when confronted with possibilities of computer usage or the tendency of individuals to be uneasy, apprehensive, or fearful about current or future use of computers | Studied relationships among computer self-efficacy, anxiety, experience, support and usage. Found computer anxiety negatively related to self-efficacy and experience. Presented concept, correlates, and suggestions for future research. Computer anxiety is influenced by personal innovativeness in IT and trait anxiety, and influences computer self-efficacy. |
| Ghani & Deshpande, 1994 | Optimal Flow | The state in which people are so intensely involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost | Sense of control and task challenge factors resulted in optimal flow. Flow related to exploratory behavior which was related to extent of computer use. |
| Nambisan, Agarwal, & Tanniru, 1999 | Technology Cognizance | A technology user's knowledge of a technology's capabilities, its potential uses and features, as well as its cost and benefits. | Organizational mechanisms (attending IT conferences, subscription to IT journals, joint ventures, and vendor demonstrations) associated with acquisition of industry specific IT knowledge and context-free IT knowledge were found to be significant determinants of technology cognizance. |
| | Ability to Explore | A technology user's perceived competence in appropriately applying the necessary cognitive and physical resources to conduct technology exploration. | Organizational mechanisms (user groups, customer support unit, user lab, and relationship manager) associated with conversion of industry specific IT knowledge and context-free IT knowledge into firm specific IT knowledge was found to be significant determinants of ability to explore. |
| | Intention to Explore | "A user's willingness and purpose to explore a new technology and find potential use…a user's purpose and motivation to innovate based on the perceived business related benefits she will derive from IT deployment" (p. 373). | Organizational mechanisms (IT steering committee, strategic IT planning committee, and IT task group) associated with acquisition of firm specific IT knowledge was found to be a significant determinant of intention to explore. |
| Rank et al., 2004 | Creativity and Innovativeness | Creativity refers to idea generation, whereas innovation refers to idea implementation… Creativity is truly novel, whereas innovation can be based on ideas that are adopted | Identified research gaps in process differentiation, integration of concepts, and cross-cultural analysis. |
| Webster & Martocchio, 1992 | Microcomputer Playfulness | Degree of cognitive spontaneity in microcomputer interactions | Developed measure and found microcomputer playfulness to have positive relationships with computer attitude, computer competence, computer efficacy, and an inverse relationship with computer anxiety |

## 3. Qualitative Study - Development of a Model

The first part of this research uses an inductive approach to identify user factors associated with IS user competency. Specifically, the Repertory Grid (RepGrid) technique and content analysis approaches were used to develop a model of IS User Competency (IUC).

### 3.1 Research Method

The RepGrid technique was used to identify factors that distinguish highly competent users from least competent users from the perspective of business professionals who are also IS users themselves. The RepGrid technique has been utilized successfully in previous IS research to identify differences in characteristics of individuals, including characteristics of software development team members (Siau et al., 2010) and qualities of excellent systems analysts (Hunter, 1993). The strength of the RepGrid technique is in capturing individuals' personal constructs that bring meaning and understanding to various phenomena (Stewart, 1981).

RepGrid is based on Kelly's personal construct theory (Hunter, 1997 citing Kelly, 1955, 1963). The premise of personal construct psychology is that each individual is his or her own scientist and that, according to Kelly, each individual creates a theoretical framework or a personal construct system to give meaning to various phenomena (Fransella et al., 2004; Stewart, 1981). In other words, these constructs are used by an individual to interpret the world (Pervin, 1984), and are used as guidance when engaging in sensemaking (Davis and Hufnagel, 2007). A critical point noted by Walker and Winter (2007) is that discriminations (or constructs) are developed by individuals in which some things are identified as similar and others as different. The discriminations are bipolar and dependent upon the bipolar poles to provide understanding. Tan and Hunter (2002) also noted Kelly's contention that personal constructs are bipolar in nature. Therefore, for example, when an individual reflects on highly competent users versus

incompetent users, they might identify bipolar construct pairs such as flexible—rigid or change agent—change resistant. In Hunter's (1997) research on excellent systems analysts, an example of bipolar construct pairs that were identified included "delegator—keeps to himself" and "knows details—confused" (p. 73). In order to explore and extract these personal construct systems, Kelly (1955, 1963) developed the RepGrid technique, which is utilized in more than 90 percent of personal construct research (Walker and Winter, 2007). Bell (1988) notes that the RepGrid relates to personal construct theory by reflecting the construing process, which is the fundamental basis of the theory itself.

Pervin (1984) quoted Bonarius (1965) in recognizing that the standardized use of the RepGrid provides a stable and representative set of constructs. The RepGrid technique allows for more precision and minimizes biases more so than other approaches (Stewart, 1981). They suggest that the technique can effectively obtain a significant amount of detailed information while limiting the input of the researcher. Hunter (1997) suggests that when the participants are allowed to select their own elements and constructs (described below), the RepGrid provides a structured data-gathering process while still providing participants the greatest amount of freedom to share their perspectives about a particular subject. Therefore, this technique is an appropriate and reliable method for capturing an extensive set of detailed and unbiased constructs from the personal construct systems of IS users (Stewart, 1981; Hunter, 1993, 1997). Details of the RepGrid technique can be found in Stewart (1981) and Fransella et al. (2004).

The research procedures used in this study consist of seven steps explained below:

***Step 1: Participant Selection***

Participants were IS users selected from a variety of industries, versus just one organization, to increase the generalizability of our findings. If just one organization was selected, a smaller number of highly competent users may have been identified by the participants (i.e., several

participants may have identified the same highly competent users) and, hence, only characteristics from this smaller selection would potentially be obtained. The sample size for the study was determined by the point of saturation where no new constructs emerged from interviews with additional subjects. Tan and Hunter (2002) indicated that a sample size of 15 to 25 is generally adequate to reach the saturation point. The definition of IS, which refer to technology-driven systems that collect, process, store, and distribute information to support the operations, analysis, and decision-making of an organization, was provided to participants to determine eligibility for participating in this research and when selecting IS users that they know, as described in Step 2.

***Step 2: Select Elements***

The next step was to solicit *elements* which are the focal point of the study (Tan and Hunter, 2002). In this research, the potential elements are IS users that the participant is familiar with who either currently work with or have previously worked with IS. At the beginning of each interview, the participant was asked questions to help them identify highly and least competent IS users that they know. The participant was then asked to identify the top and bottom three IS users from each of these categories. These six identified users were included in the pool of elements for the RepGrid study. Each element was listed on a separate card and this complete set of six elements was then utilized in step 3.

***Step 3: Identify Constructs***

*Constructs* identify the interpretation of the elements (Tan and Hunter, 2002). According to Fransella et al. (2004), individuals interpret events with the use of bipolar dimensions, or personal constructs, with which they can identify what some person/place/thing is and what it is not. For example, one set of the bipolar constructs developed by Hunter (1997) in researching the qualities of excellent system analysts was "user involvement—lack of user involvement."

The research participant was asked to identify constructs using the triadic approach. More specifically, three elements were selected by the researcher (i.e., randomly drawn but ensuring that both highly competent and least competent categories were represented) and the participant was asked to identify how two of them were similar but different from the third in the context of their ability or inability to utilize IS. Confirmation was solicited to identify the positive and negative bipolar ends of the construct. Also, the laddering approach was utilized in which questions such as "how" and "why" were asked to gain further insight into the meanings of the participant's constructs (Tan and Hunter, 2002).

***Step 4: Develop Links***

*Links* illustrate the relationship between elements and constructs from the research participant's perspective, as well as interpretations of similarities and differences (Tan and Hunter, 2002). For this step, the participant was asked to physically arrange the elements' cards according to their relative positions on each of the bipolar constructs identified. If elements were construed as being the same, they were placed together so the participant was not forced to rank one over the other. Then, the participant was asked to rate the elements on a 1 to 9 scale, with 1 being the negative end and 9 the positive end.

Steps 3 and 4 were repeated until no new constructs emerged or the point of redundancy was reached. Reger (1990) indicated that previous research identifies seven to ten triads to be sufficient.

***Step 5: Add Two Bipolar Elements***

Two additional elements that represent the extreme ends of the bipolar constructs, an Ideal User and an Incompetent User, were included in the pool of elements to support the construct elicitation process. Definitions for these individuals (utilizing the definition of highly competent user noted above) were provided to the participant. These cards were included *after* the above

procedures with the original set of six elements to introduce additional opportunities to elicit any other constructs that the participant felt would be associated with his/her conception of a highly competent user that may not have been identified with the previous six elements. Steps 3 and 4 were repeated ensuring that each triad had the Ideal User, Incompetent User, or both included. The steps were repeated until the point of redundancy was reached.

***Step 6: Visual Focusing and Review***

After the grids completion, visual focusing was utilized in which the participant was asked to review the grid and evaluate the ratings given to each element for the respective construct to ensure they agreed with what had been accomplished. Also, the participant was asked if the ratings given to the respective elements represented the participant's conception of an 'Ideal User' and 'Incompetent User.' To further verify the reliability of the constructs elicited, during the final stage of the interview, the participant was asked to focus on the highly competent users of IS that they identified earlier and asked probing questions such as: "If you can envision, for a moment, those individuals that you most closely associate with an Ideal User, how would you describe these people in terms of what makes them ideal users of information systems?" If any new constructs emerged, they were included in the existing list and step 4 was repeated.

***Step 7: Analysis of RepGrids***

To conduct a qualitative analysis of the RepGrids generated from the data, the constructs that were generated were categorized following Stewart's (1981) approach of content analysis and Strauss and Corbin's (1998) open coding methodology. The Q-sort method was also utilized by each of two coders to group these constructs into categories following the method described by Moore and Benbasat (1991). Based on these prescribed procedures, constructs were placed on individual cards, and each coder sorted the cards into piles of similar constructs and provided a label to each pile. The inter-coder consistencies were then evaluated, followed by allowing

independent corrections to be made by each coder. The final discrepancies were then resolved between the two coders through consensus.

### 3.2 Data Collection and Analysis

A total of 20 RepGrid sessions were conducted with 10 males and 10 females. Table 2 shows the demographic information of the participants. As presented in Table 2, research participants have an average work experience of 15 years and an average of 11 years of using IS. Half of the participants are in management/supervisory positions and examples of IS used by participants include SAP, Siebel, and Lawson.

**TABLE 2: DEMOGRAPHIC INFORMATION**

| Age | **21-30** | **31-40** | **41-50** | **51-60** |
|---|---|---|---|---|
| # of Participants | 6 | 7 | 5 | 2 |
| | | | | |
| Job Position | **Management** | **Non-Management** | | |
| # of Participants | 10 | 10 | | |
| | | | | |
| | **Mean** | **Max** | **Min** | |
| Work Experience | 15 | 30 | 4 | |
| IS Experience | 11 | 30 | 2 | |
| No. of people supervised | 2 | 14 | 0 | |
| | | | | |
| Industry Examples | *Retail*<br>*Publishing* | *Healthcare*<br>*HR Consulting* | *Manufacturing*<br>*Insurance* | *Chemical Engineering*<br>*Financial Services* |
| IS Examples | *Lawson*<br>*Quadra Med* | *SAP*<br>*Rumba* | *Siebel*<br>*COGNOS* | *Datatel*<br>*Custom Developed* |

All participants were able to identify three top and three bottom IS users except for one participant who could only identify two of each. A minimum of seven triads were conducted for all participants and most sessions lasted approximately 1 to 1 ½ hours. The grounded theory approach was used to analyze the qualitative data collected and to develop a conceptualization of IS User Competency. The strength of this approach is providing a means with which theory can be grounded in categories of data. In particular, the open coding methodology outlined by Strauss and Corbin (1998) and the sorting procedure described by Moore and Benbasat (1991)

were utilized in which bipolar pairs describing similar constructs were grouped or piled together and were kept separate from those bipolar pairs describing different constructs.

The saturation point for the study was reached after the sixth participant. The first six participants included individuals with extensive work experience, one up to 30 years, and fairly extensive managerial experience, one supervising up to 12 individuals. Considering managerial duties and responsibilities typically include evaluations of others, providing feedback, and assessing training improvements that are needed, the saturation point was not surprisingly reached after interviewing the first six participants. However, additional interviews were conducted to enhance the richness and validity of the findings, and to confirm that the point of redundancy or saturation has been reached.

In addition, to ensure the order of the participants did not influence the saturation point, the saturation point was reviewed as if participants were interviewed in the reverse order. If the reverse order of conducting interviews had taken place, the saturation point would have happened after 12 participants. Hence the saturation point was adequately reached. To address potential issues of construct validity and reliability, Yin's (1994) three Principles of Data Collection – using multiple sources of evidence, creating a database, and maintaining a chain of evidence – are addressed.

The first principle is addressed using multiple coders to ensure triangulation of data. Two coders independently sorted the 416 bipolar pairs elicited from the participants. In the first round of independent coding, Cohen's Kappa of .76 was achieved between the two coders. In the second round, each coder then independently reviewed their own and the other coder's sorting results, and indicated if they agreed with their original classification or the other coder's classification for constructs where they coded differently. After reviewing each other's coding

and making any corrections each of them deemed appropriate, Cohen's Kappa of .93 was obtained. These results are acceptable as Sun and Zhang (2006) who cite Moore et al. (1995) and Jarvenpaa (1989) suggest that Kappa scores no lower than .65 are considered acceptable. The remaining discrepancies were discussed and resolved through consensus between the coders. In addition, coding results were verified with the participants by presenting the results to them and giving them the opportunity to reclassify concepts, redefine any category or subcategory, or pose any other changes or questions. All subsequent responses were reviewed and clarifications/changes incorporated in the data analysis. A validation check was also performed to ensure that research participants identified individuals who met the definition of highly competent IS users instead of those who are technology savvy with no business application capacity. The results indicated that participants selected individuals matching our definition.

The second and third principles recommend creating a database and maintaining a chain of evidence such that an independent party could follow the data collected to the final conclusions. In the case study context, two separate data collections are considered: the data and the investigator's report. In this research, a database of all concepts identified by each of the participants (the data) was created and stored. For confidentiality, all research participants' identifying information was not included in the database. The results of initial coding (considered the investigator's report) and all subsequent coding and categorizations of the data were also kept in separate databases, with each iteration of coding and categorization of the results maintained separately. Also, all interviews were audio taped and the audio files were stored in a database.

As mentioned previously, open coding was carried out by having two coders examine the 416 bipolar pairs that participants generated and identify the similarities and differences using

the sorting procedure described by Moore and Benbasat (1991). The categories that emerged were further broken down into richer subcategories as appropriate. Also, following the steps of grounded theory, the different levels of subcategories were related back to their higher-level categories, and overarching categories (or *themes*) were identified. This step is consistent with identifying superordinate and subordinate constructs within a personal construct system in which subordinate constructs are included in the context of superordinate constructs (Pervin, 1984). By relating back to the bipolar ends and the anecdotal evidence in the transcripts, the names and definitions for categories and subcategories were refined and themes were identified.

**3.3 Findings**

Table 3 shows the 22 categories that emerged from the analysis along with the number of times each category and subcategory was mentioned by the participants. Table 3 also provides the definitions of the categories and subcategories as well as examples of their bipolar ends.

Several overarching themes emerged during the coding steps. These themes emerged by the common axes found among categories sharing similar properties and dimensions. These themes and the categories that fall under them are presented in Table 4. The key themes describing highly competent IS users are General Learning and Cognitive Factors, Personal Disposition and Traits, and Communication and Collaboration Skills and Tendencies. Domain Knowledge of and Skills in IS, Willingness to Try and to Explore IS, and Capability of Perceiving IS Value emerge as the core of Information Systems User Competency. These three categories present the IS skill, behavior, and capability contributing to competency in IS usage and elaborate on the definition of competency as "skills, behaviors, and capabilities" (Levy, 2006, p. 78) in the IS competency context.

| TABLE 3: CONSTRUCT CATEGORIZATION | | |
|---|---|---|
| **CATEGORY/*SUBCATEGORY*<br>(No. of Constructs)** | **Examples of Positive-Negative Bipolar Ends** | **Definition** |
| Ability and Desire to Learn (48) | | Ability and interest to self-initiate learning, find solutions to problems and discover new knowledge |
| *Willingness to Ask Questions (2)* | "Willing to ask questions - Don't ask questions" | Willingness to probe deeper to find answers |
| *Capacity for learning (9)* | "Ability to learn - Not able to learn" | Ability to assimilate new knowledge |
| *Ability to learn quickly (9)* | "Quick learner - Slow learner" | Ability to quickly understand and apply knowledge gained |
| *Ability to learn independently (9)* | "Facilitate own learning of IS - Have to be taught how" | Ability to self-initiate learning |
| *Willingness to learn (19)* | "Willing to understand new IS - Unwilling to try to understand" | Desire to obtain new knowledge and understanding |
| Domain Knowledge of and Skills in IS Usage (40) | | Understanding how IS operate and ability to operate IS |
| *Domain knowledge of IS (21)* | "Understand how IS operates - Being a strict user/not a supporter" | Technical understanding and basic knowledge of IS & operations |
| *Skills at using IS (19)* | "Effective use of system - Can't effectively use system" | Ability to perform normal IS operations well and utilize IS |
| Motivation/Perseverance (39) | "Doing whatever it takes to get job done - Clock-watchers/not focused on job" | Highly driven and determined to accomplish a task, hold a strong work ethic and is reluctant to give up one's pursuits |
| Willingness to Try and Explore IS (37) | "Not afraid of IS - Fearful" | Willingness and comfort with trying technology and using IS |
| Exposure to Technology (31) | | Prior experiences with technology |
| *Prior Experience (26)* | "Grew up w/ technology - Minimal exposure to technology" | Previous opportunities to learn/use IS |
| *On-going Use (5)* | "Technology part of life - Have to learn how to incorporate" | Continuous routinized use of technology |
| Job Experience (30) | | Specific experiences in job-related tasks |
| *Variety of Job Experience (11)* | "Exposure to multiple situations - Not exposed to multiple situations" | Exposure to multiplicity and variation |
| *Task Experience (19)* | "Users of IS reports - Not IS report user" | Specific experience in job-related tasks |
| Capability of Perceiving IS Value (27) | "Recognize potential benefits of IS - Not being able to recognize value/connection to job" | Ability to see the benefits and opportunities that IS can provide |

| | | |
|---|---|---|
| Open-mindedness (27) | "Sees big picture - Narrow-minded" | Being able to reason about new ideas/approaches and being aware of multiple perspectives |
| Willingness to Teach, Share, and Collaborate (19) | "Able to train others - Not able to train others" | Willingness to share knowledge and work with others |
| Intellectual Abilities (18) | "Logical thinking - Illogical" | Being quick, logical, and analytical in thinking processes with a high-degree of intelligence |
| Adaptability (17) | "Willing to change - Unwilling to change" | Willingness to embrace change and flexibility to adapt to changes |
| Precision in Task Execution (13) | "Likes to verify accuracy - Produce reports only/not verify" | Attention to accuracy and detail |
| Confidence (13) | "Self-confident/assured - Lacking confidence" | Sense of self-assurance in one's abilities |
| Ability to Solve Problems (10) | "Find ways to make things work - Make bigger problems/affects other things" | Capacity to resolve issues and find solutions |
| Dedication (9) | "Takes ownership of information/reports - Just doing job" | Commitment to one's job with high ownership and pride in tasks performed |
| Generation Factors (8) | "Younger - Older" | Generation one belongs to |
| Formal Education (8) | "Higher education - Less education" | Holds higher education degree |
| Communication Skills (7) | "Communicator (oral & written) - Inability to communicate" | Capacity to communicate (oral and written) |
| Sense of Curiosity with IS (5) | "Curiosity w/ technology - Phobia of technology" | Possess a curious, exploratory nature |
| Positive Attitude (4) | "Focus on positive - Focus on negative" | Having a positive attitude |
| Risk Taking Propensity with IS (3) | "Not fearful/takes risks - Afraid of breaking/doing something wrong" | Willingness to take risks |
| Efficiency at Task (3) | "Efficiency at using IS - Inefficient at using" | Ability to manage time well and carry out tasks efficiently |

**TABLE 4: THEMES FROM CODING**

| Theme | Related Categories |
|---|---|
| General Learning and Cognitive Factors | Intellectual Abilities, Ability and Desire to Learn, & Ability to Solve Problems |
| Personal Disposition and Traits | Motivation/Perseverance, Confidence, Dedication, Positive Attitude, Precision in Task Execution, Efficiency at Task, Adaptability, Sense of Curiosity with IS, Open-Mindedness, & Risk Taking Propensity with IS |
| Communication and Collaboration Skills and Tendencies | Willingness to Teach, Share, and Collaborate, & Communication Skills |

Categories that do not revolve around a common axis or theme with other categories are Formal Education, Job Experience, Exposure to Technology, and Generation Factors. Participants mentioned that highly competent users had a higher education degree, had certain job experiences that contributed to their competency of IS, have previously been exposed to technology, and were typically from a younger generation.

The categories and each of the key themes identified as well as the core of IS User Competency are discussed next.

***Information Systems User Competency Core***

The core of information systems user competency, or those categories directly related to IS, includes the categories of Willingness to Try and to Explore IS, Domain Knowledge of and Skills in IS, and Capability of Perceiving IS Value. Willingness to Try and to Explore IS emerged from characteristics that explained highly competent IS users as being unafraid to try new technologies and research how things work. Highly competent users were described as being comfortable with trying technology and using IS. These individuals were noted as being willing to invest the time to explore an IS. Their enthusiasm and playfulness with IS were also cited as characteristics, as well as their acceptance of making mistakes. As one research participant explained:

> [Referring to highly competent user] *" he loves to research how things work on the computer, whether it is web pages or the mainframe system, how all the information is connected and how to retrieve the data.*…[Referring to incompetent users] *these two do not…just using the system"*

Also, the Domain Knowledge of and Skills in IS category emerged from characteristics that described highly competent users as being able to not only comprehend the operations behind an IS, but also knowing effective ways to utilize the system. This understanding was described as having knowledge of how an IS operates and knowing ways to utilize the system effectively.

Highly competent users were not only cited as being willing to explore and having knowledge of and skills with IS, but were also cited as having high Capability of Perceiving IS Value. Highly competent users were identified as appreciating the value that technology presents and the benefits that IS can provide. Some participants indicated that highly competent users view IS as a strategic tool and as an extension of themselves. Therefore, highly competent users are recognized as seeing the potential that IS presents, being able to identify the value of IS, and being able to recognize efficiencies and improvements brought about by IS. For instance,

> [Referring to incompetent users]*"it's not even that they don't want to be technology proficient, but they just don't see the reason to do it…*[Referring to highly competent users] *because they want to be… made a very visible effort to take that technology on because they knew it was important…they wanted to do it…*[Referring to incompetent users] *these two individuals don't want to do it…you need to have a payoff, a benefit…these particular individuals don't see the payoff"*

In summary, IS users were noted as being open to trying technology and having IS skills and knowledge. They continue to use technology and incorporate it as part of their work routines, and in some instances, many aspects of their lives. They can also see many benefits and opportunities that an IS can potentially provide.

***General Learning and Cognitive Factors***

General Learning and Cognitive Factors include the categories of Intellectual Abilities, Ability and Desire to Learn, and Ability to Solve Problems. Each of these categories recognizes a unique cognitive aspect of highly competent users, and hence, is linked by the cognitive processes that were identified by research participants. As noted in Table 3, some of the categories of IS user competency that were identified were further partitioned into subcategories to provide a richer understanding of these multi-dimensional categorizations. For example, the category, Ability and Desire to Learn, was further sub-categorized into Capacity for Learning, Ability to Learn Quickly, Ability to Learn Independently, and Willingness to Learn.

Research participants indicated that highly competent users are individuals who are filled with intellectual pursuits and are invigorated by learning. They were described as individuals who search for meaning and enjoy seeing how things are connected. They are also willing to spend time to learn and to experience the learning curve, as well as being willing to make mistakes and to be wrong.

Interesting findings within the Ability and Desire to Learn category are Ability to Learn Independently and Ability to Learn Quickly. Some of the comments noted indicated that highly competent users took the initiative to learn IS and wanted the hands-on learning experience. These individuals were not only recognized for their ability and willingness to learn, but also for their ability to go beyond (or possibly forego) formal training and utilize self-initiated learning. Therefore, they may have been trained and may rely on support as they deem necessary, but are clearly not relying on training or training support alone for their ultimate knowledge acquisition in using IS. Additionally,

these individuals were noted as quick learners, being able to apply their knowledge faster, and just "get it" quickly versus being slower to learn, recall, and acclimate to IS.

Also, within the theme of General Learning and Cognitive Factors, research participants indicated that highly competent users hold a certain level of intellectual capacity or Intellectual Abilities. They were described as being logical and analytical with rapid thinking capacities versus being slow thinkers. Highly competent users were also described as problem-solvers in that they have the ability to find solutions to their IS dilemmas. Problem-solving characteristics (or Ability to Solve Problems) of highly competent users that were generated indicated that highly competent users look for solutions when problems occur and assist with trouble-shooting. See Appendix A for examples of participant commentary.

Therefore, highly competent users were described as having a general set of cognitive abilities that encompasses their intellectual abilities, their desire and capacity to learn, and their propensity to be problem-solvers. They are considered logical and analytical thinkers who learn quickly and independently. They also tend to be trouble-shooters who actively seek answers.

***Personal Disposition and Traits***

Personal Disposition and Traits include the categories of Motivation/Perseverance, Dedication, Positive Attitude, Precision in Task Execution, Efficiency at Task, Adaptability, Sense of Curiosity with IS, Open-mindedness, Confidence, and Risk Taking Propensity with IS. Research participants indicated various personal characteristics of highly competent users, hence the linkage that brings these categories together into this theme. These characteristics indicate that highly competent users are driven and persevere in their pursuits, are self-assured, are committed and take pride in what they do, and hold a positive attitude. They also give much attention to

detail and in managing their time. They are flexible, are open to new approaches, and have a multi-dimensional view which complements their exploratory nature and their propensity to take risks.

Motivation/Perseverance captures the highly driven nature of highly competent users, as well as their determination to accomplish a task, strong work ethic, and reluctance to give up their pursuits. Highly competent users were described as having patience with IS and not deterring by failures experienced when using an IS. Also, they were labeled as being aggressive, high achievers, and go-getters.

Dedication also emerged from the characteristics generated. Highly competent users were depicted as people who take pride and ownership in their work. They were also described as being committed to their departments and being happy with the fit between their job and their interests. Research participants also specifically indicated that they hold a Positive Attitude.

Research participants considered highly competent users as having a detailed approach in task execution (Precision in Task Execution) and a disciplined approach on time management at task execution (Efficiency at Task). They also noted attention to and being attuned to accuracy as characteristic of highly competent users.

Adaptability, or being open to change and able to work under a variety of conditions, was also identified as a characteristic of highly competent users. Research participants highlighted that these users take less time to adapt to change and are flexible. Also, they were noted to be able to work under a variety of conditions and were the ones who would look for change and embrace it.

Interestingly, Sense of Curiosity with IS or curious, exploratory nature was also identified as describing highly competent users. This category indicates that highly competent users have a sense of inquisitiveness and curiosity about IS. In addition, Open-mindedness of highly competent users was noted and characterizes their ability to reason about new ideas or approaches and being aware of multiple perspectives. They were noted as being able to make connections between the system and the task at hand, visualize processes, and see the big picture. They are also open to new ideas and were labeled as being creative and innovative. To note, one research participant explained their creative characteristics as:

> "*Disciplined creativity…any system requires some discipline in using it, but seeing outside the boundaries of the discipline that someone else has established and figuring out either other ways of capturing that are superior or other ways of using the data that had not been envisioned"*

This finding is especially insightful as it highlights the unstructured, novel cognitive processes that a highly competent user exhibits.

Interesting results that emerged from other personal characteristics that were identified are Risk-taking propensity with IS as well as Confidence. Highly competent IS users were noted as being willing to accept risks with IS and not wanting to stick to only what they know. For example:

> [Referring to highly competent users]"*They're also risk takers…in that they are willing to go out and they'll just try anything...*[Referring to incompetent users] *they just stay closer to what they already know and they don't branch out"*

Highly competent users are also confident in themselves. Constructs identified noted that these users are secure in their abilities and are not protective of information or their reputation. See Appendix A for examples of participant commentary.

In summary, research participants indicated that highly competent IS users have certain personal characteristics that they believe contribute to their ability to use IS better than less competent users. In their opinion, highly competent users are motivated and perseverant, hold a positive outlook, and are committed. They are precise and are efficient managers of time. They tend to be adaptable and curious with abilities to visualize processes and think in novel manners. Portraying high levels of confidence, these users tend to be willing to take risks.

***Communication and Collaboration Skills and Tendencies***

Communication and Collaboration Skills and Tendencies include the categories of Willingness to Teach, Share, and Collaborate as well as Communication Skills. These categories identify specific interactions and relations with other IS users and, therefore, are linked by the association and interaction that highly competent users have with other IS users. Highly competent users were described as inclined to share information, as well as work with and train others, which is highly dependent on their ability to communicate. The elicited constructs indicate that highly competent users have good communication skills (both written and oral), are team players and collaborators, and are good with people. See Appendix A for examples of participant commentary.

***Job Experience***

The Job Experience category is defined as specific experiences in job-related tasks. Constructs included in Job Experience indicated that individuals having multiplicity in job tasks, and having specific job tasks that lend to competency in IS as well, are associated with highly competent IS users. Research participants indicated that highly competent users had wide and varying ranges

of experiences in tasks and responsibilities. Therefore, this category includes exposure to multiplicity and variation (i.e., variety of Job Experience). Research participants also identified specific non-IS experiences that contributed to competence in IS, indicating abilities to transfer skills to the IS domain. For example, they identified those who were experienced in analyzing reports and data to be more proficient with IS use. See Appendix A for examples of participant commentary.

***Exposure to Technology***

Exposure to Technology refers to prior experiences with technology and on-going use. A highly competent user not only had high accessibility to technology, but continued to utilize technology in their job functions and in their daily lives. Research participants indicated that highly competent users were individuals who grew up with technology and have had experiences using technology. Some had extensive access to IS functions or have been heavily involved with IS implementations. See Appendix A for examples of participant commentary.

***Generation Factors***

The Generation category recognizes that the generation one belongs to can contribute to highly competent IS users' abilities to utilize IS differently from others. Research participants indicated that highly competent users were more likely to be from a younger generation. These constructs generated are deemed to represent more general characteristics of an individual. Therefore, when these characteristics were mentioned by the participant, the constructs were recorded on their grid and additional probing questions were asked (such as "how" and "why" which is consistent with the laddering technique described earlier) to identify more specific characteristics relating to them. The more specific characteristics are included in the categories previously mentioned.

***Education***

The Education category portrays the research participants' perspective that the highly competent users they identified for this research have some type of advanced or technical degree. After research participants provided such characteristics, laddering questions were also employed. These subsequent characteristics that were generated are included in the other respective categories noted above.

***Summary of Findings***

The results from this study have provided insights into the characteristics of highly competent IS users and, hence, a rich set of factors associated with IS user competency. Based on their personal construct systems, research participants indicated that characteristics of highly competent users include their understanding and capability to operate IS, their comfort levels with trying technologies and using IS, and their ability to see the value that an IS can provide. Participants indicated that the highly competent users they know tend to belong to a younger generation, hold a higher education degree, have job-related experiences, and have prior use and continued use of technologies.

Communication skills as well as willingness to use these skills to work with others were also identified. Highly competent users were described as having the capacity to learn and to initiate their own learning, utilizing logical and analytical approaches, and capable of rapid processing and learning speeds. They were labeled as being driven, committed, and positive in their outlook. Also, they were noted as attuned to accuracy and efficiency in managing their time. With an exploratory nature and openness to change, they are able to reason about new ideas and visualize in multiple dimensions and perspectives. Holding a higher level of self-assurance, they are more willing to expose themselves to risks.

A summary of the above findings is presented in Figure 1. This framework of IS User Competency (IUC) identifies the core IS constructs (i.e., Domain Knowledge of and Skills in IS, Willingness to Try and to Explore IS, and Capability of Perceiving IS Value) and the associated categories and subcategories that are all associated with IS user competency.

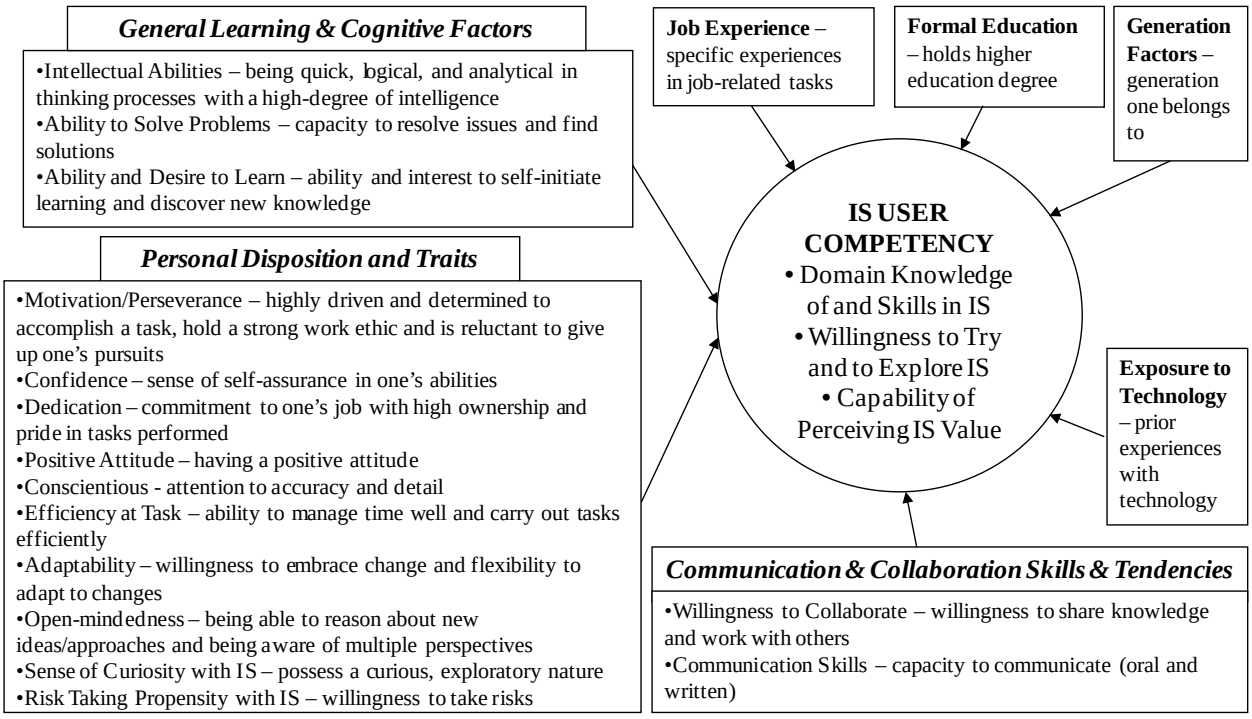



**Figure 1: IS User Competency (IUC) Framework**

## 4. Quantitative Study – Validation of IS-Specific Factors

This quantitative study validates the relationships of the IS-specific factors (i.e., domain knowledge of and skills in IS, willingness to try and to explore IS, and capability of perceiving IS value) with IS user competency.

### 4.1 Hypotheses Development

***Future Time Perspective Theory***

To assess the relationship between capability of perceiving IS value and IS user competency, we draw on the Future Time Perspective Theory, which proposes that the utility value of a present factor or task for achieving a future goal or accomplishing a future task is important for persistence, motivation, and performance outcomes (Simons et al. 2000, 2003, 2004). Utility value is the perceived value that a particular factor acquires because one relates this factor as being instrumental in achieving certain outcomes, which can be either long-term or short-term goals (Simons et al. 2004). For IS users, being able to perceive the value of IS is expected to influence achieving goals such as attaining IS user competency. Hence, if individuals can perceive the value of utilizing IS, they are more likely to achieve IS user competency.

H1: Capability of perceiving IS value will positively influence IS user competency.

According to Simons et al. (2004), "future time perspective theorists also value…the utility of what is learned for the future." (p. 345). In regards to the cognitive aspects of future time perspectives, individuals can comprehend the long-term implications of behaviors (De Volder and Lens 1982). Research findings have shown that individuals with high GPAs and persistence in their studies attached greater value to future goals and to studying hard to reach these future goals than those with lower GPAs and less study persistence. Therefore, those with greater knowledge or skills (i.e., higher GPAs) identified greater value in studying to achieve future goals. In an IS context, this implies that having knowledge and skills in IS can influence the value one assigns to IS or one's understanding of the benefits and opportunities that might be obtained with IS. Therefore, domain knowledge of and skills in IS is hypothesized to influence capability of perceiving IS value.

H2: Domain knowledge of and skills in IS will positively influence capability of perceiving IS value.

***Theory of Trying***

The theory of trying, an extension of both the theory of planned behavior (Ajzen 1985) and the theory of goal pursuit (Bagozzi and Edwards 1998), proposes that trying is a reflection of action and some aspects of actual behavior (Ahuja and Thatcher 2005). Trying has been referred to as "mental and physical activities leading up to and regulating the instrumental acts directly producing goal attainment" (Bagozzi and Edwards 1998, p. 598). Arguments have been made that if individuals are constrained by a lack of resources, they may not be interested in engaging in exploration (Thatcher et al. 2003). Researchers have proposed that "in order to effectively utilize a new technology in an innovative manner…Organizational actors need to understand *both* what the technology is capable of providing, as well as how it might best be utilized within the constraints imposed by the existing organizational environment and work processes" (Nambisan et al. 1999, 371). In the context of IS, having domain knowledge of and skills in IS is expected to increase one's willingness to explore or attempt to try IS.

H3: Domain knowledge of and skills in IS will positively influence willingness to try and to explore IS.

As referred to in the Theory of Trying, trying is a reflection of action and satisfying all of the necessary conditions for performance of a particular behavior (Mathur 1998). Also, trying is associated with the activities that provide the structure for actions to occur and achieve certain outcomes (Bagozzi and Edwards 1998). Therefore, if one is in a state of willingness to try and to explore, this could provide the condition for certain associated behaviors to occur and outcomes to be realized.

Previous MIS research has cited that innovating with technologies can result in realizing the full potential of IT (Ahuja and Thatcher 2005). Therefore, in the context of IS user competency, willingness to try and to explore IS may result in IS user competency or the ability to realize the fullest potential and the greatest performance from IS use. Suggestions have also been made that users may acquire an initial introduction and awareness to a particular technology, but the knowledge gained needs additional refinement through interaction with the technology (Nambisan et al. 1999). Hence, although domain knowledge may be acquired (which can thereby influence one's willingness to try and to explore IS as proposed by H3), one's willingness to try and to explore IS is needed to develop IS user competency, which is hypothesized as follows.

H4: Willingness to try and to explore IS will positively influence IS user competency.

***Theory of Expert Competence***

According to the Theory of Expert Competence, competency is dependent upon domain knowledge, associated psychological traits, cognitive skills, effective decision strategies, and appropriate task characteristics such that competency can be applied (Shanteau 1992). The knowledge, just like expertise, is domain specific. Therefore, developing expert competence in a particular domain requires prerequisite knowledge or content knowledge, but the expertise will only be developed for that particular domain (Shanteau 1989, 1992). Various research studies have indicated the importance of domain knowledge (or referred to as a common core of knowledge) for expert performance to be realized (Libby and Luft 1993; Bonner and Lewis 1990; Einhorn 1974).

Previous research has identified that employees who were expected to become proficient IT/IS users needed a significant amount of knowledge and assistance to achieve competency

(Lee 1986) and "in general, participants with higher IS domain knowledge have been found to perform better than those with less domain knowledge" in contexts such as program comprehension (Khatri et al. 2006, p. 83). Also, previous research studies have demonstrated the importance of IS and application domain knowledge in tasks such as comprehending conceptual schemas and problem-solving in various contexts (Khatri et al. 2006). Hence, domain knowledge of and skills in IS is expected to influence IS user competency.

H5: Domain knowledge of and skills in IS will positively influence IS user competency.

Figure 2 shows the research model.

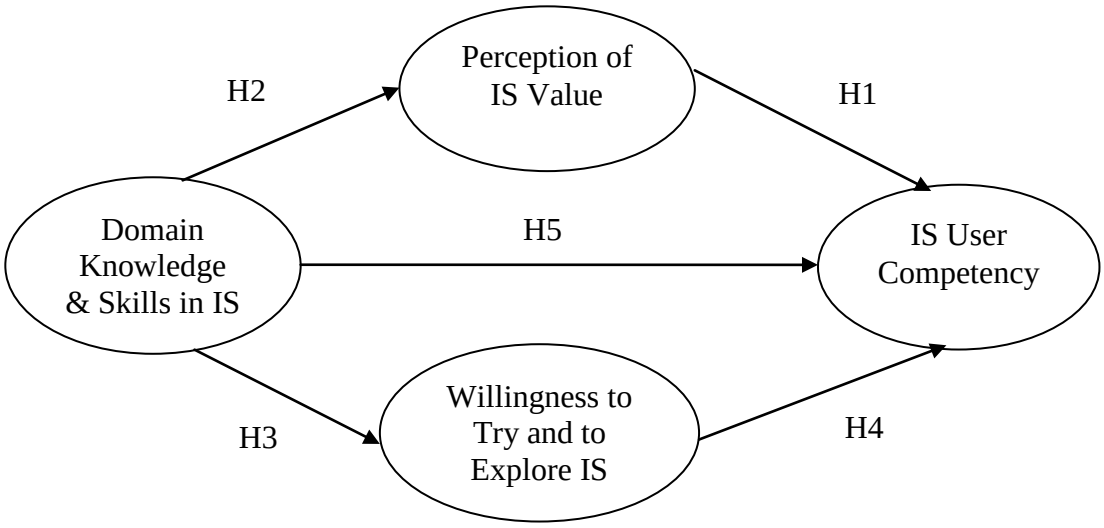



**Figure 2: Proposed Research Model**

### 4.2 Research Method and Procedures

The proposed research model (see Figure 2) was tested utilizing a survey method. The target population for this survey is individuals who are IS users and who utilize IS for business-related tasks. A nation-wide insurance company in the Midwest was utilized for the research. Considering that organizations in the insurance industry are significant users of information

systems, this industry is considered appropriate for this research. Only one organization is selected for this study to increase the internal validity of the results by minimizing potential confounding effects due to organizational and extraneous variables.

The measurement items for the IS-specific state factors (i.e., capability of perceiving IS value, willingness to try and to explore IS, and domain knowledge of and skills in IS) and IS user competency were first adapted from existing literature. For constructs in which existing scales do not capture the conceptualization provided by the research participants in the qualitative study, additional items were developed. All items were assessed on a 7-point Likert scale, with 1 being strongly disagree and 7 being strongly agree. Although perceived usefulness is considered a theoretically distinct construct from capability of perceiving IS value, it was measured and included in the data analysis for both the pilot study and final survey to provide support for this distinction. The factor measurement items (see Appendix B) that were used in the full-scale survey were refined based on the results of a pilot study involving more than 100 subjects.

A total of 596 subjects from the insurance company participated in the full-scale survey. Demographics of the subjects are presented in Table 5. As shown in Table 5, the subjects have an average of 11 years of work experience with the current organization, 23 years of total work experience, and 19 years of IS experience.

| TABLE 5: DEMOGRAPHIC INFORMATION | | | |
|---|---|---|---|
| **Age** | **# of Participants** | | |
| 21-30 | 72 | | |
| 31-40 | 143 | | |
| 41-50 | 205 | | |
| 51-60 | 141 | | |
| 61-70 | 35 | | |
| | | | |
| **Job Position** | | | |
| Management | 158 | | |
| Non-Management | 438 | | |
| | | | |
| | **Minimum** | **Maximum** | **Mean** |
| Computer Experience | 3 | 46 | 23 |
| IS Experience | 2 | 40 | 19 |
| Work Experience w/ Current Organization | <1 | 45 | 11 |
| Total Work Experience | <1 | 61 | 23 |

### 4.3 Data Analysis

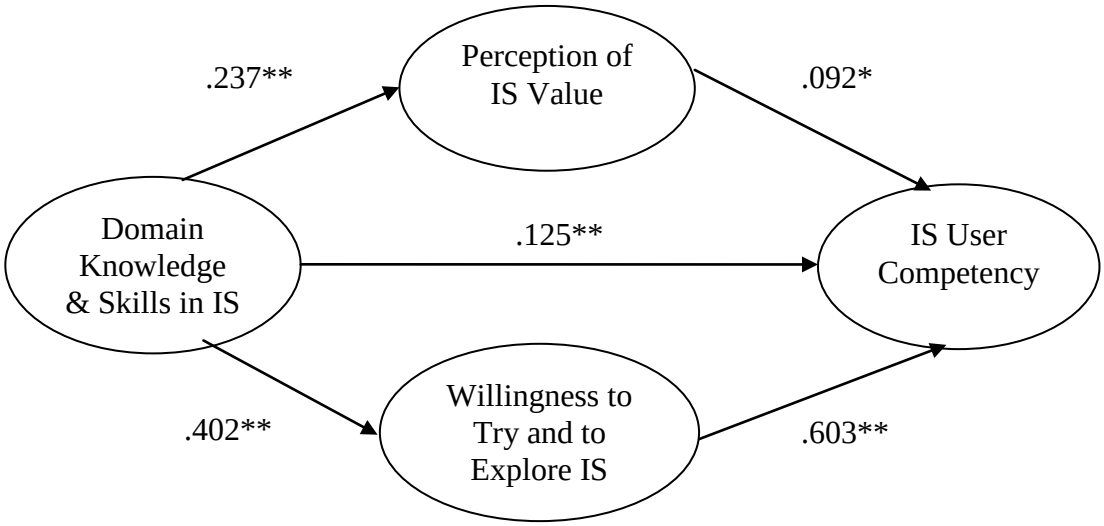
Factor analysis was conducted using principal components analysis with Varimax rotation and Kaiser normalization. The factor analysis includes not only the four variables in the research model but also perceived usefulness, which is included to demonstrate that capability of perceiving IS value is a distinct construct from perceived usefulness in the literature. Descriptive statistics and factor analysis results are presented in Appendices C and D respectively. Statistical analyses were conducted to assess reliability, skewness and kurtosis, common method variance, and discriminant and convergent validity. Results of these analyses were within acceptable ranges. Because of the presence of some non-normality, a logarithmic transformation of the data was performed. Factor analysis results show that five factors emerged – the four variables in the research model and perceived usefulness, which is a distinct construct from capability of perceiving IS value. Reliability analysis was conducted utilizing Cronbach's alpha coefficiences and the results are shown

Appendix E. All four factors achieved acceptable Cronbach's alpha coefficients of above .90.

Covariance-based structural equation modeling using maximum likelihood (ML) estimation was utilized to assess the measurement model and test the structural model in Figure 2 with MPlus 5.1. A measurement model for all factors was analyzed first to provide support for the assumption of unidimensionality, with the final model achieving acceptable fit, $\chi 2$ (395) = 2555.594, $p$ <.001, CFI = .901, RMSEA = .096, SRMR = .088. Although the chi-square statistic is significant, this can be attributed to the large sample size. The structural model, which also achieved acceptable fit [$\chi 2$ (396) = 2568.373, $p$ <.001, CFI = .900, RMSEA = .096, SRMR = .098], shows that all direct paths to IS user competency are significant - capability of perceiving IS value (B = 0.092; $p$ = .006), domain knowledge of and skills in IS (B = 0.125; $p$ = .001), as well as willingness to try and to explore IS (B = .603; $p$ < .001). Also, other significant paths include the paths from domain knowledge of and skills in IS to capability of perceiving IS value (B = 0.237; $p$ < .001) and willingness to try and to explore IS (B = 0.402; $p$ < .001). Therefore, domain knowledge of and skills in IS significantly influences capability of perceiving IS value, willingness to try and to explore IS, and IS user competency. Also, capability of perceiving IS value and willingness to try and to explore IS significantly influence IS user competency. The results provide support for all hypotheses. The model accounts for 46.4% of the variance in IS user competency.

Also, t-tests were performed to determine if the regression coefficients are statistically different from each other. The results indicate that the path coefficient from willingness to try and to explore IS to IS user competency is statistically different from (i.e., higher than) the path coefficient from capability of perceiving IS value to IS user competency ($t$ = 11.106, $p$ < .001)

and the path coefficient from domain knowledge of and skills in IS ($t$ = 10.061, $p$ < .001) to IS user competency. The path coefficient from domain knowledge of and skills in IS to IS user competency is not statistically different from the path coefficient from capability of perceiving IS value to IS user competency ($t$ = .666, $p$ = .50).




***p <=.01 **p<=.00**

**Figure 3: Research Model**

### 4.4 Discussion of Results

Based on the results from this research study, all five hypotheses are supported. In other words, domain knowledge of and skills in IS influence IS user competency both directly and indirectly through capability of perceiving IS value and willingness to try and to explore IS. Hence, one's understanding of IS will help to enhance one's ability to identify the benefits and opportunities that IS can provide. Knowledge and skills in IS also influence one's propensity to explore and willingness to try to use IS. Finally, IS user competency is also influenced by one's domain knowledge and skills in IS.

Capability of perceiving IS value and willingness to try and to explore IS directly influence IS user competency. The results suggest that if an IS user is able to recognize the potential of IS, this perception can influence his/her IS user competency. Also, if an IS user is willing to engage in utilizing IS and experimenting with it, this can also increase his/her level of IS user competency.

Interestingly, the results suggest that the factor that has the most significant, direct influence on IS user competency is willingness to try and to explore IS. Hence, the most important factor that can be emphasized in improving an IS user's ability to utilize IS to its fullest potential and obtain the greatest performance from IS use is one's willingness to try to use IS and to be exploratory with IS.

**5. Discussions of Comparisons with MIS Literature**

This section presents and discusses a comparison of the constructs in our research model with those in the literature. The findings of this study highlight some common constructs with those existing in the literature as well as new constructs and perspectives on IS user competency that have not been explored in the MIS literature

**5.1 Domain Knowledge of and Skills in IS**

Based on a comparison between the constructs previously studied in MIS research and the findings from this study, the constructs from previous research that share similarities with domain knowledge of and skills in IS include technology cognizance, IT knowledge, and ability to explore.

Technology cognizance was described as having an understanding of the technical features, the capabilities of information systems, cost and benefits, and potential uses (Nambisan et al. 1999). Therefore, this construct appears multi-dimensional because it not only taps onto one's IS knowledge, but also one's understanding of the benefits. However, it does not tap on whether one is able to operate IS. An IS user not only needs to know or understand the features, capabilities, and uses of IS, but he or she also needs the basic skills to operate IS in order to realize or take advantage of the benefits of IS. In regards to the knowledge of IS, the findings from this research study suggest that highly competent IS users have the basic knowledge of the underpinnings of information systems. However, differences with technology cognizance arise in that domain knowledge of and skills in IS includes other aspects such as *how* to operate IS (e.g., extracting information) versus just having knowledge of *what* business activities are supported.

Previous research has looked at IT competence in business managers (Bassellier et al. 2003). One aspect of IT competence is IT knowledge, which is considered "specialized knowledge possessed by individuals: how well they understand fundamental IT concepts, how well informed they are about IT in their organization" (Bassellier et al. 2003, p. 320). IT knowledge includes general knowledge of technology (e.g., personal computer, multimedia), applications (e.g., e-mail, WWW, enterprise resource planning), systems development (e.g., traditional system development life cycle, prototyping), management of IT (e.g., IT budget, IT

policies, current IS application assets of one's business unit), and access to IT knowledge (e.g., IT people to contact). Although this is similar to domain knowledge of and skills in IS as identified in this research study, it is also different in that the focus from a business user's perspectives is on knowledge of IS rather than on IT/IS management, planning, and development. More specifically, the construct, domain knowledge of and skills in IS, that emerged in this research study is more focused in that it specifically identifies the functionality of IS, how to operate IS (e.g., extract information), and the skills one possesses to utilize the available features and functions of IS.

The construct, ability to explore, is defined as the perception of one's ability in utilizing the required cognitive and physical skills to explore technology (Nambisan et al. 1999). This construct is similar to skills in using IS since it includes elements of ability to utilize and apply necessary technical skills. It is different from skills in using IS, however, in that it specifically refers to the context of being able to explore technology and having the skills to conduct exploration activities, whereas skills in using IS are associated with operating IS or performing basic IS functions.

In summary, domain knowledge of and skills in IS has certain dimensions that are similar to other MIS constructs. These similarities include referring to basic, high-level knowledge of IS. The main difference arises in that domain knowledge of and skills in IS also includes basic skills to operate IS which is beyond having an understanding of the features and capabilities of IS.

### 5.2 Willingness to Try and to Explore IS

In comparing the construct of willingness to try and to explore IS with existing MIS constructs in the literature, similarities emerge with personal innovativeness in the domain of IT, trying to innovate with IT, and intention to explore a technology.

Personal innovativeness in the domain of IT (PIIT), considered a domain-specific *trait*, has been defined as one's propensity to try any new IT (Agarwal and Prasad 1998, p. 206). Therefore, as a trait, it is projected to be stable across various types of IT. PIIT "epitomizes risk-taking behavior" (Agarwal and Prasad 1998, p. 207) and those with higher levels of PIIT are more apt to take risks. Willingness to try and to explore IS is conceptualized, however, as a state or dynamic situation-specific individual difference such that it is a relatively enduring disposition that can be changed or modified through experience or training. Both constructs capture the essence of willing to try IS, for this context, but willingness to try and to explore IS also incorporates an individual's willingness to engage in exploratory behavior. Two of the measurements items for PIIT tap on this element, but the construct generated from this research appears to tap into a deeper aspect of exploration. For instance, participants indicated that highly competent IS users *like to explore IS/poke around*, and *loves to research how things work.* Therefore, there are commonalities between these two constructs, but distinctive differences in that PIIT is a trait and willingness to try and to explore IS is conceptualized as a state with deeper elements of exploratory behavior.

Trying to innovate with IT is considered a goal and is defined as a "user's goal of finding new uses of existing workplace information technologies" (Ahuja and Thatcher 2005, p. 431). The construct has been measured with two items "I try to find new uses of IT" and "I try to use IT in novel ways" (Ahuja and Thatcher 2005, p. 459). This construct is similar to willingness to

try and to explore IS considering participants indicated that highly competent IS users were individuals who have *eagerness to explore alternative uses.* However, willingness to try and to explore IS encompasses other facets such as being comfortable with trying technology and making mistakes.

Intention to explore refers to one's willingness, intention, and motivation to explore new technologies and innovate based on perceptions of the benefits that may be realized (Nambisan et al. 1999). Hence, this construct is judgment dependent whereas willingness to try and to explore IS is a general construct that is potentially contingent upon various other environmental factors such as facilitating conditions and subjective norms. The intention to explore construct has been measured using three items such as "I intend to explore new IT for potential application in my work context," and "I intend to explore new IT for enhancing the effectiveness of my work" (Nambisan et al. 1999, p. 392). Similar to willingness to try and to explore IS, both constructs incorporate an individual's willingness to explore technology. However, intention to explore is a goal-oriented construct whereas willingness to try and to explore IS is more situational dependent.

Therefore, willingness to try and to explore IS has some similarities and differences in comparison to previous MIS constructs. Similarities include that it taps into conceptualizations included in three previous constructs (i.e., personal innovativeness in the domain of IT, trying to innovate with IT, and intention to explore a technology) such as being willing to try (such as with PIIT), trying to discover novel uses with existing technologies, and being willing to explore new IT. However, differences arise in that willingness to try and to explore IS seems to have greater depth in that it also encompasses individuals' willingness to research how things work,

being comfortable with trying technology and making mistakes with it, and is conceptualized as a state or dynamic situation-specific individual difference versus a domain-specific trait.

**5.3 Capability of Perceiving IS value**

When evaluating the IS user competency factors that emerged in this research, some interesting findings emerged with the capability of perceiving IS value construct. Most noteworthy, capability of perceiving IS value highlights that identifying the importance of IS is an important characteristic of highly competent IS users. Hence, IS users need to be able to appreciate and understand the benefits that IS can derive in order to achieve IS user competency. However, this construct is considered a *state* or dynamic situation-specific individual difference, whereas the perceived usefulness construct associated with the Technology Acceptance Model (TAM) is a *belief* (Davis 1989).

Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p. 320) and is considered "people's subjective appraisal of performance" (p. 335). Although there is some similarity between capability of perceiving IS value and perceived usefulness considering that they both tap onto perceptions of benefits that can be obtained (i.e., job performance enhancement), they diverge in many aspects. Capability of perceiving IS value is not only a *state* or dynamic situation-specific individual difference, versus a *belief*, but also encompasses a more extensive aspect. In this study, highly competent IS users who have obtained IS user competency are able to go beyond just being able to see the usefulness of a system, they are also able to recognize the potential opportunities and value that IS can provide.

For example, participants indicated that highly competent users apply IS as a strategic tool and view IS as an extension of themselves. Therefore, highly competent users may not only

be enhancing their job, but may also be transforming their job responsibilities or other job activities. Hence, perceived usefulness is a construct developed to assess one's belief of the usefulness of a system associated with job-related tasks, whereas capability of perceiving IS value assesses one's overall perception of the value that IS can provide.

Enhancing job performance usually entails accomplishing specific job routines. However, transforming job responsibilities may include identifying new uses of a system that were not previously envisioned. Additionally, transforming job responsibilities may include identifying value-added opportunities to leverage the system in strategic or competitively advantageous ways, which is more extensive than improving the performance of existing job routines and stretches the dimensions of perceived usefulness. Therefore, predictors of intentions to adopt technology to improve job performance may run along a continuum, however the ends are distinctive with perceptions of *usefulness* (considered a state for this discussion) on one end and capability of perceiving IS value on the other.

Previous research has cited the importance of IS users being able to develop innovative applications and identify opportunities to exploit new technologies as a matter of organizational survival (Nambisan et al. 1999). Therefore, consideration needs to be given to the growing need of IS users to not only adopt and use technology, but to identify advantages that can be gained with technology. The capability of perceiving IS value construct is not only different from perceived usefulness because it is conceptualized as a state versus a belief, but it also seems to fall on the extreme end of perceptions of IS, something that may be very important to achieving IS user competency versus just intending to adopt IS.

Perceived value is defined as "the overall evaluation of change related to a new IS implementation based on the comparison between benefits and costs" (Kim and Kankanhalli

2009, p. 571). This construct, as operationalized, assesses perceptions that result when an individual weighs the costs of time and effort with changing to a new IS versus the benefits or value that can be derived. Therefore, both constructs tap onto IS users' perceptions of benefits and value. However, they are different in that the perceived value construct used by Kim and Kankanhalli (2009) focuses on switching to a new IS, whereas the capability of perceiving IS value construct, as conceptualized according to the researching findings from this study, focuses on opportunities, benefits, and advantages of any IS, both existing and new.

As noted previously, technology cognizance appears to be a multi-dimensional construct that encompasses understanding technical features of IS, as well as benefits and potential uses (Nambisan et al. 1999). Scale items include knowing the benefits that can be derived from technologies and the business activities that the technology can be applied to. This dimension of technology cognizance is similar to capability of perceiving IS value in that individuals understand the benefits of IS. It's also different in that research participants from this study also indicated that being able to identify new opportunities was important.

Therefore, capability of perceiving IS value has conceptual similarities and differences with perceived value and technology cognizance in the MIS literature. It is similar to Kim and Kankanhalli's conceptualization of perceived value and Nambisan et al.'s dimension of technology cognizance (referring to benefits) in that both of them tap on aspects of IS benefits and value. However, it is different in that capability of perceiving IS value in this research is tapping on the extreme end of a continuum (encompassing strategic value and opportunities) and does not focus on just perceptions of the change. Also, the capability of perceiving IS value construct that emerged from this research study incorporates identifying opportunities and possibilities associated with IS.

### 5.4 Summary of Comparisons

In summary, this study finds conceptual similarities between previous MIS research constructs and the IS-specific factors or dynamic situation-specific individual differences associated with IS user competency. All three IS-specific factors (i.e., domain knowledge of and skills in IS, willingness to try and to explore IS, and capability of perceiving IS value) have dimensions that incorporate conceptual elements of constructs previously used in MIS research, such as technology cognizance and personal innovativeness in the domain of information technology. However, the comparisons between constructs also finds dimensions of these constructs that have not been explored and, hence, has identified other aspects associated with IS user competency. For instance, highly competent IS users understand limitations associated with IS as well as how business processes are facilitated. They are comfortable with trying technology and making mistakes. Also, they are not only able to recognize benefits associated with job enhancement, but can envision much greater opportunities and value. Considering the growing need for IS user competency, more MIS research in this area is warranted.

In addition, a paucity of research exists that studies these existing MIS constructs in an IS user competency context. For instance, personal innovativeness in the domain of IT has been studied in the context of perceptions of IT, intentions to use IT, beliefs about technology usage (e.g., ease of use), innovation characteristics (e.g., compatibility), and environmental influences (e.g., work overload) (Agarwal and Prasad 1998, Lewis et al. 2003, Thatcher et al. 2003, Yi et al. 2006). Previous research has studied mechanisms associated with technology cognizance, ability to explore a technology, and intention to explore a technology which included attending IT conferences, setting up user labs, and establishing an IT task group (Nambisan et al. 1999). Research involving perceived value has focused on user acceptance and resistance to new IS

(Kim and Kankanhalli 2009). Therefore, studying IS-specific factors in an IS user competency context has the potential to not only fill this gap in the literature but also create a more complete nomological network that associates these new and existing constructs with IS user competency.

## 6. Implications and Conclusions

This section provides the theoretical and practical implications, as well as limitations, future research, and conclusions.

### 6.1 Theoretical Contributions and Implications

The intent of this research is to generate a Theory for Explaining (Gregor, 2006) to provide a more complete understanding of IS user competency. Gregor (2006) suggests that these types of theories help to explain poorly or imperfectly understood phenomena. In this research study, new factors associated with IS user competency were identified that have not been previously explored in MIS research. Hence, our previous understanding of the potential factors associated with IS user competency have been incomplete. The IS User Competency framework developed based on our research findings provides an advancement towards a better understanding of IS user competency.

Of existing theories that attempt to explain human competency and learning, Bandura's Social Cognitive Theory (an extension to Social Learning Theory) is well-recognized in the literature (Bandura, 1977, 1986). According to Bandura's Social Cognitive Theory (SCT) (1977, 1986), human behavior is not driven primarily by external stimuli or by inner forces. Instead, the theory proposes an interactive model in which behavioral, environmental, and cognitive/other personal factors are "triadic reciprocal determinants" of each other. Also, SCT incorporates personal factors, such as self-efficacy, and its impact on the application of knowledge. Therefore, SCT acknowledges that personal factors are important and can influence one's actions and,

ultimately, competencies achieved. However, Bandura (1986, 1997) focuses on self-efficacy as the key personal factor and does not specifically identify or examine other personal factors that can influence one's competency and, in particular, one achieving highly competent levels in IS usage.

Although some of our research findings are consistent with various aspects of Social Cognitive Theory (SCT) (Bandura, 1986, 1977), the added findings from this research study expand on SCT to acknowledge a greater set of personal factors contributing to one's competencies, specifically in the context of IS user competency. For instance, our research identifies factors such as being adaptable to change and *willingness* to modify thoughts or behaviors to expand one's IS competency. Also, this research identified the personal factor of risk taking propensity with IS. If an individual, through self-initiated actions or experiential learning, does not have the propensity to take risks with IS, their knowledge acquisition may be limited. These limitations may arise due to the restricted amount of risks or new experiences they are willing to endure. Having an exploratory nature or sense of curiosity with IS, was also recognized as a factor associated with IS user competency. In this same consideration, one's propensity to want to explore their environment or to have a curious nature that propels them to experiment with new behaviors may contribute to their knowledge and competencies.

Therefore, these additional factors may need to be incorporated when considering SCT in future research, especially in contexts that focus on achieving elite levels of competency.

The results of the measurement of the Capability of Perceiving IS Value construct also shed light onto the application of the Perceived Usefulness (PU) construct associated with TAM to the context of IS user competency. The items that measure capability of perceiving IS value, which refer to perceiving the benefits and opportunities of IS, did not load with the PU items

from the literature (see Appendix B for the full-scale survey factor analysis and Table 6 for factor analysis involving perceived usefulness and capability of perceiving IS value only).

**TABLE 6: FACTOR ANALYSIS – PERCEIVED USEFULNESS AND CAPABILITY OF PERCEIVING IS VALUE**

| | Perceived Usefulness | Capability of Perceiving IS value |
|---|---|---|
| PIV1 | **.895** | .284 |
| PIV2 | **.870** | .367 |
| PIV3 | **.870** | .335 |
| PIV4 | **.878** | .350 |
| PIV5 | **.866** | .308 |
| PIV6 | **.838** | .363 |
| PIV9 | .388 | **.759** |
| PIV10 | .337 | **.836** |
| PIV11 | .294 | **.865** |
| PIV12 | .321 | **.805** |
| PIV13 | .228 | **.836** |
| PIV14 | .346 | **.802** |
| PIV16 | .314 | **.782** |

The data suggests that a new and important construct of capability of perceiving IS value has emerged for studying IS use in the context of competent IS usage and is needed in future research on IS competency. Therefore, the findings also provide support for extending Social Cognitive Theory and including other IS factors, such capability of perceiving IS value, in an IS user competency context.

### 6.2 Implications for Practice

The main implication for practitioners is to consider possible training interventions as well as hiring criteria when considering individuals who they desire to have IS user competency. The

following are examples of training interventions that can be pursued, but this list is not exhaustive considering the rich set of findings generated by this research study.

*Intentional Practice and Exposure to Technology.* Users can be given opportunities to explore technology on their own to increase practice. Practice is, of course, heavily emphasized in any learning or expertise subject-matter (Feltovich et al., 2006), and would hence be a vital area of consideration in acquiring IS competence and increasing the amount of IS training. For example, users can be allowed to take technological devices home or access a beta system for them to explore and practice with.

*Independent Learning and Problem-Solving.* Interventions may enhance independent learning and problem-solving skills. For example, IS users may engage in problem representation tasks or be taught various problem-solving strategies such as means-ends analysis (Bruning et al., 2004). They can be encouraged to conduct solution evaluations that entail evaluating both the product and the process of problem-solving so they can determine if the best solution was obtained and what refinements in the process can be made or utilized in future problem-solving tasks. For instance, if they encounter errors when they are trying to run system processes, they can evaluate different means of researching and resolving the error, and evaluate the outcomes of the error's resolution. Then, they can review the methods used to analyze the error to determine if the most feasible solution was reached and if they should utilize the same approach when future errors are encountered.

*Enhancing Goal Setting.* Another training opportunity is to have trainees set goals before IS training commences. For example, these goals can be specific to a new feature or function of the system they want to learn. In accordance with self-regulation theories, setting specific goals and

having higher motivation (or intentions) can lead to better performance and a greater likelihood of the desired behavior occurring (Shayo et al., 1999 citing Locke and Latham, 1991).

*Improving Capability of Perceiving IS value/Benefits.* Emphasis could also be placed on helping individuals identify the benefits that an IS can provide. Bannister's (2002) longitudinal study found that of two departments within the same organization, the one with the most successful development of IS had experienced increasing understanding of IS value and benefits among management and staff. Therefore, training can include encouraging and assisting individuals to view or widen their conception of IS value and benefits within their individual roles and responsibilities as well as those related to the overall organization.

*Social Learning.* Training can also take the form of working in teams, which may assist in enhancing one's willingness to explore and willingness to share and collaborate. Spitler (2005) also studied mechanisms that consultants used to learn IT/IS necessary for their job tasks. Social interaction among other peer users was a notable factor contributing to learning.

*Hiring Criteria.* Although training may be considered to improve certain user characteristics, some of these may be more appropriately considered as hiring criteria. Although every position and job responsibility will vary in terms of requirements for these attributes (e.g., formal education, intellectual ability), some general attributes were highlighted by the research participants and hence, are worth considering when developing employment screening mechanisms. For example, attention to detail may be considered for those positions in which accuracy is paramount. One's sense of curiosity with IS may not be easily enhanced by intervention efforts and hence, could potentially be used as hiring criteria.

### 6.3 Limitations and Future Research

There are some limitations in this research. A possible limitation is that the RepGrid technique may not tap on cognitive processes of highly competent users because cognitive processes are largely 'hidden' or not directly 'visible' to others. Hence, further studies are needed to identify and study these processes. Another potential limitation includes the generalizability of our findings which may be limited to competency in the IS application or usage context. Additional research is needed to extend the generalizability to other contexts of competency and to other types of technology usage phenomena such as online gaming and mobile application usage. Also, the current research examines IS user competency after it has been achieved or observed by other IS users. Additional research can explore the process of achieving IS user competency.

### 6.4 Conclusions

This research contributes to a grounded and theoretical conceptualization of IS user competency. It encompasses both inductive and deductive processes of inquiry to develop a rich understanding of the factors associated with IS user competency and provide support for the relationships between IS-specific state factors and IS user competency. More specifically, a IS User Competency Model was developed based on the findings from a grounded and inductive approach using the Repertory Grid technique. A key strength of the Repertory Grid technique is in bringing meaning to phenomena by tapping into individuals' personal construct systems. Therefore, constructs are provided by the participants which allow a broader and richer understanding of factors associated with IS user competency. A deductive approach using the survey method was used to validate the relationships between IS-specific state factors and IS user competency. The results of the survey revealed that all three factors are important to IS user competency, with willingness to try and to explore IS having the greatest influence or

explanatory power. Overall, identifying the factors that are most likely to foster highly competent IS users will provide greater opportunities for improved IS proficiency and greater IS benefits being realized for IS users.

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## Appendix A

| Examples of Participant Commentary | |
|---|---|
| **Themes**/Categories/*Sub-categories* | Participant Commentary Examples |
| **General Learning and Cognitive Factors**/ Ability and Desire to Learn/ *Capacity for Learning* | [Referring to incompetent users]*"you would find yourself repeatedly helping them on the same thing…they are unable to transfer the skills from one application to the next.* [Referring to highly competent user] *someone who retains what they've been shown something once or twice…ability to take skills learned in one setting and apply into new or different settings"* |
| **General Learning and Cognitive Factors**/ Ability and Desire to Learn/ *Ability to Learn Independently* | [Referring to highly competent users] *"This group of people would be able to facilitate their own learning of the system, whereas this person* [referring to incompetent user] *would have to be taught how to do everything."*<br>[Referring to incompetent users]*"they don't understand the system or don't take the time to understand…someone who just gives up. Its kind of like the impatient part, they won't learn it or refuses to learn it because they can rely on someone else...*[Referring to highly competent user] *who goes the extra mile to learn it. Who would take a…class and who would go find opportunities to learn it."* |
| **General Learning and Cognitive Factors**/ Intellectual Abilities | [Referring to competent user] *"he's a genius..he can figure anything out..I would say towards IS..even the rate or speed of thinking, how fast they process information..it makes it easier for them to work with information systems…*[Referring to incompetent users]*intelligence in areas other than IS…slow, methodical thinker."* |
| **General Learning and Cognitive Factors**/ Ability to Solve Problems | *"I think it goes back to problem solving...*[Referring to highly competent users] *these individuals by nature are problem-solvers and* [Referring to incompetent user] *this individual, sort of by nature, is either a problem creator or…they just bring the issue's attention to others. They identify problems but they don't fix anything or they actually create the problems."* |
| **Personal Disposition and Traits/** Motivation/ Perseverance | [Referring to competent users]*"Just willing to help out when other people are having problems. It might not necessarily be their problem, but they are always willing to jump in to lend a hand…motivated…achievers…*[Referring to incompetent user] *disengaged in that they don't want to help…disengaged with people they work with…someone who just doesn't care, doesn't want to be number one…satisfied with average…they lack any type of competition to be number one"* |
| **Personal Disposition and Traits**/ Dedication | [Referring to highly competent users]*"They're happy where they are and they're not looking… to get out of the department or get out of their current job..*[Referring to incompetent user]*whereas this is not where his heart is at and not where he wants his career to be, this is temporary…so he's not committed to it, so what if he doesn't learn it, he's not going to use these skills somewhere else…*[Referring to highly competent user] *opposite is committed"* |
| **Personal Disposition and Traits**/ Precision in Task Execution | [Referring to highly competent user]*"a detailed person…*[Referring to incompetent users] *disorganized…*[Referring to highly competent user] *quality of work is higher…accuracy…*[Referring to incompetent users] *more errors, these two are careless"* |

| | |
|---|---|
| **Personal Disposition and Traits**/ Adaptability | [Referring to incompetent users] *"hard to adapt to change…their reaction was negative, it was hard for them to adapt to the change and accept the change. Timeframe, it took them longer to adapt to the change then other users experiencing that same change…*[Referring to highly competent user] *Easy to adapt to changes. For the short time the individual has been here, (*name of IS user element) *has been able to adapt very easily, very quickly, even initiated some of the changes and gave ideas."* |
| **Personal Disposition and Traits**/ Sense of Curiosity with IS | [Referring to highly competent users]*"contributes a little bit to curiosity with technology* [Referring to incompetent user] *as opposed to a phobia."*<br>[Referring to highly competent user] *This person is inquisitive and* [Referring to incompetent users] *these people aren't…accepting of the status quo."* |
| **Personal Disposition and Traits**/ Open-mindedness | [Referring to incompetent users]*"I don't think they could be as proficient as others because it's almost a visual thing. I can be standing right next to them and say click on File and drop down to Import or Export and literally they can't see it on the screen.…*[Referring to highly competent user]*whereas others could understand the graphic layout better…* [Referring to incompetent users] *Its almost as if the information system, if it were like a hologram of sticky notes or a file cabinet or something that they could, kind of in a virtual reality, open up that they could use, its just the fact that its on a computer screen that its so flat and one-dimensional that its difficult…* [Referring to highly competent user] *really visualize something one-dimensional in a three-dimensional world…its kind of hard to put into writing but I know a lot of people, myself included, when I'm working…when I pull up a file, in my head, I see a file and it makes sense to me… but I think some people just see an icon."*<br>[Referring to incompetent users] *"I don't think neither one of these two were very creative thinkers, they were very transactional kind of employees…*[Referring to highly competent user] *someone who sees the relationships between context and tasks…Something about openness to new ways of doing things…*[Referring to incompetent user] *wants to do things the same way or the old way."* |
| **Personal Disposition and Traits**/ Risk Taking Propensity with IS | [Referring to highly competent users]*"They're also risk takers…in that they are willing to go out and they'll just try anything...*[Referring to incompetent users] *they just stay closer to what they already know and they don't branch out*<br>[Referring to highly competent user] *"This person is not fearful or is willing to take risks and* [Referring to incompetent users] *these people are afraid to do something wrong or they'll break it"* |
| **Personal Disposition and Traits**/ Confidence | [Referring to incompetent users] *"one thing they lack is their ability to make other people feel comfortable and believe in them,* [Referring to highly competent user] *could sell anything to anybody…she's very confident in her abilities and who she is and* [Referring to incompetent users] *they just lack that confidence and it comes off… another way of phrasing that is self-assurance."* |
| **Communication and Collaboration Skills and Tendencies**/ Willingness to Teach, Share, and Collaborate | [Referring to highly competent user]*"willing to teach other users…*[Referring to incompetent users] *unwilling to teach/unable to teach…unwillingness to share information…*[Referring to highly competent user] *willing to share, willing to update…*[Referring to incompetent user] *whereas this person would put the incorrect information in or not at all."* |

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| **Communication and Collaboration Skills and Tendencies**/ Communication Skills | [Referring to highly competent user] "*communicator…this would be communicating…both* (referring to both oral and written)…[Referring to incompetent users] *inability to communicate."* |
| Willingness to Try and to Explore IS | [Referring to highly competent user]"*This person likes to explore around the IS and find out what's behind the drop downs.*…[Referring to incompetent users] *these people don't poke, don't probe deeper"*<br>[Referring to highly competent user] *"this is a power user…he gets it, he loves to research how things work on the computer, whether its web pages or the mainframe system, how all the information is connected and how to retrieve the data.*…[Referring to incompetent users] *these two do not…just using the system"* |
| Exposure to Technology | [Referring to incompetent user] *"this individual, it may be their first experience with an IS* [Referring to highly competent users] *these individuals have had several experiences with IS… or… they have used at other employers…that may be a good proxy for understanding IT systems… these individuals have worked with multiple different types of IT and IS systems* [Referring to incompetent user] *whereas this person probably has limited exposure…these individuals have definitely worked with less than 5* [Referring to highly competent user] *whereas this person has worked with more than 5"*<br>[Referring to highly competent user] *"It becomes second-nature…grow up using something… those things are more engrained…the way to use technology is part of their lives compared to.*…[Referring to incompetent users] *have to learn how to incorporate it into lives they have already established.*…[Referring to highly competent user] *use everyday…people use it more everyday.*…[Referring to incompetent users] *do not use everyday"* |
| Capability of Perceiving IS Value | [Referring to incompetent users]"*its not even that they don't want to be technology proficient, but they just don't see the reason to do it.*…[Referring to highly competent users] *because they want to be…have taken computer classes or made a very visible effort to take that technology on because they knew it was important…they wanted to do it.*…[Referring to incompetent users] *these two individuals don't want to do it…you need to have a payoff, a benefit…these particular individuals don't see the payoff"* |
| Job Experience | [Referring to incompetent users]"*These two have a limited set of tasks that they are responsible for,* [Referring to highly competent user] *whereas this person has a wide range of tasks…that they are responsible for.*…[Referring to incompetent user] *this individual spends the majority of their day entering data in the system and these individuals almost never…another way of putting it is this person performs a repetitive task* [Referring to highly competent users] *whereas these roles are definitely not repetitive task-oriented.*<br>[Referring to highly competent user]"*More practical applications of the data, such as forecasting.*…[Referring to incompetent user] *manual entry of the data but not getting the output…or seeing the reports and making a decision based on what comes out…its a task.*…[Referring to highly competent user] *experience of knowing how to use the data in the right way…using the output of the data or the reports or the aggregation of the data going in.*…[Referring to incompetent user] *no experience.*…[Referring to highly competent users] *they would try to solve business issues, not IS technical issues.*…[Referring to incompetent user] *doesn't solve business issues."* |

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| Domain Knowledge of and Skills in IS | [Referring to incompetent users]"*they don't understand basic functionality for individuals who have been using it for the amount of time they should have been using it…*[Referring to highly competent user] *understanding basic underpinnings"*<br>[Referring to highly competent users] *"this set of individuals would have the ability to create new reports to access the data that they want to get out of the system…*[Referring to incompetent user] *this person would not be able to create reports…*[Referring to highly competent user] *best know how to utilize the system to facilitate business processes,* [Referring to incompetent user] *would not understand the relationship between the system and the business process"* |

## Appendix B

| SURVEY- FACTOR MEASUREMENT ITEMS | | |
|---|---|---|
| **Research Construct and Definition** | **Existing Literature Construct and Definition** | **Measurement Items** |
| Capability of Perceiving IS Value - the ability to see the benefits and opportunities that IS can provide | Perceived Usefulness - "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320) | 1. Using information systems in my job enables me to accomplish tasks more quickly.<br>2. Using information systems improves my job performance.<br>3. Using information systems in my job increases my productivity.<br>4. Using information systems enhances my effectiveness on the job.<br>5. Using information systems makes it easier to do my job.<br>6. I find information systems useful in my job. |
| | Perceived Value - "the overall evaluation of change related to a new IS implementation based on the comparison between benefits and costs" (Kim & Kankanhalli, 2009, p. 571) | 7. Considering the time and effort that I would spend completing a task without the use of information systems, utilizing information systems is worthwhile.<br>8. Considering the hassle that I would experience to complete a task without the use of information systems, utilizing information systems is beneficial to me. |
| | New items developed based on research participants' concepts from the RepGrid study and based on results from Pilot Study | 9. I envision new opportunities to enhance job performance by using information systems.<br>10. I envision new opportunities to achieve competitive advantages for the organization by using information systems.<br>11. I envision new opportunities to achieve strategic advantages for the organization by using information systems.<br>12. Information systems are viewed as a strategic tool.<br>13. I can see the opportunities that the organization can derive from information systems.<br>14. I see the value that the organization can derive from information systems.<br>15. I can perceive why the organization utilizes information systems to achieve its objectives.<br>16. I can envision the benefits that the organization can derive from information systems.<br>17. I couldn't imagine completing job tasks without information systems.<br>18. I envision how information systems contribute to accomplishing job tasks. |

| | | |
|---|---|---|
| Willingness to Try and to Explore IS - willingness and comfort with trying technology and using IS | Personal innovativeness in the domain of information technology -"the willingness of an individual to try out any new IT" (Agarwal & Prasad, 1998, p. 206) | 1. When I hear about new information systems, I look for ways to experiment with them.<br>2. Among my peers, I am the first to try out new information systems.<br>3. I experiment with new information systems. |
| | Trying to Innovate with IT - "a user's goal of finding new uses of existing workplace information technologies" (Ahuja & Thatcher, 2005, p.431) | 4. I try to find new uses of information systems.<br>5. I try to use information systems in novel ways.<br>6. I try to be creative in using information systems. [Added item] |
| | Intention to Explore a Technology – "a user's willingness and purpose to explore a new technology and find potential use…a user's purpose and motivation to innovate based on the perceived business related benefits she will derive from IT deployment" (Nambisan, Agarwal, & Tanniru, 1999, p. 373) | 7. I explore new information systems for potential application in my work context.<br>8. I explore new information systems for enhancing the effectiveness of my work.<br>9. I spend considerable time and effort in exploring new information systems for potential applications. |
| | New items developed based on research participants' concepts from the RepGrid study | 10. I do not mind making mistakes with information systems.<br>11. I prefer to be told how to use information systems.<br>12. I am uncomfortable exploring information systems.<br>13. I am afraid of making mistakes when exploring information systems.<br>14. I am unwilling to try using information systems that I am not familiar with. |

| | | |
|---|---|---|
| Domain Knowledge of and Skills in IS - understanding how IS operate and ability to operate IS | Technology cognizance – "a user's knowledge about the capabilities of a technology, its features, potential use, and cost and benefits, i.e., it relates to *awareness-knowledge*" (Nambisan, Agarwal, & Tanniru, 1999, p. 372)<br><br>IT Knowledge – "specialized knowledge possessed by individuals: how well they understand fundamental IT concepts, how well informed they are about IT in their organization" (Bassellier, Benbasat, & Reich, 2003, p. 320) | 1. I have general knowledge of information systems.<br>2. I have general knowledge of the available features of information systems.<br>3. I have general knowledge of the functionality of information systems.<br>4. I have general knowledge of how to extract information from information systems.<br>5. I have general knowledge of the type of business activities in which information systems have been/can be deployed.<br>6. I have the skills to use information systems.<br>7. I have the skills to utilize the available features of information systems.<br>8. I have the skills to use the functions of information systems.<br>9. I have the skills to extract information from information systems. |
| IS User Competency - the ability to utilize IS to its fullest potential and obtain the greatest performance from IS use | IT Business Integration – "their ability to visualize the ways in which IT can contribute to organizational performance and to look for synergies between IT and business activities" (Bassellier & Benbasat, 2004, p. 680) | 1. I am capable of utilizing information systems to its fullest potential. [Added item]<br>2. I am capable of developing novel uses of information systems to address business problems. [Added item]<br>3. I am capable of analyzing ways to use information systems to obtain the greatest performance from information systems use. [Added item]<br>4. I am capable of utilizing information systems to achieve the greatest organizational impact.<br>5. I am able to utilize information systems to develop competitive advantages for my organization. [Added item]<br>6. I am able to utilize information systems to develop strategic advantages for my organization. [Added item]<br>7. I am able to utilize information systems to obtain maximum performance. [Added item]<br>8. I am able to develop novel uses of information systems to obtain superior performance. [Added item]<br>9. I am able to utilize information systems to address novel business problems. [Added item]<br>10. I am able to develop novel uses of information systems to address unique circumstances. [Added item] |

## Appendix C

| DESCRIPTIVE STATISTICS | | | | |
|---|---|---|---|---|
| **Item** | **Minimum** | **Maximum** | **Mean** | **Std Dev** |
| *Capability of Perceiving IS Value* | | | | |
| PIV1 | 1 | 7 | 6.42 | .88 |
| PIV2 | 1 | 7 | 6.32 | .92 |
| PIV3 | 1 | 7 | 6.34 | .95 |
| PIV4 | 1 | 7 | 6.35 | .87 |
| PIV5 | 1 | 7 | 6.32 | .96 |
| PIV6 | 1 | 7 | 6.42 | .83 |
| PIV9 | 1 | 7 | 6.10 | .95 |
| PIV10 | 1 | 7 | 6.18 | .94 |
| PIV11 | 1 | 7 | 6.11 | .97 |
| PIV12 | 1 | 7 | 6.29 | .91 |
| PIV13 | 1 | 7 | 6.28 | .82 |
| PIV14 | 1 | 7 | 6.37 | .75 |
| PIV16 | 1 | 7 | 6.29 | .80 |
| PIV (average) | | | 6.29 | .73 |
| *Domain Knowledge of and Skills in IS* | | | | |
| DKS1 | 1 | 7 | 6.13 | .81 |
| DKS2 | 1 | 7 | 6.02 | .89 |
| DKS3 | 1 | 7 | 6.00 | .94 |
| DKS4 | 1 | 7 | 5.89 | 1.01 |
| DKS5 | 1 | 7 | 5.90 | 1.00 |
| DKS6 | 2 | 7 | 6.12 | .82 |
| DKS7 | 2 | 7 | 6.02 | .89 |
| DKS (average) | | | 6.01 | .80 |
| *Willingness to Try and to Explore IS* | | | | |
| WTE1 | 1 | 7 | 5.29 | 1.35 |
| WTE2 | 1 | 7 | 4.76 | 1.46 |
| WTE3 | 1 | 7 | 4.95 | 1.49 |
| WTE4 | 1 | 7 | 5.02 | 1.42 |
| WTE7 | 1 | 7 | 4.95 | 1.43 |
| WTE8 | 1 | 7 | 5.07 | 1.40 |
| WTE9 | 1 | 7 | 4.09 | 1.49 |
| WTE (average) | | | 4.88 | 1.23 |

| | | | | |
|---|---|---|---|---|
| *IS Competency* | | | | |
| ISC1 | 1 | 7 | 4.97 | 1.34 |
| ISC3 | 1 | 7 | 4.88 | 1.41 |
| ISC4 | 1 | 7 | 4.93 | 1.31 |
| ISC5 | 1 | 7 | 4.80 | 1.37 |
| ISC6 | 1 | 7 | 4.76 | 1.37 |
| ISC7 | 1 | 7 | 5.11 | 1.23 |
| ISC8 | 1 | 7 | 4.68 | 1.37 |
| ISC9 | 1 | 7 | 4.85 | 1.32 |
| ISC10 | 1 | 7 | 4.76 | 1.40 |
| ISC (average) | | | 4.86 | 1.19 |

## Appendix D

| FACTOR ANALYSIS | | | | | |
|---|---|---|---|---|---|
| | **PU** | **PIV** | **WTE** | **DKS** | **ISC** |
| PIV1 | **.885** | .279 | .141 | .009 | .014 |
| PIV2 | **.866** | .355 | .111 | .056 | .048 |
| PIV3 | **.863** | .329 | .120 | .020 | .039 |
| PIV4 | **.868** | .343 | .141 | .041 | .010 |
| PIV5 | **.859** | .295 | .141 | .016 | .049 |
| PIV6 | **.827** | .361 | .124 | .033 | .016 |
| PIV9 | .385 | **.717** | .142 | .152 | .151 |
| PIV10 | .331 | **.811** | .122 | .114 | .129 |
| PIV11 | .286 | **.837** | .135 | .122 | .132 |
| PIV12 | .303 | **.789** | .169 | .064 | .107 |
| PIV13 | .224 | **.819** | .097 | .114 | .099 |
| PIV14 | .341 | **.782** | .132 | .093 | .088 |
| PIV16 | .305 | **.742** | .176 | .113 | .152 |
| DKS1 | .105 | .154 | **.871** | .140 | .132 |
| DKS2 | .145 | .154 | **.886** | .170 | .158 |
| DKS3 | .121 | .136 | **.889** | .174 | .178 |
| DKS4 | .127 | .175 | **.816** | .177 | .234 |
| DKS5 | .135 | .152 | **.803** | .146 | .232 |
| DKS6 | .119 | .068 | **.695** | .207 | .354 |
| DKS7 | .119 | .110 | **.674** | .191 | .378 |
| WTE1 | .098 | .147 | .216 | **.777** | .260 |
| WTE2 | .005 | .035 | .206 | **.794** | .278 |
| WTE3 | .025 | .071 | .217 | **.807** | .311 |
| WTE4 | .070 | .127 | .238 | **.735** | .389 |
| WTE7 | .035 | .143 | .128 | **.766** | .396 |
| WTE8 | .047 | .167 | .146 | **.761** | .376 |
| WTE9 | -.032 | .105 | .092 | **.691** | .366 |
| ISC1 | -.012 | .068 | .258 | .272 | **.709** |
| ISC3 | -.012 | .083 | .203 | .381 | **.761** |
| ISC4 | .026 | .103 | .163 | .281 | **.842** |
| ISC5 | -.017 | .159 | .143 | .225 | **.858** |
| ISC6 | -.011 | .167 | .129 | .250 | **.850** |
| ISC7 | .111 | .107 | .247 | .190 | **.790** |
| ISC8 | .047 | .069 | .193 | .310 | **.831** |
| ISC9 | .095 | .101 | .227 | .262 | **.806** |
| ISC10 | .075 | .085 | .230 | .338 | **.793** |

PIV-PU = Capability of Perceiving IS Value (Items adapted from Perceived Usefulness); PIV = Capability of Perceiving IS Value (New items); WTE = Willingness to Try and to Explore IS; DKS = Domain Knowledge of and Skills in IS; ISC = IS User Competency

**Appendix E**

| CRONBACH'S ALPHA COEFFICIENTS | |
|---|---|
| **Construct** | **Cronbach's Alpha Coefficient** |
| Capability of Perceiving IS Value | .95 |
| Willingness to Try and to Explore | .94 |
| Domain Knowledge of and Skills in IS | .95 |
| IS User Competency | .96 |

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Working Papers on Information Systems | ISSN 1535-6078



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