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Abstract

Considerable research investigates information technology (IT) adoption at the individual or organizational level. However, scholars have noted the potential observer and recall biases and the disconnection between individual and organizational IT adoption research. Based on Innovation Diffusion Theory, this study analyzes an existing archival dataset, O*NET, to explore the relationships between occupational characteristics (e.g. adaptability, gender composition, analytical thinking) and the adoption of emergent information technologies (EIT). Correlation test results based on 69 business occupations suggest that the socioeconomic status and occupational values of a profession are generally associated with its usage of EIT. Nevertheless, this research shows mixed associations between IT adoption and occupational communication behavior. In addition, we find that professionalism and the working activities might play a moderating role in IT adoption by occupations. Those results help triangulate previous explorations of organizational and individual IT adoption and yield implications for further investigations.

Keyword: Innovation Diffusion; Occupational Characteristics; Information Technologies

I. Introduction

For decades, IT adoption and usage have been one of the central themes of information system research. Seminal theories have been developed and used to examine the adoptions, implementations, and diffusions of information technologies. Examples include the Theory of Reasoned Action, Social Cognitive Theory, Technology Acceptance Model, Theory of Planned Behavior, Perceived Characteristics of Innovating, Unified Theory of Acceptance and Use of Technology, Task-Technology Fit Theory, and Innovation Diffusion Theory (Jeyaraj et al. 2006).

Considerable research investigates individual or organizational technology adoption by field survey, field study, event study, case study, or multiple methods (Jeyaraj et al. 2006). Rogers (1995) suggests that research which focuses on "*intention to use*" or bases on surveys may suffer from respondents' "*recall bias*"[1]. In addition, researchers' observations might be altered by their "*pro-innovation bias*"[2] (Fichman 2004; Jeyaraj et al. 2006; Rogers 1995). Jeyaraj et al. (2006) review 99 published IT adoption studies between 1992 and 2003 and conclude that the pro-innovation and recall biases are evident in both individual and organizational adoption studies. An archival analysis of the usage of emergent information technologies (EIT) may help reduce the potential of these biases. Specifically, the U.S. Department of Labor develops and updates the Tools and Technology Database (T2DB) to show the tools and technologies that are required by major U.S. occupations to carry out their business functions (Dierdorff et al. 2006). Such data may provide more objective measurements of actual usage of multiple tools and technologies by occupational groups, potentially lessening the effects from responders' and researchers' biases.

While previous research investigates IT adoption at the individual or organizational level, scholars have noted the disconnection between individual and organizational IT adoption research –

[1] In psychology, recall bias is a type of systematic bias which occurs when the way a survey respondent answers a question is affected not just by the correct answer, but also by the respondent's memory. This can affect the results of the survey (Wikipedia "Recall bias," 2008.)

[2] According to Jeyaraj et al (2006), researchers on innovation diffusion may assume that "*all adoption is good*" and thus bias respondents toward a specific direction (Jeyaraj et al, 2006)

organizational IT adoption studies seldom consider the characteristics of decision-makers or other stakeholders (e.g., top managers, champions); environmental characteristics (e.g., external pressure; social network) were not investigated by individual IT adoption studies (Jeyaraj et al. 2006). Devoted to this issue, the 2004 Diffusion Interest Group in Information Technology Conference recommended working on building a better linkage between micro (i.e. individual) and macro (i.e. organizational) IT adoption research (Jeyaraj et al. 2006). Instead of examining the characteristics of an individual's or an organization's IT adoption, this study assumes that workers in the same occupation perform similar functions and share some commonalities in personalities and characteristics and focuses on the relationships between those traits and the degree using EIT. Such investigation may avoid the interferences of responders' preferences in the individual IT adoption studies and the influences of corporate culture or industry types in the organizational IT adoption research, providing different perspectives based on multiple occupational groups that cross the boundaries of departments or corporations.

Reese (1988) assumed that attitudes may lead to differences in the information society and argued that only by comparing occupational characteristics simultaneously can researchers investigate the unique contribution of each influence. By contrasting professionals, managers, clerical staff, and blue-collar workers, he concluded that "*one's occupation clearly affects use of communication technologies and how they are regarded"* (pp.67). This research replies to his call for more studies.

Everett Rogers' Innovation Diffusion Theory (IDT) provides quantitative and qualitative indicators for assessing the likely rate of the diffusion of a technology and identifies numerous factors that facilitate or hinder technology evaluation, adoption, and implementation, which is "*an increasingly popular reference theory for empirical studies of information technology*" (Fichman 1992). In addition, IDT is the only theory that was applied both in individual and organizational IT adoption studies (Jeyaraj et al. 2006). Rogers summarizes that the diffusion of an innovation is influenced by the characteristics of the

innovation itself as well as the potential innovation adopters' socioeconomic status, personality values, and communication behavior (Rogers 1995). This research utilizes the IDT to predict the relationships between occupational characteristics and occupational usage of EIT.

In summary, the purpose of this research is to scrutinize the relationships between occupational characteristics and their actual usage of EIT by examining existing archives – O*NET and T2DB – with the IDT serving as the research framework. Our results provide evidence that the socioeconomic status and occupational values of a profession are generally associated with its usage of EIT. The relationships between occupational communication behavior and the degree of using EIT are mixed and deserve further investigations. Furthermore, this research suggests that professionalism or work activities may serve as moderators in the context of IT adoptions.

This research is organized as follows. Section II describes the IDT and hypothesis developments of this research. Section III introduces the research methodology, including databases used, variable definitions, and the coding process, followed by the research results in Section IV. Section V concludes this research with discussions, contributions, and limitations.

II. Theory and Hypotheses

The adoption, implementations, and diffusion of information technologies have been explored by many theories, such as Theory of Reasoned Action, Technology Acceptance Model, and Task-Technology Fit Theory (Jeyaraj et al. 2006). While those theories have been empirically tested by various methodologies, such as field surveys, field studies, event studies, case studies, or a combination of methods, most research adopts a similar research paradigm (See Figure 1). Based on the economic-rationalistic models, the dominant research design assumes that characteristics of the potential innovation adopters may influence their degree of adoption (Fichman 1992; Jeyaraj et al. 2006) and thus individuals or organizations "*with a greater quantity of what might be called "The Right Stuff" are expected to exhibit a greater quantity of innovation" (Fichman 1992)*

Insert Figure 1 about here

Drawn from different background, various theories define, emphasize, and categorize those "right stuffs" in different manner. For example, rooted in social psychology, the Theory of Reasoned Action (TRA) lays emphasis on the influences of one's attitude toward innovation and the subjective norm on his/ her behavioral intention (Fishbein et al. 1975). Applying TRA to individual IT acceptance, Davis et al proposed the Technology Acceptance Model (TAM) in 1989 and stressed the importance of users' perceptions on a specific technology's usefulness and ease-of-use (Davis 1989). Later in 2000, TAM was extended to be TAM2 by including the impacts of subjective norm on users' adoption (Venkatesh et al. 2000a).

2.1 The Innovation Diffusion Theory

Grounded in sociology, the IDT has a long history as a multi-disciplinary research model since its creation in 1962 (Rogers 1995). Researchers in multiple domains (e.g. geography, sociology, economics, education, communication, marketing, information system) utilize IDT's quantitative and qualitative indicators to assess the likely rate of innovation diffusion and to identify factors that facilitate technology evaluation, adoption, and implementation. As of July 30, 2008, the 1983 version of Rogers' "Diffusion of Innovations" book has been cited for 13,533 times by academic publications, according to the Google Scholar (Google Scholar 2008).

IDT proposes five attributes of innovations that influence technology adoption: relative advantage, compatibility, complexity, trialability, and observability. In addition, Rogers summarizes and categorizes attributes of innovators that contribute to the explanation of innovation adoption into three groups: (1) socioeconomic status; (2) personality values; and (3) communication behavior (Rogers 1995).

2.2 Socioeconomic Status (SES)

2.2.1 Formal Education and Trainings

Based on prior research, Rogers concludes that earlier adopters have more formal education than

later adopters (Rogers 1995). Reviewing 48 empirical studies on individual IT adoption published between 1992 and 2003, Jeyaraj et al identified three studies that investigate the influences of formal education on IT adoption, two of which show significantly positive impacts (Jeyaraj et al. 2006). Therefore, this research posits that:

Hypothesis 1a: The required level of formal education of an occupation is positively correlated with its usage of EIT.

In addition, Jeyaraj et al reviewed three studies that explored the relationships between user training and IT adoption, all of which show positive correlations (Jeyaraj et al. 2006). Based on the IDT and prior research, this research investigates the correlations between training and the usage of EIT by:

Hypothesis 1b: The level of training of an occupation is positively correlated with its usage of EIT.

Note that while most prior IT adoption research attempts to build causal relationships between the quantity of the "*Right Stuffs*" and the quantity of innovation adoptions (Figure 1), this research focuses on the *strength* and *directions* of their correlations for the following reasons. First, this study explores the relationships by investigating existing archival datasets, which describe contemporaneous characteristics of various occupations. The lack of temporal difference hinders this research from investigating the causal relationships among variables. Second, some relationships under investigation are bi-directional by nature. For example, an occupation's intensive on-the-job trainings enable its high usage of EIT; in the meantime, occupations may demand rigorous trainings because of their frequent use of EIT. Third, this research assumes that the career choices occur in a free job market, where employees can join or leave an occupation at their own discretions. In other words, people who possess certain traits may choose to enter a profession for its occupational characteristics, but meanwhile the occupation demonstrates certain unique patterns because of the workers who self-select to enter its market. Last but not least, most prior studies investigated users' specific IT adoption by questionnaires or interviews; thus,

respondents' characteristics might not be influenced by their decisions of using the IT or not. For example, Gefen and Straub (1997) investigate the influence of gender difference on the perception and use of email. Gender itself will not be altered by respondents' decisions of using emails or not. However, this research explores the relationships between occupational characteristics and occupational usage of EIT. The gender composition of an occupation might be influenced by its usage of EIT, assuming gender and EIT use are not orthogonal.

2.2.2 Gender

Gender has been generally missing from IT behavioral studies (Gefen et al. 1997; Sun et al. 2006). Based on the Technology Acceptance Model (TAM), Venkatesh and Morris (2000b) indicate that male (female) IT usage decisions are influenced by their perceptions of usefulness (perceptions of ease of use and subjective norm). According to the Theory of Planned Behavior, Venkatesh et al. (2000c) demonstrate that men were more strongly influenced by their attitude toward using the new technology and that women were mostly driven by the subjective norm and perceived behavioral control. To formulate the Unified Theory of Acceptance and Use of Technology, Venkatesh et al. (2003) control for the influences of gender and confirm the moderating effects of gender in IT adoption decision-making processes. In addition, meta analyses in Sun and Zhang (2006) validate the moderating role of gender in IT adoption studies.

While those results suggest possible differences between men and women, Jeyaraj et al. (2006) list gender as "*the worst predictors of IT adoption by individuals*" because only one study in their review shows significant gender impacts. They also conclude that "*researchers would need a compelling reason to continue including these (variables) in future research*" (parenthesis added by the author). Even though gender is not specifically identified in the IDT, previous mixed results on IT adoption suggest the necessity of further investigations. Therefore, this research investigates the magnitude of correlation by:

Hypothesis 2: The gender composition of an occupation is correlated with its degree of using

EIT.

2.3 Occupational Values

A "*surpassing achievement in vocational psychology*" (Savickas et al. 1999), John Holland's occupation interest model asserts that the congruence between one's personality and the work environment determines his/her satisfaction, stability, and achievement (Chartrand et al. 1999), suggesting the linkage between individual characteristics and occupational values and its influences over career choice and success.

Based on prior works on innovation diffusion, Rogers concludes that personality variables have not been fully investigated, probably because of the field interview method and resulting difficulties in measuring personality (Rogers 1995). In addition, previous studies seldom investigated the relationships between adopter characteristics and their IT adoptions (Jeyaraj et al. 2006). This research explores the relationships between occupational EIT usage and three occupational values - innovativeness, abstraction, and attitude toward changes.

2.3.1 Innovativeness

IT adoption studies use "*personal innovativeness*" to describe adopters' personal values and investigate its relationship with technology adoption (Agarwal et al. 1997). Exploring the relationship between occupational values and occupational usage of EIT, this research defines the innovativeness of an occupation by its work style, ability requirement, and major work activities – an innovative occupation requires creativity and alternative thinking to develop new ideas, procedures, or solutions for work-related problems; it also demands the ability to come up with unusual or clever ideas. Based on the prior research on individual innovativeness, this research proposes that an innovative occupation tends to use more EIT.

Hypothesis 3: The level of innovativeness of an occupation is positively correlated with its usage of EIT.

2.3.2 Abstraction

According to IDT, when determining whether to accept a new idea or technology, people rely on different types of information for their decision-making purposes - later adopters make their decisions mostly based on their observations of peers' actual usage, whereas early adopters tend to decide on the basis of abstract information and stimuli (Rogers 1995). Investigating physicians' acceptance of telemedicine, Chau and Hu (2002) found that subjective norms appeared to have no significant effects on behavior intention, inconsistent with the theory of planned behavior. They contribute the differences to the subjects of the research – physicians were well-trained and possess intellectual capabilities to develop independent evaluations; therefore, subjective norms consequently place less weight on others' opinions for physicians, comparing with the general public.

To respond to the dynamic environment, workers have to collect and analyze data and utilize their logic reasoning or sensemaking skills to make decisions. Thus, their ability to deal with abstract information is of specific importance to the efficiency and effectiveness of decision-making. Information technologies have been developed to facilitate data collection and analyses as well as the decision-making processes. Therefore, this research posits that an occupation which requires analyzing information and using logic to address work-related issues tends to use more EIT.

Hypothesis 4: An occupation's required level of abstraction ability is positively correlated with the usage of EIT.

2.3.3 Attitude toward Changes

EIT adoption brings change; thus, the attitude toward changes may influence individual's openness to change and willingness to adopt a new idea, concept, and technology. Based on previous works, Rogers concludes that early adopters have a more favorable attitude toward changes than later adopters (Rogers 1995). In the occupational level, this research posits that an occupation which requires openness to changes and varieties in the workplace tends to use more EIT.

Hypothesis 5: An occupation's attitude toward changes is positively correlated with its usage of EIT.

2.3.4 Knowledge of Information Technologies

Knowledge of innovation helps adopters evaluate its pros and cons and decrease skepticism towards it. Based on the review of prior works, Rogers generalizes that earlier adopters have greater knowledge of innovations than later adopters (Rogers 1995). This research posits that an occupation that requires more knowledge about computers and electronics, engineering and technologies, telecommunications, and communication and media uses more EIT.

Hypothesis 6: An occupation's required level of knowledge in information technologies is positively correlated with its usage of EIT.

2.4 Communication Behavior

Rogers posits that individuals' communication behavior (e.g. social participation, interpersonal networks, geographic location, or mass media exposure) partially determines the quantity and quality of information which they rely upon to determine whether to adopt the innovation. Also, the pressure of peers and their first-hand adoption and usage experience play an important role in innovation adoption decisions, especially for later adopters (Rogers 1995). In addition, Iacovou et al. (1995) indicate that external pressure from the supply chain or industry standard push corporation to adopt electronic data interchange (EDI), but the influences of peer pressure or social network on IT adoptions have not been explored (Jeyaraj et al. 2006).

One of the most important contributions of information technologies is its ability to enhance or facilitate inter-personal or inter-organizational communications. Therefore, occupations with different communication behaviors might use information technologies differently. This research investigates the relationships between occupational communicational behaviors and occupational usage of EIT by the following dimensions.

2.4.1 Social Participation

Social participation determines the amount of information or pressure from peers or colleagues; therefore, Rogers reviewed prior studies and concludes that earlier adopters have more social participation than later adopters (Rogers 1995). Following his generalization, this research posits that an occupation that requires more social contacts with colleagues, work group members, external customers, and the general public tends to use more EIT.

Hypothesis 7: The level of social participation of an occupation is positively correlated with its usage of EIT.

2.4.2 Connectedness

Rogers defines "*connectedness*" as the degree to which an individual is linked to others and concludes that earlier adopters are more interconnected through interpersonal networks than are later adopters (Rogers 1995). This research defines the degree of connectedness of an occupation by its work activities - occupations that require more communications with supervisors, peers, subordinates, and people outside of the organization and ask for establishing and maintaining interpersonal relations are assumed to be "highly-interconnected" and thus tend to use EIT.

Hypothesis 8: The level of connectedness of an occupation is positively correlated with its usage of EIT.

2.4.3 Exposure to Interpersonal Communication Channels

Interpersonal communication channels play an important role in innovation adoption because they provide potential adopters with first-hand, trustworthy, "here-and-now" information as to the observation or actual usage of an innovation. Rogers concludes that earlier adopters have greater exposure to interpersonal communication channels than later adopters (Rogers 1995).

Among occupations, a profession's exposure to interpersonal communication channels can be defined by its work context; occupations that require more public speaking, telephone conversations,

emails, written letters and memos, and face-to-face discussions are assumed to have greater exposure to interpersonal communication channels. This research hypothesizes that occupations with high exposure to interpersonal communication channels tend to use more EIT for their contributions in cost, efficiency, and effectiveness.

Hypothesis 9: An occupation's exposure to interpersonal communication channels is positively correlated with its usage of EIT.

III. Methods

3.1 Research Model

As indicated in Section 2.2.1, while most prior IT adoption research attempts to build *causal* relationships by following the "*dominant paradigm for IT innovation research*" model (Figure 1), this research focuses on the magnitude and directions of the *correlations* between the occupational usage of EIT and the SES, occupational value, and communication behavior of the occupations (see Figure 2).

Insert Figure 2 about here

3.1.1 Occupational Usage of EIT

An occupation's "Occupational Usage of EIT" (OUEIT) index is determined by the following function:

$$OUEIT_i = \sum_{1}^{j} EMERG_j * USAGE_{i,j}$$

Where $OUEIT_i$: The i-th business occupation's usage of EIT; i= 1 to 69;

$EMERG_j$: The degree to which the j-th tools or technologies is emergent in 2007; as indicated by AICPA's Emerging Technologies lists; j= 1 to 224

$USAGE_{i,j}$: Whether the i-th business occupation required the j-th tools or technologies for their major job duties, as indicated by T2DB; $USAGE_{i,j}$ = 0 or 1.

Specifically, this research explores the relationships between occupational characteristics and their OUEIT by examining 69 business professions (O*NET Groups 11, 13, 15, 41, and 43; See Table 2). The

U.S. Department of Labor develops and publishes the Tool and Technology Database (T2DB), which identifies 224 tools and technologies that are required by those 69 business occupations to perform their major functions (See Appendix 2 for samples). If T2DB indicates that the j-th tools or technologies is required by the i-th business occupation, the $USAGE_{i,j}$ will be coded as 1; otherwise 0. Note that $USAGE_{i,j}$ is dichotomous because the T2DB only indicates whether a specific tool or technology is required by an occupation; T2DB does not show each occupation's frequency of using every tool or technology.

To build awareness about important and emerging information technologies, the American Institute of Certified Public Accountants (AICPA) announces its annual "Top 10 Technologies" starting from 1989. This research utilizes these data to determine the degree to which the j-th tools or technologies is emergent (i.e., $\mathbf{EMERG_j}$).

After determining the $USAGE_{i,j}$ and $EMERG_j$,, this research then sums their products to represent the OUEIT for each occupation. The more EIT that is used by a business occupation, the higher its OUEIT is. This research conducts alternative coding to ensure the robustness of results (See Appendix 4 and 5). The following sections introduce the T2DB and ACIPA's Emerging Technologies charts in greater details. Coding process is presented in Appendix 4.

3.1.1.1 Tool and Technology Database (T2DB)

To facilitate workforce development, employee training, and vocational and career guidance, the U.S. Department of Labor develops and updates the Tool and Technology Database (T2DB), a component of O*NET, to show the machines and equipment (i.e. tools) and IT hardware and software (i.e. technologies) that are required by sampled occupations to perform their major tasks (Dierdorff et al. 2006). See Appendix 3 for more information about T2DB.

The initial T2DB was first published in December 2005 and contained 14,633 tools and technologies data for 156 occupations. Expanded in October 2007, the T2DB used by this research

identifies over 25,000 essential tools and technologies that are required by 327 in-demand occupations to perform successfully on the job (National Center for O*NET Development 2008). The 224 required tools and technologies for business occupations ($USAGE_{i,j}$) were then weighted by the "AICPA's Top 10 Emerging Information Technologies List" to determine the OUEIT of these occupations. Appendix 2 shows the tools and technologies that are required by accounting-related occupations to carry out their central functions.

3.1.1.2 AICPA's Top 10 Emerging Technologies

To build the awareness about important and emerging information technologies, the AICPA first established an annual "Top 10 Technologies" list in 1989 (AICPA Information Technology Committee 2008). Since then, the AICPA's information technology research subcommittee identified the EIT, applications, and issues that the accounting practitioners should know to improve service quality, increase efficiency, and control costs (Cytron et al. 2001). Later, the voting panel of the list expanded to include the Certified Information Technology Professional credential holders, the AICPA members of the information technology section, and the members of the Information Systems Audit and Control Association (ISACA), covering experts in industry, public accounting, academia, and government. For example, the 2006 list was compiled, ranked, assembled, and published with input from over 2,000 members of the AICPA and the ISACA (The Illinois CPA Society 2006). Since CPAs are trusted business advisors, technologically competent, and intricately involved in the flow of information within business (AICPA Information Technology Committee 2008), the Top 10 EIT lists provide a direct measurement as to whether an information technology is emergent at a specific point of time (see Appendix 1). Note that those charts include technologies that are crucial to accounting and other business professions. For example, fuel cells, digital homes, spam technology, and disaster recovery were in the 2005 list, whereas data mining and radio frequency identification (RFID) in 2004.

3.2 Occupational Characteristics

To assist in making informed decisions about education, training, career choices, and work, the U.S. Department of Labor administers and sponsors the O*NET, a comprehensive database of worker attributes and job characteristics. O*NET contains information about the required education level and trainings, knowledge domains, working skills, abilities, interests, general work activities, styles, and work context for more than 800 U.S. occupations (National Center for O*NET Development 2008).

This research retrieved each occupation's required formal education (H1a) and trainings (H1b) directly from O*NET Version 12, with the latter being measured by two variables – on-site training (organized classroom study provided by the employer) and on-the-job training (serving as a learner or trainee on the job under the instruction of a more experienced worker).

To present historical and current labor force and earnings data for women and men, the U.S. Census Bureau of the Bureau of Labor Statistics conducted a national monthly survey of approximately 60,000 households. The Department of Labor has published survey results in its "Women in the Labor Force: A Databook" in September 2006 to mark several notable changes in women's labor force activities compared to men's (Bureau of Labor Statistics 2005). The databook provides this research with gender composition data (H2).

While the O*NET provides single measurements for abstractions (H4) and attitude towards changes (H5), some other variables of this research are represented by multiple measurements. This research uses principal component analysis (PCA) to reduce the dimensionality of innovativeness (H3), knowledge of information technologies (H6), social participation (H7), connectedness (H8), and exposure to interpersonal communication channels (H9). Table 1 shows the data sources, title, definitions, and the Cronbach's Alpha of related variables in the O*NET database.

Insert Table 1 about here

As shown in Table 1, H3, H6, and H8 demonstrate a satisfactory level of measurement reliability

(Cronbach's Alpha>0.7). The first principal component scores of innovativeness (H3), knowledge of information technologies (H6), and connectedness (H8) can represent >60% of the original variables' variations.

However, social participation (H7) has a 0.580 Cronbach's Alpha, whose first principal component score can only represents 47.8% of its original variations, whereas interpersonal communication channels (H9) has a 0.420 Cronbach's Alpha, whose first principal component fails to interpret a majority of its original variations (32.4%). Since the dimensionality reduction process of H7 and H9 fails to provide a linear combination that can satisfactorily represent the variations in original variables, further analyses on H7 and H9 will be conducted in their original variable level, instead of their 1st PCA scores.

3.3 Samples

Based on the work activities and environments of each occupation, the O*NET Version 12 categorizes 949 occupations into 23 occupational groups. This research adopts its taxonomy and focuses on the EIT usage of 69 business occupations, including Managers (O*NET Group 11), Business & Finance (Group 13), Computer & Mathematical (Group 15), Sales (Group 41), and Office and Administrative Support (Group 43) (See Table 2).

Insert Table 2 about here

To control for the influences of professionalism and other associated variables, this research followed the classifications of O*NET and defined Groups 11, 13, and 15 as professional business occupations and Groups 41 and 43 as clerical business occupations.

3.4 Statistical Models

This research investigates the relationships between occupational characteristics and their usage of EIT; therefore, parametric and nonparametric correlation tests were used to examine the strength and directions of associations. To mitigate the possible confounds of professionalism and working activities

and environments, this research use partial correlation to perform hypothesis testing as well. Specifically, this research conducts (1) ANOVA of OUEIT on confounding variables, so that the residuals are the variance in OUEIT after the effect of the confounding variable is considered; (2) ANOVA of occupational characteristics on confounding variables, so that the residuals are the variance in occupational characteristics after the effect of the confounding variable is considered; and (3) parametric and non-parametric correlation tests by the residual of OUEIT (from Step 1) and the residual of occupational characteristics (from Step 2). The partial correlation procedure allows this research to test the strength and direction of associations, while controlling for another confounding variable. The following section presents the results of the statistical analyses.

IV. Results

4.1 Descriptive Statistics

4.1.1 Descriptive Statistics

Table 3 shows the descriptive statistics of the independent variables, including their means, medians, and standard deviations. Note that PCA process projects original values onto a new dimension with a standardized normal distribution; therefore, Innovativeness (H3), Knowledge of IT (H6), and Connectedness (H8) all have zero as their means and one as their STDEV. Descriptive statistics of other variables represent the central tendency or dispersions of their original O*NET values.

This research utilizes ANOVA procedure to determine the between-group differences (results not shown). Except for on-site training (H1b), attitude toward changes (H5), connectedness (H8), and face-to-face communication (H9), all other variables demonstrate significant differences among occupational groups. Such differences suggest that the occupational group may confound the relationships between OUEIT and occupational characteristics. Table 4 shows the Pearson's correlations among occupational characteristics and their significance levels, suggesting that most variables are highly correlated.

4.1.2 Ecological Validity

Table 5 shows the ecological validity of this research's coding scheme, whose results were presented by professionalism (i.e. professional vs. clerical) and by occupational usage of EIT. The profession using the most EIT is Computer and Information System Manager, followed by 8 other IS/IT occupations. Top 3 non-IS/IT occupations that use the most EIT are Advertising and Promotions Managers (7.38), Accountants (6.42), and Transportation Managers (6.26).

While the Department of Labor defines them as professional occupations, Food Service Managers (1.26), Actuaries (1.54), and Loan Counselors (1.68) use no more EIT than most clerical business occupations. Descriptive statistics of OUEIT (See Table 3) indicates that Computer & Mathematical occupations (Group 15) use the most EIT, followed by Management (Group 11), Business & Finance (Group 13), and clerical occupations (Groups 41 and 43).

T2DB identifies 224 tools or technologies that are required by business occupations to perform their major functions, 137 of which do not appear on the AICPA EIT lists during 1994 and 2007. Table 6 shows the EMERG scores for T2DB tools and technologies that appeared on the lists. The overall results suggest that the current coding scheme for the EMERG score and OUEIT provides a satisfactory level of ecological validity. Appendices 4 and 5 present alternative coding schemes and their results.

4.2 Correlation Tests

4.2.1 Socioeconomic Status

Table 7 shows the results of Pearson correlations and partial correlations after controlling for professionalism and work activity differences. The Pearson correlations for formal education (H1a) and both trainings (H1b) are all significantly positive, suggesting that business occupations using more EIT tend to require higher educational attainment and on-site and on-the-job training. After controlling for professionalism (i.e. professional vs. clerical) and work activities (by using Group Codes), some significances fade away but most correlations remain positive. Overall, these parametric measurements

confirm the positive relationships between OUEIT and occupational requirement of formal education and training (H1).

The Pearson correlation between OUEIT and gender composition (i.e. female percentage) is significantly negative, suggesting that occupations with higher percentage of female employees tend to have lower OUEIT (H2). Nevertheless, while the correlation still remains significantly negative after controlling for professionalism, it loses significance after work activities are controlled. Such mixed results suggest the influences of work environments and activities as well as the necessity for further investigations.

Overall, the Pearson and partial correlation results provide marginal support of IDT that the SES of an occupation is generally associated with its usage of EIT.

4.2.2 Occupational Values

H3 to H6 investigate the association between OUEIT and occupational values. Correlation test results of H3 (Innovativeness) suggest that occupations that require creativity and alternative thinking to develop new, unusual, clever ideas or to generate new applications, relationships, systems, or products tend to use more EIT. Such results were unaffected by the influences of professionalism and work activities.

Consistent with the IDT, jobs that required analyzing information and using logic to address work-related issues and problems use more EIT than other occupations (H4). Occupations using more EIT tend to require more adaptability, flexibility, (H5) and knowledge in IT (H6). In sum, the Pearson and partial correlations suggest that the degree of using EIT is associated with the occupation's values; even after professionalism and work activities are controlled.

4.2.3 Communication Behaviors

The IDT suggests that an individual's communication behavior partially determines the quantity and quality of information about the advent, adoption, implementations, and diffusion of innovations. In

addition, communication behaviors of an individual may influence the amount of peer pressure to adopt information technologies.

As indicated in Table 7, occupations that value the interactions with external customers or general public tend to use less EIT (H7), contrary to the prediction of IDT. Also, jobs that require frequent contacts with others through telephone, face-to-face, or otherwise use less EIT as well (H9). In addition to the differences in the strength of associations, the directions of the relationship occasionally change when professionalism or work activities were controlled (e.g. social orientation (H7), connectedness (H8), or telephone conversation (H9)). Such results indicate the unstable relationships between occupational communication behaviors and their usage of EIT.

V. Discussions, Contributions, and Limitations

Overall, correlations are significant between OUEIT and occupational socioeconomic status and between OUEIT and occupational values, suggesting that the degree of using EIT is generally associated with occupational characteristics. The differences between Pearson and partial correlation results indicate that professionalism and work activities might play a moderating role in the relationship between OUEIT and occupational characteristics. Such results yield implications that studies investigating the IT adoption of an industry (e.g. banking (Pennings et al. 1992); transportation (Premkumar et al. 1997)) or a specific occupation (e.g. IS professionals (Iivari et al. 1997); public managers (Kraemer et al. 1993)) might be under the influences of their subjects' characteristics. For example, based on responses from over 400 physicians, Chau and Hu (2002) compare the TAM and the theory of planned behavior and found that "*TAM may not be appropriate for user populations that have considerably above-average general competence and intellectual capacity*". In addition to suggesting the importance of individual intellectual capabilities, such results also imply that the occupational characteristics of a profession may moderate their IT usage decisions.

In addition, the moderating roles of occupational differences may deserve further investigations

for future research. Venkatesh et al. (2003) reviewed eight seminal IT acceptance or adoption theories and advanced the Unified Theory of Acceptance and Use of Technology. In addition to four direct determinants – performance expectancy, effort expectancy, social influence, and facilitating conditions, they also tested and incorporated the moderating effects of gender, age, experience, and voluntariness of use. This research provides evidence that the occupation of the individuals and the occupational characteristics might also influence the relationships. For example, this research provides evidence that female-oriented occupations tend to use less EIT, but its significance fades away when differences in work activities are controlled. While Jeyaraj et al. (2006) suggest that researchers need compelling reasons to investigate the influences of gender or age on IT adoptions; instead, this research calls for more research on those individual characteristics.

As to IDT's proposition on communication behavior and IT adoptions, this research can only provide limited support. This inapplicability might be driven by the contextual differences between IDT and this research. Particularly, IDT suggests that individuals' communication behaviors will determine the quantity and quality of information and of peer pressure, and ultimately influence individuals' decisions on innovation adoptions. This research focuses on the IT usage of business occupations and their characteristics. Whether the intensity of social participation (H7), the closeness to others (H8), and the frequency of using communication channels (H9) are all positively associated with the quantity and quality of information and of peer pressure is questionable. Also, the directions of some variables with IT usage are not easy to predict. For example, occupations value face-to-face discussions may take advantage of video conferences or other communication technologies, but they may adopt the traditional approach as well.

The limitations of the study come from the validity of the databases used, the occupations investigated, and the limited sample size. First, while the O*NET has been widely used by sociology, economic, and human resources research, it may still suffer from some validity issues. Specifically, the

O*NET data were collected by questionnaires, which may expose this research to some biases related to respondents or the design of O*NET questionnaire (e.g. length, question orders). Also, while O*NET Center gathers data on approximately 100 occupations each year, data in each version of O*NET does not reflect the situation and descriptions at the same point of time. Therefore, the cross-occupational comparison results will inevitably be influenced by time factor, especially when occupations within a dynamic environment are involved. Furthermore, even though the developers have examined the validity of T2DB by comparing their results to hardcopy publications and by counseling subject matter experts, the completeness of the database cannot be confirmed. In other words, their comparisons and counsels can only make sure all items listed in T2DB being used by occupations under investigation, but cannot make sure all tools and technologies used by occupations under investigations have been included in the T2DB. Second, this research focuses on 69 business occupations and their EIT usage, resulting in a small sample size and lower external validity to other uninvestigated occupations. Also, the sample size stops this research from using more complex statistical models (e.g. structural equation modeling) and fully investigating possible influences of interactions. In addition, the lack of temporal differences in T2DB and O*NET stops this research from building causal relationships between OUEIT and occupational characteristics.

The adoption of information technologies has been an important research area for decades. While most prior studies explore individual or organizational IT adoption by various research methods, this research focuses on the occupational usage of emergent information technologies by exploring existing archives. Our results suggest that the socioeconomic status and occupational values of a business profession are generally associated with its degree of using EIT, supporting the Innovation Diffusion Theory. Nevertheless, this research shows mixed results between OUEIT and occupational communication behavior, which deserves further investigations. In addition, we find that professionalism and the working activities play a moderating role in the context of IT adoption.

Figure 1 The Dominant Paradigm for IT Innovation Research (Fichman 2004; Jeyaraj et al. 2006)

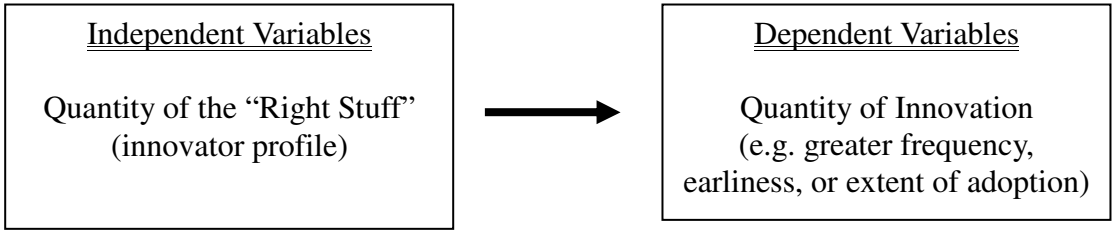
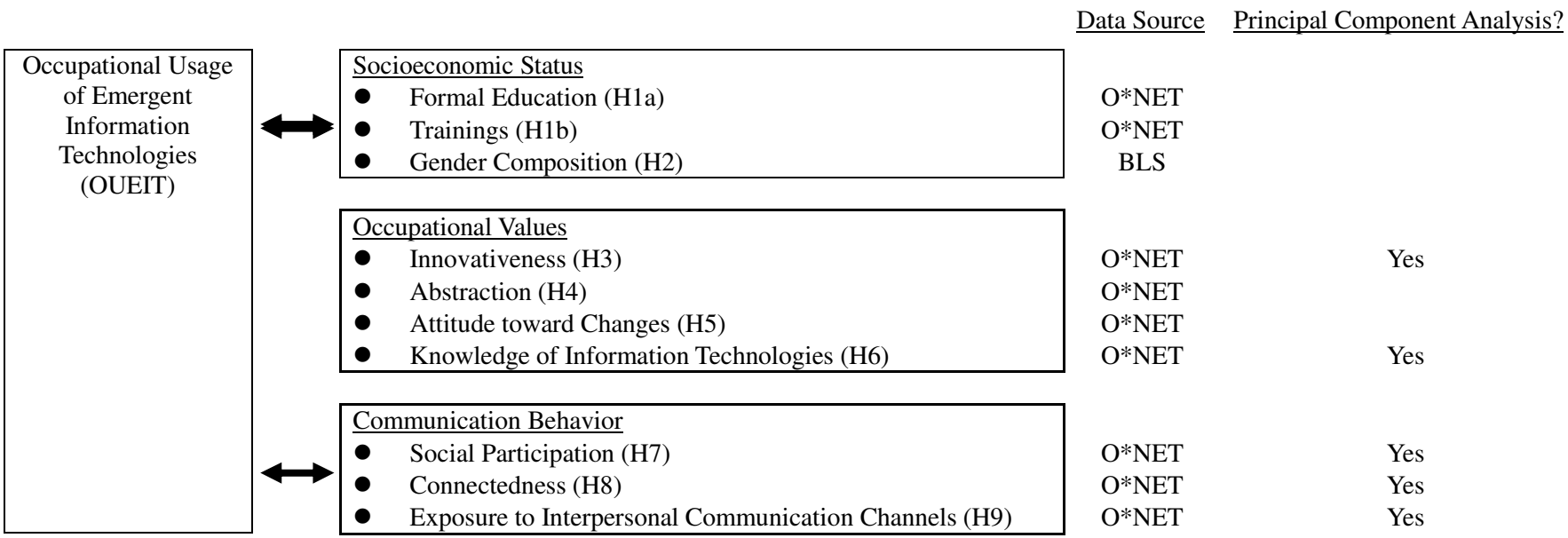


Figure 2 Research Model



Note: BLS: Bureau of Labor Statistics

Table 1 Descriptions of O*NET Variables used in this research

Variables	O*NET Group	O*NET Title	O*NET Definition/ Question	Cronbach's Alpha	% of the 1st Principal Component
Innovativeness (H3)	Style	Innovation	Job requires creativity and alternative thinking to develop new ideas for and answers to work-related problems	0.754	67.7%
	Abilities	Originality	The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.		
	Activities	Thinking Creatively	Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions.		
Abstraction (H4)	Style	Analytical Thinking	Job required analyzing information and using logic to address work-related issues and problems.	X	X
Attitude toward Changes (H5)	Style	Adaptability Flexibility	Job requires being open to change (positive or negative) and considerable variety in the workplace	X	X
Knowledge of Information Technologies (H6)	Knowledge	Computers & Electronics	Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.	0.806	65.2%
		Engineering & Technology	Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures and equipment to the design and production of various goods and services.		
		Telecommunications	Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems.		
		Communication & Media	Knowledge of media production, communication, and dissemination techniques and methods. This includes alternative ways to inform and entertain via written, oral, and visual media.		
Social Participation (H7)	Style	Social Orientation	Job requires preferring to work with others rather than alone, and being personally connected with others on the job.	0.580	47.8%
	Context	Work group or team	How important are interactions that require you to work with or contribute to a work group or team to perform your current job?		
		External customers or the public in general	In your current job, how important are interactions that require you to deal with external customers (as in retail sales) or the public in general (as in police work)?		
		Coordinate or lead others	In your current job, how important are interactions that require you to coordinate or lead others in accomplishing work activities (not as a supervisor or team leader)?		

Table 1 Descriptions of O*NET Variables used in this research (Cont'd)

Variables	O*NET Group	O*NET Title	O*NET Definition/ Question	Cronbach's Alpha	% of the 1st Principal Component
Connectedness (H8)	Activities	Communicating with supervisors, peers, or subordinates	Providing information to supervisors, coworkers, and subordinates by telephone, in written form, email, or in person.	0.757	68.2%
		Communicating with people outside the organization	Communicating with people outside the organization, representing the organization to customers, the public, government, and other external sources. This information can be exchanged in person, in writing, or by telephone or email.		
		Establishing and maintaining interpersonal relationships	Developing constructive and cooperative working relationships with others and maintaining them over time.		
Interpersonal Communication Channels (H9)	Context	Face-to-face discussions	How often does your current job require face-to-face discussions with individuals and within teams?	0.420	32.4%
		Public speaking	How often does your current job require public speaking (one speaker with an audience)?		
		Telephone conversation	How often does your current job require telephone conversation?		
		Email	How often does your current job require electronic mail?		
		Written letters and memos	How often does your current job require written letters and memos?		
		Contact with others	How much contact with others (by telephone, face-to-face, or otherwise) is required to perform your current job?		

Table 2 Business Occupations in 2007 T2DB

O*NET Group	Number of Occupations	Occupations	
11 Managers	15	◆ Advertising and Promotions Managers ◆ Marketing Managers ◆ Human Resources Managers ◆ Industrial Production Managers ◆ Transportation Managers ◆ Storage and Distribution Managers ◆ Construction Managers ◆ Engineering Managers	◆ Medical and Health Services Managers ◆ Sales Managers ◆ Purchasing Managers ◆ Food Service Managers ◆ Financial Managers, Branch or Department ◆ Treasurers and Controllers ◆ Computer and Information Systems Managers
13 Business & Finance	17	◆ Wholesale and Retail Buyers, Except Farm Products ◆ Personal Financial Advisors ◆ Claims Examiners, Property and Casualty Insurance ◆ Loan Officers ◆ Insurance Adjusters, Examiners, and Investigators ◆ Financial Analysts ◆ Financial Examiners ◆ Credit Analysts ◆ Assessors	◆ Insurance Underwriters ◆ Appraisers, Real Estate ◆ Loan Counselors ◆ Budget Analysts ◆ Cost Estimators ◆ Tax Preparers ◆ Accountants ◆ Auditors
15 Computer & Mathematical	10	◆ Database Administrators ◆ Computer Software Engineers, Systems Software ◆ Computer Systems Analysts ◆ Network and Computer Systems Administrators ◆ Network Systems and Data Communications Analysts	◆ Computer Support Specialists ◆ Computer Software Engineers, Applications ◆ Computer Programmers ◆ Computer Security Specialists ◆ Actuaries
41 Sales	12	◆ Real Estate Sales Agents ◆ Sales Engineers ◆ Insurance Sales Agents ◆ Sales Representatives, Wholesale and Manufacturing, Technical ◆ Sales Agents, Securities and Commodities ◆ Sales Representatives, Wholesale and Manufacturing, Except Technical	◆ First-Line Supervisors/Managers of Retail Sales Workers ◆ Retail Salespersons ◆ Sales Agents, Financial Services ◆ Cashiers ◆ Demonstrators and Product Promoters ◆ Counter and Rental Clerks
43 Office and Administrative Support	15	◆ Desktop Publishers ◆ Dispatchers, Except Police, Fire, and Ambulance ◆ Shipping, Receiving, and Traffic Clerks ◆ Production, Planning, and Expediting Clerks ◆ Tellers ◆ Customer Service Representatives ◆ Medical Secretaries ◆ Insurance Policy Processing Clerks	◆ Hotel, Motel, and Resort Desk Clerks ◆ Insurance Claims Clerks ◆ Bill and Account Collectors ◆ Payroll and Timekeeping Clerks ◆ Brokerage Clerks ◆ New Accounts Clerks ◆ Bookkeeping, Accounting, and Auditing Clerks

Table 3 Descriptive Statistics - Mean/ Median (Standard Deviation)

Hypo.	Variable (Mean/ Median (STDEV))	All Business Occupation (N=69)	Management (N=15)	Business & Finance (N=17)	Computer & Mathematical (N=10)	Sales (N=12)	Office & Administrative Support (N=15)
H1a	Required Years of Formal Education	14.27 / 14.24 (1.55)	14.89 / 14.92 (1.11)	14.69 / 14.61 (1.11)	15.72 / 15.55 (1.09)	13.31 / 13.20 (2.02)	12.98 / 12.86 (0.60)
H1b	Training - Average Months of On-the-Job Training	9.37 / 7.41 (6.78)	11.85 / 9.52 (8.87)	10.91 / 9.86 (4.66)	11.83 / 9.16 (7.16)	8.06 / 6.36 (7.49)	4.58 / 4.22 (1.74)
	Training - Average Months of On-site Training	7.48 / 6.47 (5.04)	8.96 / 6.82 (6.94)	9.78 / 8.52 (4.42)	8.95 / 9.19 (3.49)	5.72 / 5.13 (4.19)	3.85 / 3.77 (2.10)
H2	Gender Composition (Female %)*	46.06 / 44.20 (23.10); N=43	39.77 / 41.00 (24.76); N=9	50.01 / 52.40 (19.66) ; N=8	24.42 / 24.60 (7.07) ; N=9	47.24 / 48.55 (16.05) ; N=8	69.43 / 68.70 (19.26) ; N=9
H3	Innovativeness	0.00 / 0.08 (1.00)	0.82 / 0.71 (0.52)	-0.21 / -0.30 (0.60)	0.85 / 1.12 (0.67)	-0.19 / -0.03 (0.98)	-1.00 / -1.00 (0.86)
H4	Abstraction - Analytical Thinking	3.94 / 4.00 (0.55)	3.98 / 3.96 (0.32)	4.21 / 4.41 (0.44)	4.51 / 4.47 (0.27)	3.54 / 3.61 (0.63)	3.55 / 3.64 (0.43)
H5	Attitude toward Changes – Adaptability/ Flexibility	4.07 / 4.06 (0.32)	4.14 / 4.20 (0.38)	4.00 / 3.89 (0.36)	4.19 / 4.18 (0.27)	4.07 / 4.02 (0.17)	3.98 / 4.03 (0.29)
H6	Knowledge of Information Technologies	0.00 / -0.24 (1.00)	0.23 / 0.23 (0.73)	-0.49 / -0.32 (0.57)	1.65 / 1.76 (1.04)	-0.39 / -0.51 (0.67)	-0.46 / -0.65 (0.51)
H7	Social Participation - Social Orientation	3.47 / 3.44 (0.52)	3.81 / 3.79 (0.44)	3.24 / 3.22 (0.50)	2.99 / 2.84 (0.48)	3.54 / 3.55 (0.33)	3.65 / 3.49 (0.43)
	Social Participation - Work group or team	4.18 / 4.19 (0.41)	4.50 / 4.51 (0.30)	4.01 / 4.04 (0.45)	4.04 / 4.09 (0.47)	4.09 / 4.07 (0.36)	4.20 / 4.20 (0.28)
	Social Participation - External customers or the public in general	3.76 / 3.95 (0.82)	3.97 / 4.20 (0.72)	3.56 / 3.67 (0.71)	2.69 / 2.69 (0.71)	4.46 / 4.70 (0.56)	3.92 / 3.97 (0.50)
	Social Participation - Coordinate or lead others	3.52 / 3.51 (0.53)	4.07 / 4.18 (0.39)	3.25 / 3.30 (0.50)	3.29 / 3.35 (0.47)	3.56 / 3.49 (0.54)	3.38 / 3.38 (0.26)
H8	Connectedness	0.00 / -0.02 (1.00)	0.40 / 0.36 (0.74)	0.18 / 0.11 (0.95)	-0.41 / -0.65 (0.85)	-0.03 / 0.32 (1.36)	-0.31 / -0.56 (0.96)
H9**	Communication Channels- Public speaking	22.15 / 10.90 (27.83)	26.56 / 21.37 (19.34)	8.00 / 5.25 (9.11)	9.09 / 7.54 (7.12)	45.25 / 28.99 (44.96)	24.00 / 9.40 (28.75)
	Communication Channels- Face-to-face discussions	295.96 / 296.92 (47.66)	307.29 / 320.55 (49.13)	309.60 / 296.92 (38.45)	288.57 / 287.12 (51.98)	284.35 / 292.56 (61.91)	283.40 / 291.08 (38.62)
	Communication Channels- Telephone conversation	324.25 / 348.13 (59.64)	356.64 / 365.00 (15.81)	334.97 / 341.88 (29.05)	266.55 / 260.61 (75.23)	294.15 / 338.57 (95.68)	342.27 / 344.42 (21.57)
	Communication Channels- Email	253.04 / 276.51 (96.58)	271.59 / 312.81 (89.25)	268.34 / 261.08 (63.80)	328.46 / 335.11 (40.09)	187.53 / 227.74 (138.80)	219.30 / 218.01 (83.11)
	Communication Channels- Written letters and memos	148.48 / 133.38 (79.07)	159.04 / 129.34 (65.63)	194.97 / 181.51 (82.11)	88.67 / 78.41 (51.69)	126.67 / 127.54 (88.73)	142.57 / 133.38 (68.57)
	Communication Channels- Contact with others	264.61 / 264.63 (71.97)	292.56 / 309.52 (53.32)	249.58 / 253.72 (82.59)	194.85 / 216.61 (51.72)	297.17 / 319.62 (64.68)	274.17 / 264.63 (62.63)
-	Occupational Usage of EIT	4.61 / 3.94 (3.16)	5.15 / 5.02 (2.73)	3.71/ 3.19 (1.43)	9.53/ 10.86 (3.43)	2.73/ 2.47 (2.41)	3.33/ 3.94 (1.75)

* The Department of Labor only provides partial occupational gender composition.

** Original data were collected by interval scales. This research has converted them into "number of days in one year that a specific communication is used for business purposes"

Table 4 Pearson Correlation Matrix (N=69)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
A. Required Years of Formal Education	1.00	0.54 (0.00)	0.34 (0.00)	-0.41 (0.01)	0.61 (0.00)	0.74 (0.00)	0.16 (0.19)	-0.24 (0.05)	0.05 (0.66)	-0.40 (0.00)	0.11 (0.36)	0.28 (0.02)	-0.42 (0.00)	0.27 (0.03)	0.19 (0.11)	0.70 (0.00)	0.21 (0.09)	-0.35 (0.00)	0.42 (0.00)
B. Average Months of On-the-Job Training		1.00	0.62 (0.00)	-0.52 (0.00)	0.39 (0.00)	0.44 (0.00)	0.14 (0.25)	-0.15 (0.22)	0.09 (0.44)	-0.28 (0.02)	0.12 (0.32)	0.14 (0.27)	-0.31 (0.01)	0.25 (0.04)	0.20 (0.11)	0.51 (0.00)	0.21 (0.08)	-0.19 (0.12)	0.30 (0.01)
C. Average Months of On-site Training			1.00	-0.52 (0.00)	0.29 (0.02)	0.35 (0.00)	0.08 (0.54)	-0.06 (0.64)	0.08 (0.50)	-0.19 (0.11)	0.05 (0.66)	0.10 (0.42)	-0.25 (0.04)	0.24 (0.05)	0.17 (0.15)	0.43 (0.00)	0.26 (0.03)	-0.06 (0.61)	0.20 (0.10)
D. Gender Composition (Female %)				1.00	-0.59 (0.00)	-0.40 (0.01)	-0.09 (0.56)	0.33 (0.03)	-0.06 (0.69)	0.28 (0.07)	-0.27 (0.08)	-0.02 (0.91)	0.22 (0.16)	-0.11 (0.47)	0.10 (0.53)	-0.34 (0.03)	0.10 (0.54)	0.46 (0.00)	-0.53 (0.00)
E. Innovativeness					1.00	0.42 (0.00)	0.18 (0.13)	-0.06 (0.65)	0.18 (0.13)	-0.18 (0.13)	0.29 (0.02)	0.35 (0.00)	-0.09 (0.48)	0.14 (0.27)	0.15 (0.21)	0.44 (0.00)	0.06 (0.65)	-0.09 (0.45)	0.51 (0.00)
F. Abstraction - Analytical Thinking						1.00	0.31 (0.01)	-0.15 (0.21)	-0.03 (0.80)	-0.51 (0.00)	-0.13 (0.29)	0.12 (0.31)	-0.38 (0.00)	0.22 (0.07)	0.12 (0.34)	0.52 (0.00)	0.15 (0.23)	-0.32 (0.01)	0.36 (0.00)
G. Attitude toward Changes							1.00	0.48 (0.00)	0.09 (0.47)	-0.20 (0.11)	0.00 (0.97)	0.21 (0.08)	0.01 (0.95)	0.20 (0.11)	0.05 (0.70)	0.01 (0.93)	-0.11 (0.35)	0.08 (0.49)	0.29 (0.01)
H. Social Orientation								1.00	0.30 (0.01)	0.28 (0.02)	0.08 (0.52)	0.35 (0.00)	0.30 (0.01)	0.26 (0.03)	0.26 (0.03)	-0.20 (0.09)	0.12 (0.31)	0.51 (0.00)	-0.20 (0.11)
I. Work group or team									1.00	0.18 (0.13)	0.59 (0.00)	0.16 (0.20)	0.14 (0.24)	0.38 (0.00)	0.18 (0.13)	0.01 (0.93)	-0.13 (0.28)	0.23 (0.06)	0.04 (0.74)
J. External customers or the public in general										1.00	0.32 (0.01)	0.20 (0.10)	0.35 (0.00)	-0.06 (0.63)	0.28 (0.02)	-0.36 (0.00)	0.13 (0.28)	0.68 (0.00)	-0.36 (0.00)
K. Coordinate or lead others											1.00	0.16 (0.18)	0.14 (0.24)	0.16 (0.19)	0.11 (0.39)	-0.11 (0.39)	-0.04 (0.76)	0.20 (0.10)	0.08 (0.50)
L. Connectedness												1.00	-0.09 (0.45)	0.10 (0.43)	0.40 (0.00)	0.21 (0.09)	0.35 (0.00)	0.35 (0.00)	0.06 (0.61)
M. Public speaking													1.00	0.07 (0.56)	-0.12 (0.32)	-0.43 (0.00)	-0.20 (0.10)	0.42 (0.00)	-0.14 (0.24)
N. Face-to-face discussions														1.00	0.25 (0.04)	0.18 (0.14)	0.13 (0.30)	0.15 (0.20)	0.03 (0.78)
O. Telephone conversation															1.00	0.31 (0.01)	0.37 (0.00)	0.34 (0.00)	-0.08 (0.53)
P. Communication Channels- Email																1.00	0.29 (0.02)	-0.32 (0.01)	0.34 (0.00)
Q. Written letters and memos																	1.00	0.12 (0.31)	-0.24 (0.05)
R. Contact with others																		1.00	-0.29 (0.01)
S. Knowledge of IT																			1.00

Note: Significance is shown in parentheses.

Table 5 Occupational Usage of Emergent Information Technologies (OUEIT) for selected business occupations

Panel A - Bottom 10 Clerical Occupations (Groups 41 and 43)	OUEIT
Counter and Rental Clerks	.29
Insurance Claims Clerks	.50
Cashiers	.54
Demonstrators and Product Promoters	.86
Hotel, Motel, and Resort Desk Clerks	.87
Retail Salespersons	.93
Sales Agents, Financial Services	1.11
New Accounts Clerks	1.82
First-Line Supervisors/ Managers of Retail Sales Workers	1.82
Payroll and Timekeeping Clerks	1.93

Panel B - Top 10 Clerical Occupations (Groups 41 and 43)	OUEIT
Real Estate Sales Agents	8.74
Dispatchers, Except Police, Fire, and Ambulance	5.86
Shipping, Receiving, and Traffic Clerks	5.69
Desktop Publishers	5.55
Sales Engineers	4.73
Bookkeeping, Accounting, and Auditing Clerks	4.44
Bill and Account Collectors	4.38
Customer Service Representatives	4.26
Tellers	4.04
Insurance Sales Agents	4.01

Panel C- Bottom 10 Professional Occupations (Groups 11, 13, and 15)	OUEIT
Food Service Managers	1.26
Actuaries	1.54
Loan Counselors	1.68
Appraisers, Real Estate	2.06
Sales Managers	2.23
Tax Preparers	2.44
Insurance Underwriters	2.46
Cost Estimators	2.99
Credit Analysts	3.03
Assessors	3.10

Panel D - Top 10 Professional Occupations (Groups 11, 13, and 15)	OUEIT
Computer and Information Systems Managers	13.18
Network and Computer Systems Administrators	12.65
Computer Software Engineers, Systems Software	12.52
Database Administrators	11.64
Network Systems and Data Communications Analysts	11.31
Computer Systems Analysts	11.23
Computer Support Specialists	10.49
Computer Software Engineers, Applications	9.56
Computer Security Specialists	7.76
Advertising and Promotions Managers	7.38

Table 6 EMERG scores

Commodity Title	EMERG
Compliance software	0.96
Document management software	0.93
File system software	0.93
Backup or archival software	0.93
Computer based training software	0.93
Camera based vision systems for automated data collection	0.93
Content delivery networking equipment	0.93
File versioning software	0.93
Storage networking software	0.93
Voice recognition software	0.93
Enterprise resource planning ERP software	0.89
Materials requirements planning logistics and supply chain software	0.89
Requirements analysis and system architecture software	0.89
Metadata management software	0.88
Application server software	0.86
Platform interconnectivity software	0.86
Enterprise application integration software	0.86
Interactive voice response software	0.86
Authentication server software	0.86
Interactive voice recognition equipment	0.86
Information retrieval or search software	0.86
Internet directory services software	0.86
Wireless software	0.82
Radio frequency data communication equipment	0.82
Radio frequency identification devices	0.82
Web page creation and editing software	0.79
Portal server software	0.79
Web platform development software	0.79
Data mining software	0.79
Mobile messaging service software	0.76
Voice mail systems	0.76
Tablet computers	0.71
Data base reporting software	0.71
CRM software	0.71
Location based messaging service platforms	0.71
Graphics tablets	0.71
Helpdesk or call center software	0.71
Global positioning system receivers	0.71
Contact center software	0.71
Mobile location based services software	0.71
Vehicular global positioning systems	0.71
Industrial control software	0.61
Desktop communications software	0.57
Gateway software	0.57
Transaction security and virus protection software	0.57

Commodity Title	EMERG
Notebook computers	0.55
Personal digital assistant or organizers	0.55
Electronic funds transfer point of sale equipment	0.43
Content workflow software	0.41
Internet browser software	0.39
Network connectivity terminal emulation software	0.29
Teleconference equipment	0.29
ISDN access devices	0.29
Network security and virtual private network VPN equipment software	0.29
Network security or virtual private network VPN management software	0.29
Network analyzers	0.29
Server load balancer	0.29
ISDN testers	0.29
Videoconferencing systems	0.29
Network conferencing software	0.29
Digital Telephones	0.29
Electronic mail software	0.29
Graphics or photo imaging software	0.18
Video creation and editing software	0.18
Digital cameras	0.18
Optical network management software	0.18
Optical character reader or scanning software	0.18
Project management software	0.18
Expert system software	0.18
Computer servers	0.14
Network operation system software	0.14
Network interface cards	0.14
Network routers	0.14
Network switches	0.14
Network monitoring software	0.14
WAN switching software and firmware	0.14
Configuration management software	0.14
Administration software	0.14
Network operating system enhancement software	0.14
Analytical or scientific software	0.14
Financial analysis software	0.14
Data base user interface and query software	0.11
Access servers	0.11
Data base management system software	0.11
Access software	0.11
LAN software	0.11
Object oriented data base management software	0.11

Table 7 Pearson Correlation & Significance (1-tailed)

Hypo.	Name	Name	Pearson Correlation	Partial Correlation		Supported?
				Controlling for Professionalism (Pro. vs. Clerical)	Controlling for Work Activities (Group Code)	
H1a^	Formal Education	Required years of formal education	0.34 (0.002)***	0.14 (0.128)	-0.02 (0.431)	Mixed
H1b^	Training	Required months of on-the-job training	0.28 (0.009)***	0.15 (0.104)	0.18 (0.066)*	Mixed
		Required months of on-site training	0.25 (0.018)**	0.09 (0.227)	0.17 (0.084)*	Mixed
H2^^	Gender Composition	Percentage of female	-0.46 (0.001)***	-0.33 (0.016)**	-0.11 (0.249)	Mixed
H3^	Innovativeness	PCA of 3 variables - Innovation, Originality, and Thinking Creatively	0.47 (0.000)***	0.34 (0.002)***	0.24 (0.025)**	Y
H4^	Abstraction	Analytical Thinking	0.43 (0.000)***	0.27 (0.012)**	0.16 (0.088)*	Y
H5^	Attitude toward changes	Adaptability/ Flexibility	0.29 (0.007)***	0.27 (0.013)**	0.23 (0.031)**	Y
H6^	Knowledge of IT	PCA of 4 IT knowledge	0.72 (0.000)***	0.68 (0.000)***	0.45 (0.000)***	Y
H7^	Social Participation	Workgroup or team	0.03 (0.408)	0.01 (0.458)	0.05 (0.349)	
		External customer or the public in general	-0.54 (0.000)***	-0.46 (0.000)***	-0.30 (0.007)***	Reverse
		Coordinate or lead others	-0.11 (0.191)	-0.15 (0.105)	-0.17 (0.081)*	
		Social Orientation	-0.10 (0.202)	-0.02 (0.430)	0.17 (0.085)*	
H8^	Connectedness	PCA of 3 variables	-0.01 (0.470)	-0.08 (0.269)	0.07 (0.272)	
H9^	Interpersonal Communication Channels	Face-to-face discussions	0.07 (0.288)	-0.01 (0.452)	0.10 (0.219)	
		Public speaking	-0.20 (0.047)**	-0.08 (0.247)	-0.07 (0.284)	Mixed
		Telephone conversation	-0.05 (0.346)	-0.07 (0.276)	0.23 (0.029)**	Mixed
		Email	0.48 (0.000)***	0.38 (0.001)***	0.32 (0.004)***	Y
		Written letters and memos	-0.18 (0.068)*	-0.26 (0.017)**	-0.01 (0.468)	Mixed
		Contact with others	-0.27 (0.013)**	-0.20 (0.049)**	-0.03 (0.419)	Mixed

***: Significance < 0.01; **: Significance between 0.01 and 0.05; *: Significance between 0.05 and 0.10

^: Sample Size = 69; ^^: Sample Size = 43

Table 8 Spearman Correlation & Significance (1-tailed)

Hypo.	Name	Name	Spearman Correlation	Partial Correlation		Supported?
				Controlling for Professionalism (Pro. vs. Clerical)	Controlling for Work Activities (Group Code)	
H1a^	Formal Education	Required years of formal education	0.37 (0.001)***	0.26 (0.015)**	0.06 (0.300)	Mixed
H1b^	Training	Required months of on-the-job training	0.28 (0.010)**	0.14 (0.125)	0.16 (0.096)*	Mixed
		Required months of on-site training	0.32 (0.003)***	0.15 (0.107)	0.25 (0.018)**	Mixed
H2^^	Gender Composition	Percentage of female	-0.42 (0.003)***	-0.30 (0.024)**	-0.11 (0.233)	Mixed
H3^	Innovativeness	PCA of 3 variables - Innovation, Originality, and Thinking Creatively	0.47 (0.000)***	0.35 (0.002)***	0.28 (0.010)**	Y
H4^	Abstraction	Analytical Thinking	0.40 (0.000)***	0.25 (0.019)**	0.20 (0.051)*	Y
H5^	Attitude toward changes	Adaptability/ Flexibility	0.28 (0.009)***	0.30 (0.006)***	0.25 (0.021)**	Y
H6^	Knowledge of IT	PCA of 4 IT knowledge	0.63 (0.000)***	0.67 (0.000)***	0.35 (0.002)***	Y
H7^	Social Participation	Workgroup or team	0.13 (0.139)	0.09 (0.235)	0.12 (0.161)	
		External customer or the public in general	-0.43 (0.000)***	-0.35 (0.002)***	-0.22 (0.032)**	Reverse
		Coordinate or lead others	-0.02 (0.437)	-0.08 (0.248)	-0.12 (0.156)	
		Social Orientation	-0.07 (0.276)	0.02 (0.428)	0.16 (0.097)*	
H8^	Connectedness	PCA of 3 variables	0.00 (0.498)	-0.02 (0.421)	0.07 (0.282)	
H9^	Interpersonal Communication Channels	Face-to-face discussions	0.08 (0.266)	0.01 (0.483)	0.06 (0.309)	
		Public speaking	-0.11 (0.186)	-0.06 (0.304)	-0.04 (0.374)	
		Telephone conversation	0.09 (0.226)	0.10 (0.212)	0.20 (0.053)*	
		Email	0.50 (0.000)***	0.43 (0.000)***	0.29 (0.007)***	Y
		Written letters and memos	-0.10 (0.201)	-0.21 (0.042)**	0.02 (0.421)	Mixed
		Contact with others	-0.25 (0.018)**	-0.19 (0.056)*	-0.02 (0.426)	Mixed

***: Significance < 0.01; **: Significance between 0.01 and 0.05; *: Significance between 0.05 and 0.10

^: Sample Size = 69; ^^: Sample Size = 43

Table 9 Pearson Correlation & Significance (1-tailed) – Professional Occupations Only

Hypo.	Name	Name	Management (Group 11) & Business and Finance (13) (N=32)		IS/ IT (Group 15, excluding Actuaries) (N=9)	
			Pearson Correlation	Spearman Correlation	Pearson Correlation	Spearman Correlation
H1a^	Formal Education	Required years of formal education	0.09 (0.304)	0.14 (0.219)	-0.45 (0.113)	-0.28 (0.230)
H1b^	Training	Required months of on-the-job training	0.55 (0.001)***	0.22 (0.110)	-0.17 (0.327)	-0.12 (0.383)
		Required months of on-site training	0.11 (0.268)	0.12 (0.248)	0.37 (0.165)	0.43 (0.122)
H2^^	Gender Composition	Percentage of female	-0.16 (0.276)	-0.09 (0.368)	0.24 (0.271)	-0.06 (0.441)
H3^	Innovativeness	PCA of 3 variables - Innovation, Originality, and Thinking Creatively	0.22 (0.114)	0.17 (0.170)	0.44 (0.117)	0.68 (0.021)**
H4^	Abstraction	Analytical Thinking	0.02 (0.463)	-0.04 (0.416)	0.41 (0.134)	0.36 (0.171)
H5^	Attitude toward changes	Adaptability/ Flexibility	0.36 (0.022)**	0.36 (0.021)**	0.32 (0.204)	0.17 (0.334)
H6^	Knowledge of IT	PCA of 4 IT knowledge	0.58 (0.000)***	0.53 (0.001)***	-0.07 (0.427)	0.05 (0.449)
H7^	Social Participation	Workgroup or team	0.28 (0.061)*	0.28 (0.059)*	0.00 (0.496)	0.03 (0.466)
		External customer or the public in general	-0.21 (0.121)	-0.06 (0.378)	-0.42 (0.131)	-0.40 (0.143)
		Coordinate or lead others	0.14 (0.220)	0.15 (0.201)	-0.16 (0.336)	-0.13 (0.366)
		Social Orientation	0.31 (0.040)**	0.41 (0.010)**	0.67 (0.024)**	0.73 (0.012)**
H8^	Connectedness	PCA of 3 variables	-0.07 (0.358)	0.01 (0.483)	0.34 (0.182)	0.33 (0.190)
H9^	Interpersonal Communication Channels	Face-to-face discussions	0.02 (0.465)	-0.01 (0.470)	0.04 (0.462)	0.05 (0.449)
		Public speaking	-0.06 (0.371)	0.05 (0.394)	-0.06 (0.442)	0.03 (0.466)
		Telephone conversation	0.27 (0.071)*	0.30 (0.045)**	-0.01 (0.494)	-0.03 (0.466)
		Email	0.32 (0.038)**	0.40 (0.011)**	-0.05 (0.447)	0.10 (0.399)
		Written letters and memos	-0.17 (0.171)	-0.12 (0.251)	0.26 (0.250)	0.30 (0.216)
		Contact with others	-0.07 (0.352)	-0.04 (0.421)	0.47 (0.103)	0.58 (0.050)**

***: Significance < 0.01; **: Significance between 0.01 and 0.05; *: Significance between 0.05 and 0.10

^: Sample Size = 69; ^^: Sample Size = 43

Appendix 1 AICPA's EIT List – 2004 ~ 2007 (Panel A)

	2007	2006	2005	2004
1	Information Security Management	Information Security	Information Security	Information Security
2	Identity and Access Management	Assurance and Compliance Applications	Electronic Document Management (paperless or less-paper office)	Spam Technology
3	Conforming to Assurance and Compliance Standards	Disaster and Business Continuity Planning	Data Integration	Digital Optimization
4	Privacy Management	IT Governance	Spam Technology	Database and Application Integration
5	Disaster Recovery Planning and Business Continuity Management	Privacy Management	Disaster Recovery	Wireless Technologies
6	IT Governance	Digital Identity and Authentication Technologies	Collaboration and Messaging Technologies	Disaster Recovery
7	Securing and Controlling Information Distribution	Wireless Technologies	Wireless Technologies	Data Mining
8	Mobile and Remote Computing	Application and Data Integration	Authentication Technologies	Virtual Office
9	Electronic Archiving and Data Retention	Paperless Digital Technologies	Storage Technologies	Business Exchange Technology
10	Document, Content and Knowledge Management	Spyware Detection and Removal	Learning and Training Competency (End Users)	Messaging Applications
11	Training and Awareness	E-mail Filtering including Spam and Malware scanning	RFID (Radio Frequency Identification)	ID/Authentication
12	Business Process Improvement, Workflow & Process Exception Alerts	Outsourcing	Search	Radio Frequency Identification (RFID)
13	Improved Application and Data Integration	Storage & Backup Technologies	Fuel Cells	3G Wireless
14	Web Deployed Applications	Patch & Network Management Tools	Digital Home	Simple Object Access Protocol (SOAP)
15	Enterprise System Management	Technology Competency & Effective Utilization	Display Technology	Autonomic Computers

Data Source: AICPA webpage (AICPA Information Technology Committee 2008)

Appendix 1 (Cont'd) AICPA's EIT List – 1999 ~ 2003 (Panel B)

	2003	2002	2001	2000	1999
1	Information Security	Business and financial reporting applications	Information security and controls	E-business	Year 2000
2	Business Information Management	Training and technology competency	E-business	Information security and controls	Internet
3	Application Integration	Information security and controls	Electronically-based business and financial reporting	Training and technology competency	Information security and controls
4	Web Services	Quality of service	Privacy	Disaster recovery	Training and technology competency
5	Disaster Recovery	Disaster recovery (business continuation and contingency planning)	Training and technology competency	High availability and resiliency of systems	Technology Management and Budgeting
6	Wireless Technologies	Communication technologies bandwidth	Disaster recovery	Technology management and budgeting	Disaster Recovery
7	Intrusion Detection	Remote connectivity tools	Qualified IT personnel	Electronic financial reporting.	The Virtual Office.
8	Remote Connectivity	Web-based and web-enabled applications	Quality of service	Internet issues	Privacy
9	Customer Relationship Management	Qualified IT personnel	Electronic audit trail	The virtual office	Electronic money
10	Privacy	Messaging applications (e-mail, faxing, voicemail, instant messaging)	Application service provider (ASP)	Privacy	Electronic evidence
11	ID Authentication				
12	M-Commerce				
13	Tablet PC				
14	3G Wireless				

Data Source: 1999 & 2000 - Journal of Accountancy (AICPA Information Technology Committee 1999; Tie 2000); 2001~2003 –AICPA webpage (AICPA Information Technology Committee 2008)

Appendix 1 (Cont'd) AICPA's EIT List – 1994 ~ 1998 (Panel C)

	1998	1997	1996	1995	1994
1	Internet, Intranets, Private Networks and Extranets	Security issues	Image processing	EDI	Electronic data interchange (EDI)
2	Year 2000 Issues	Image processing	Electronic data interchange (EDI)	Area networks	Area networks
3	Year 2000 issues - data transmission, e-commerce, and other transactions.	General communications technology	Security	Cooperative and client-server computing	Cooperative and client-server computing
4	Security and Controls	The Internet and public online services	Electronic commerce	Image processing	Image processing
5	Training & Technology Competency	Training and technology competency	Communications technologies	quick response	Quick response
6	Electronic Commerce	The year 2000	Workflow technology	Distributed database & Relational databases	Distributed databases
7	Communications Technologies	Electronic commerce	Area networks	Communication technologies	Relational databases
8	Telecommuting/ Virtual Office	Workflow	Collaborative computing and groupware	local area network Inoperability	Communications technologies
9	Mail technology information	Private networks, including intranets	Cooperative and client-server computing	Electronic commerce	Local area network interoperability
10	Remote Connectivity	Electronic data interchange	Intelligent Agents	Collaborative Computing & Groupware	Automatic identification
11			Business process reengineering	business process-reengineering	
12			Mail technology	Expert Systems	
13			Expert systems	Workflow Technology	
14			Quick response	Intelligent Agent	
15			Telecommuting	Security	
16				Executive Information Systems	

Data Source: Journal of Accountancy (1994; 1996; 1998; 1997)

Note: While the purpose of AICPA's subcommittee or voting panels is to decide the Top 10 information technologies, sometimes there were more than 10 technologies in the lists (e.g. "Honorable Mention" between 2003 and 2006; Top 15 technologies in 1996)

Appendix 2 Accounting-related occupations in T2DB and their tools and technologies

	Accountants	Auditors	Cost Estimators	Financial Managers, Branch or Department	Tax Preparers	Treasurers, Controllers, and Chief Financial Officers
Accounting software	*		*	*	*	*
Adding machines	*	*		*	*	*
Analytical or scientific software		*	*			
Calendar and scheduling software					*	
Compliance software	*	*				
Data base reporting software	*		*			
Data base user interface and query software	*	*		*	*	*
Desktop computers	*	*	*	*	*	*
Development environment software	*					
Document management software	*					
Electronic mail software				*	*	*
Enterprise application integration software	*					
Enterprise resource planning ERP software	*			*		*
Financial analysis software	*	*	*	*	*	*
Human resources software				*	*	*
Internet browser software				*	*	
Inventory management software	*					
Notebook computers	*	*	*	*	*	*
Office suite software				*	*	*
Personal computers	*	*	*	*		*
Personal digital assistant PDAs or organizers	*	*	*	*		*
Presentation software				*		*
Project management software			*		*	
Scanners	*	*	*	*		
Spreadsheet software	*	*	*	*	*	*
Tablet computers	*	*	*	*		*
Tax preparation software	*				*	
Time accounting software	*	*			*	
Web page creation and editing software					*	
Word processing software				*	*	*

(* indicates that the tool or technology is necessary to carry out the occupation's central functions

Appendix 3 Tool and Technology Database (T2DB)

To develop the T2DB, the U.S. Department of Labor project analysts first get familiar with each occupation under investigation by reviewing occupational characteristics in the O*NET database, by studying task information of the occupation, and by exploring other industrial or general field of study sources. Project analysts then locate and capture essential tools and technologies by reviewing task descriptions of O*NET and by searching the Internet, including visiting professional associations' websites, analyzing university curricula syllabi, and using general search engines.

Four minimal inclusion criteria must be met for a candidate to be deemed essential tools and technologies: (1) clear evidence must be found to link tools and technologies to the target occupation; (2) the Internet-based source must provide quality information; (3) use of tools and technologies must have an expectation of some form of training, ranging from a minimum of on-the-job training, initial supervision, or demonstration of use to more formal trainings or vocational educations; and (4) the tools and technologies cannot be materials (e.g. paper/ bandage).

To examine the viability of the tools and technologies data collected from the O*NET and the Internet, the developers of the T2DB compare their results to hardcopy publications (e.g., textbooks) and consult with subject matter experts to review and validate collected data. The collected tools and technologies data are organized and classified according to the United Nations Standard Products and Services Code (UNSPSC) and compiled and structured into two levels: commodity (e.g., Microsoft Word, Word Perfect) and class (e.g., Word processing software), which helps to facilitate a standardized and common language for tools and technologies information (Dierdorff et al. 2006).

Appendix 4 Coding Process

AICPA's Charts

Information technologies show up in the AICPA's list in various expressions or terminologies. For example, "disaster recovery" appeared in 1999~2005 charts, but was relabeled as "disaster and business continuity planning" in 2006 and then as "disaster recovery planning and business continuity management" in 2007. Researchers of this study first categorized and condensed all items on the charts separately. One-hundred and fifty-two items on the 1994~2007 charts were reduced into 62 groups, resulting in a coder agreement (i.e. Cohen's Kappa) of 0.98. Coders then met and discussed to reconcile the differences.

Tools & Technologies → AICPA's Charts

T2DB identifies 224 tools and technologies that are required by 69 business occupations to carry out their central functions. Researchers of this study best matched these 224 tools and technologies with those 68 groups on the 1994~2007 AICPA charts. For example, compliance software is required by accountants and auditors (See Appendix 2), which showed up in the 2006 and 2007 charts (See Appendix 1). Adding machines (e.g. 10-key calculators) are commonly used but never appeared on the AICPA charts. Initial coder agreement for this process was 0.521. Coders then met and discussed to reconcile the differences and create uniform linkages.

EMERG Scores

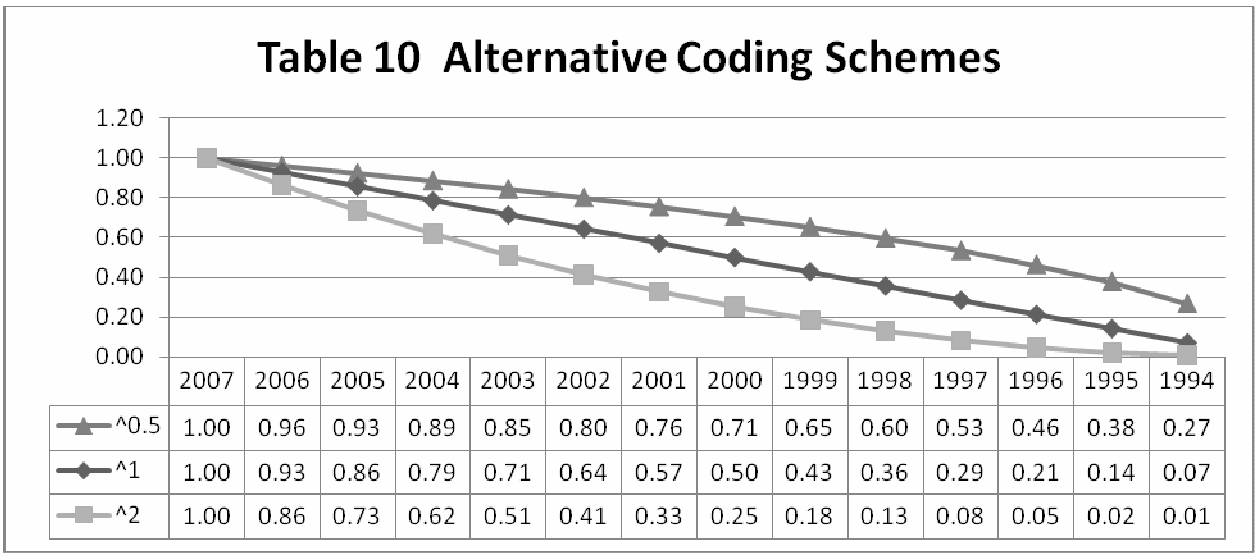
The T2DB used by this research was developed in 2005 and then updated in 2007. The AICPA's annual "Top 10 Emerging Technologies List" was first published in 1989. To account for the degree of emergence, this research determines that tools and technologies that first appeared on AICPA's 2007 Chart have an EMERG score of 1 (the most emergent) and those that have never appeared on the lists have their EMERG as 0 (i.e. not emergent at all). Tools and technologies that

showed up in 2006, 2005… 1995, and 1994 charts would have their EMERG scores as 0.93, 0.86 …, 0.14, and 0.07, respectively.

To ensure that the research results were not influenced by the coding scheme, this research employs other alternatives as well. Specifically, in addition the method described above (Coding^1), we determine the EMERG scores for T2DB tools and technologies by taking its squares (Coding^2) or square roots (Coding^0.5) of their original EMERG scores. Table 10 shows the EMERG codings under various methods. For example, the EMERG scores for tools and technologies that appeared on the 2000 AICPA list under Coding^2, Coding^1, or Coding ^0.5 are 0.25, 0.50, or 0.71, respectively.

In addition, to remove possible impacts of coding, we also count the number of appearance as the EMERG scores for each T2DB tools and technologies. For example, "compliance software" appeared on the 2006 and 2007 charts, so its EMERG score is 2, whereas "screwdriver" has a value 0 because it never showed up on the charts.

In sum, this research determines the EMERG scores by (1) COUNT, which does not consider the nearness to Year 2007; (2) Coding^1, which provides constant measurements of nearness to Year 2007; (3) Coding^2, which provides accelerating measurements of nearness to Year 2007; and (4) (3) Coding^2, which provides decelerating measurements of nearness to Year 2007. Statistics under Coding^1 were reported as the main results, whose robustness was tested by the other three schemes and reported in Appendix 5.



	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
^0.5	1.00	0.96	0.93	0.89	0.85	0.80	0.76	0.71	0.65	0.60	0.53	0.46	0.38	0.27
^1	1.00	0.93	0.86	0.79	0.71	0.64	0.57	0.50	0.43	0.36	0.29	0.21	0.14	0.07
^2	1.00	0.86	0.73	0.62	0.51	0.41	0.33	0.25	0.18	0.13	0.08	0.05	0.02	0.01

Multiple Appearances

Many tools or technologies appeared on the AICPA charts during 1994 and 2007 more than once. To determine of their degree of being emergent, we employ multiple coding:

- First-Appearance, where the EMERG score of a tool or technology was determined by its first appearance on the AICPA charts. For example, compliance software appeared on the 2006 and 2007 charts, so its EMERG score under Coding^1 is 0.93 (2006).

- Sum, where the EMERG score of a tool or technology was determined by summing all its appearances on the AICPA charts. For example, compliance software appeared on the 2006 and 2007 charts, so its EMERG score under Coding^1 is 1.93 (i.e. 0.93 (for 2006) + 1 (for 2007)).

- Average, where the EMERG score of a tool or technology was determined by averaging its individual EMERG scores. For example, compliance software appeared on the 2006 and 2007 charts, so its EMERG score under Coding^1 is 0.965 (i.e. 1.93/2).

- Last-Appearance, where the EMERG score of a tool or technology was determined by its last appearance on the AICPA charts. For example, compliance software appeared on the 2006 and 2007 charts, so its EMERG score under Coding^1 is 1 (2007).

Results under "Average" basis were reported as the major results, where other schemes were tested to verify the robustness of the statistical conclusions. Pearson correlations under different EMERG score definitions and multiple appearance determinations range from 0.89 to 0.99, all of which are significant in 0.001 levels (Results not shown). Appendix 5 presents the results under those alternative coding schemes.

Appendix 5 Additional Analyses

Alternative Coding Scheme

Thus far, the EMERG scores for each tool and technology in T2Db were determined by their average scores. In other words, if an item showed up in the AICPA charts for multiple times, this research uses the average EMERG score to represent how emergent it is. To ensure the robustness of statistical results, this research determines those EMERG score by alternative schemes – (1) First-appearance; (2) Sum; and (3) Last-appearance. In addition, this research also adopts multiple coding schemes to determine the EMERG scores for T2Db tools and technologies – (1) Count; (2) Coding^1; (3) Coding^2; and (4) Coding ^0.5 (Se Appendix 4 for more details). Statistical results shown in previous section remain qualitatively similar under alternative schemes (results not shown).

Nonparametric Analysis

Table 8 shows the results of nonparametric correlations. Specifically, Steps 1 and 2 (the derivation of residuals; See Section 3.4) were conducted in the same manner, but Step 3 uses Spearman's rho test, instead of Pearson product-moment correlation. Parametric (Table 7) and nonparametric (Table 8) results remain qualitatively equivalent.

Analyses on Professional Professions (Group 11, 13, and 15)

Table 9 shows the results of parametric and nonparametric correlations for management, business, and finance occupations (Group 11 and 13; N=32) and for IS/ IT professionals (Group 15, excluding actuaries; N=9).

Socioeconomic status (H1~H2) of the professional business occupations (Group 11, 13, and 15) seldom shows significant associations with their usage of EIT. While change attitude (H5) and IT knowledge (H6) of management, business, and finance professions still demonstrate

significantly positive relationships with their usage of EIT, similar correlations and significance could not be found from IT/IT professionals. Surprisingly, social orientation (H8) displays significantly positive associations with professional occupations' usage of EIT, a result that was not found by all business occupations.

Overall, statistical results focusing on professional occupations suggest that work characteristics may moderate some relationships between occupational usage of EIT and their socioeconomic status, occupational values, and communication behaviors.

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