# Factors Influencing Government Employee Performance via Information Systems Use: an Empirical Study

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**Abstract**: Based on the task-to-performance chain, this study seeks to investigate the implications and consequences of government employee performance via information systems. Data was collected from 847 employees of the Taipei City government through the stratified proportion sampling method. In addition, the multiple regression method is used to investigate factors that influence employee performance. The results indicate that three factors affect performance: task-technology fit, computer self-efficacy, and utilization. Utilization was found to have the greatest positive effect on performance. In addition to verifying prior empirical findings, this study presents factors that influence employee performance and information systems development work in the context of e-government.

**Keywords**: task-to-performance chain, task-technology fit, computer self-efficacy, performance, e-government

## 1. Introduction

With the rapid development of information technology (IT), the use of information systems (IS) to improve employee performance in organizations is evolving. Organizations are introducing computer technology and developing their own IS for more efficient management. The growing utilization of IS may encourage employees to increasingly use IS to help them perform tasks and manage work. This has resulted in rapid development of the electronic government (e-government) concept. The concept refers to the use of IT/IS by government to provide citizens and organizations with more convenient access to government's services. The main purpose of e-government is to build a government that exists everywhere and is ready to serve at any time. Through the use of different information equipment, e-government allows enterprises and the public to receive related services at any place and any time. However, the implementation of such new, innovative policies must achieve a consensus among most of the personnel within the organization. Therefore, the employee performance can be regarded as the outcome of e-government. Accordingly, factors influencing employee performance via IS use becomes an important theme in the context of e-government.

At the end of the twentieth century, Osborne and Gaebler (1992) proposed the enterprise-oriented concept as an innovative guide to government for providing convenient and rapid service to the public. Tony and Ian (2000) also pointed out that renovating government is necessitated by its inefficiency. Therefore, the government should change into an efficiency organization (Heeks, 1999). Along with this tendency, governments have strived to introduce effective IS for employees to provide e-service to the public. Industrialized countries such as the United Kingdom, the United States, and Japan are constantly proposing new government renovation plans. To keep up with world trends, the Taiwanese government, under the "E-Government Action Plan" provided by the Research, Development, and Evaluation Commission of Executive Yuan (2001), has promoted implementing e-government throughout the country. According to reports by the Center for Public Policy at Brown University, Taiwan's e-government services were ranked third among 198 countries in 2007 and second in 2008 (West, 2007, 2008). Also, through many years of development and implementation, e-government has become an important strategy for the implementation of reinvented and innovative services in many countries. While organizations have spent considerable money on IS to improve employee performance, understanding and measuring the success of IS are the most important tasks for managers. The success of IS has been well-documented in research (Lucas, 1975; DeLone, 1988; Iivari and Ervasti, 1994; Grover et al., 1996). One way to measure IS success is to determine the impact of IS on individual or organizational performance (Lucas, 1975; DeLone, 1988). In this study, we focus on the impact of IS on individual performance as the dependent variable of interest. This study assesses employee performance using the extended task-to-performance chain (TPC), one of the most widely used models for evaluating workplace technology adoption and the impact of that adoption on


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performance. Proposed by Goodhue and Thompson (1995), the TPC model incorporates insights from two complementary streams of research: the task-technology fit (TTF) as a predictor of performance, and the utilization as a predictor of performance (see Figure 1). When an organization introduces IT/IS to support individual tasks, the TPC model can be used to assess how IT/IS fits within the individual's characteristics, technology function, and the task design. Moreover, an organization can recognize the effect on employee performance and deliberate on how to improve technology functionality or design a training course to enhance employee performance.

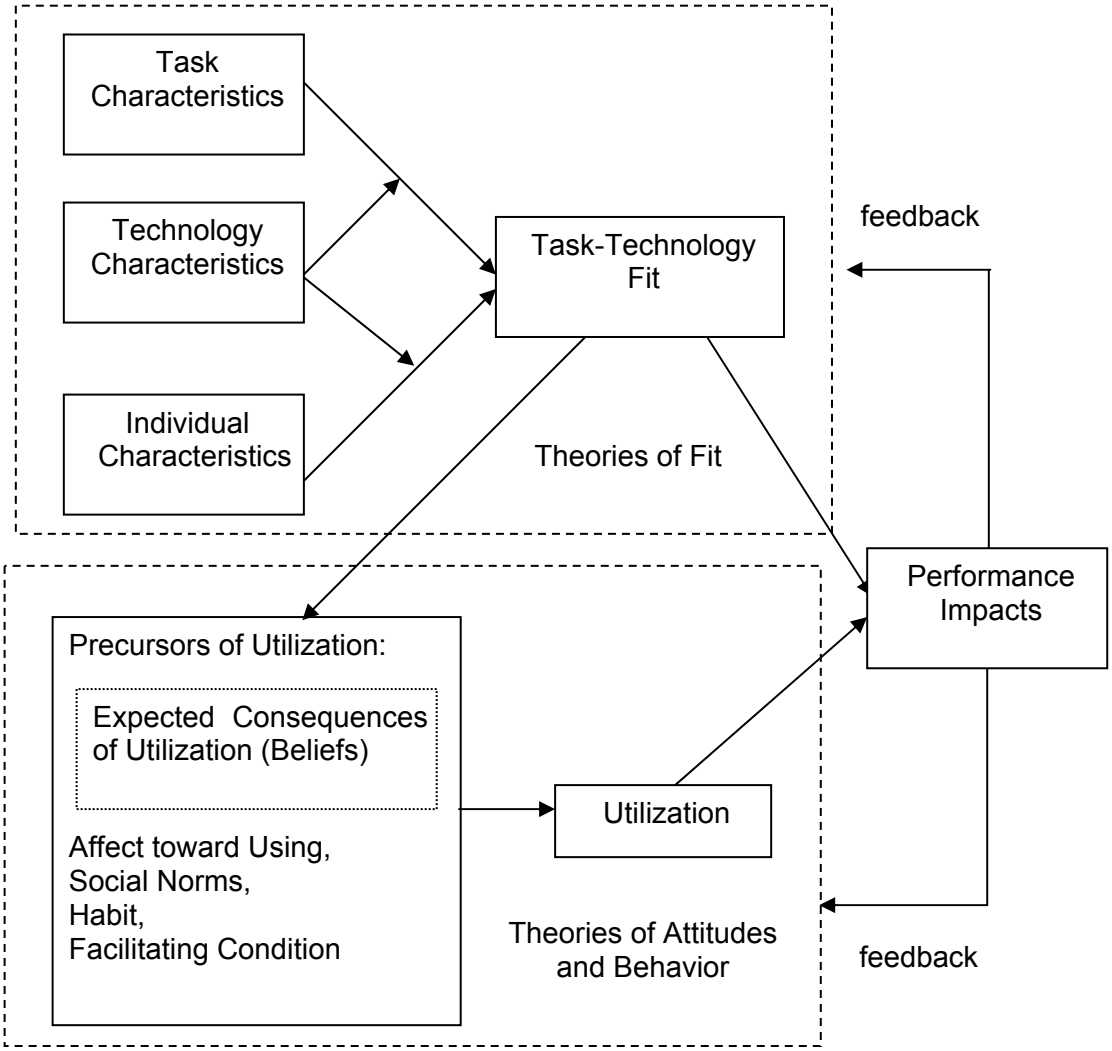


**Figure 1:** The technology-to-performance chain (Goodhue and Thompson, 1995, p. 217)

In the original research of Goodhue and Thompson (1995), the subset of the TPC model (see Figure 2) was empirically tested. In Goodhue and Thompson's model, performance is determined jointly by utilization and TTF. TTF will influence the utilization of IS, and TTF will be affected by both task characteristics (TC) and technology characteristics (TNC). However, individual characteristics are not tested under the TPC model. According to the original argument of Goodhue and Thompson (1995), individual characteristics include training, computer experience, and motivation. In the other extended TPC-related model, an individual characteristic — computer self-efficacy (CSE) — was added to the model, which could improve the explanatory power of original model (Dishaw and Strong, 2002). In our opinion, this study's practicality would have been diminished if we had not considered the influence of individual characteristics. Consequently, the current study added a "CSE" construct to test the model.

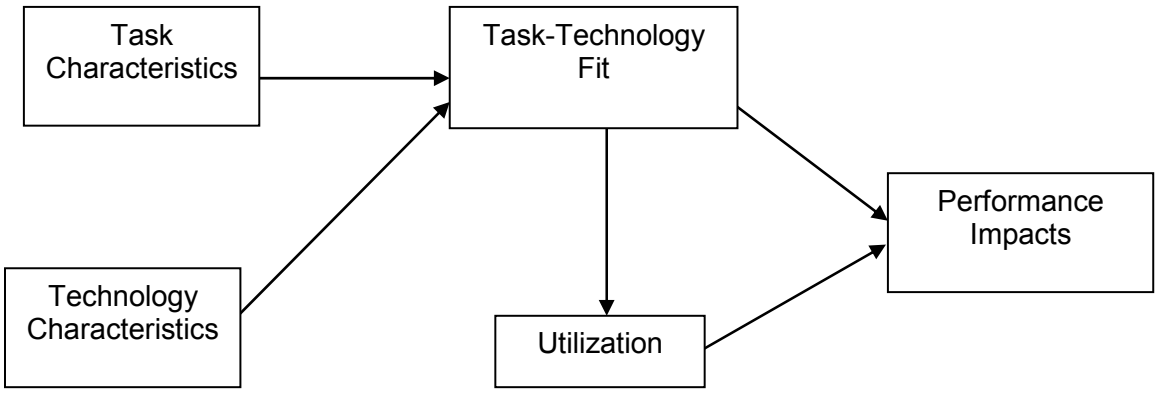


**Figure 2:** The subset of technology-to-performance chain (Goodhue and Thompson, 1995, p. 220)

## 2. Research model and hypotheses

The research model tested in this study is shown in Figure 3. In the model, the CSE construct has been added for integrity. The proposed constructs and hypotheses are supported by prior studies in related field literature.

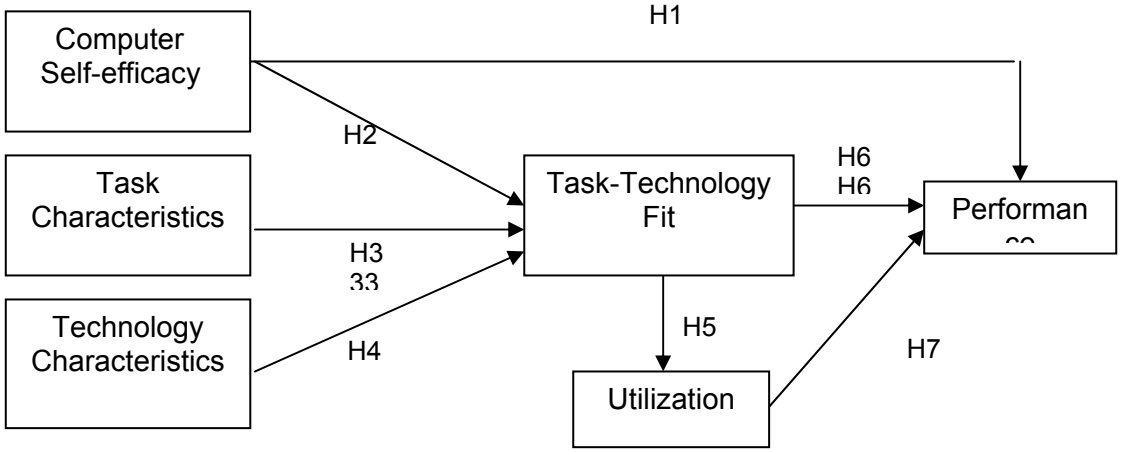


**Figure 3:** Research model

### 2.1 Computer self-efficacy

The concept of self-efficacy, derived from social cognitive theory (Bandura, 1977, 1982), is defined as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performance" (Bandura, 1986, p. 391). A study by Stajkovic and Luthans (1998) found a strong positive relationship between self-efficacy and task performance, with self-efficacy as a predicting factor; related research supports this result (Wood and Bandura, 1989a, 1989b; Compeau and Higgins, 1995a). A related construct, called CSE, has been derived from the broader construct of self-efficacy. Compeau and Higgins (1995b) concluded that CSE is the judgment of one's ability to apply computer skills to complete the specified tasks. Chalmers (2003) indicated that CSE represents an individual's perceptions of his or her ability to use computers to accomplish a task. In prior research, CSE was considered an individual characteristic that was added to test the TPC-related model (Dishaw and Strong, 2002). The results revealed that CSE positively affected TTF. Recently, Lee et al. (2007) also demonstrated that CSE positively affected TTF of applying PDA technology for insurance tasks. Further, other studies have investigated consequences of CSE, such as increased performance (Yi and Davis, 2003; Johnson, 2005). There also exists empirical evidence of a positive relationship between CSE and user performance (Compeau and Higgins, 1995b; Marakas et al., 1998). Our study focuses on whether employees believe that they have the necessary knowledge, skills, or ability to use IS in the context of e-government. Based on the theoretical and empirical support from the CSE literature, we test the following hypotheses:

**H1:** CSE will positively affect the performance of employees.

**H2:** CSE will positively affect the TTF of employees.

### 2.2 TPC-related constructs

The TPC model offers a promising theoretical base for examining the factors that influence employee performance. In the original model, tasks are broadly defined as "the actions carried out by individuals in turning inputs into outputs" (Goodhue and Thompson, 1995, p. 216). TC might be considered an attribute related to the tasks. Technologies are viewed as "tools used by individuals to carry out tasks" (Goodhue and Thompson, 1995, p. 216). Moreover, "technologies" also refers to computer systems (hardware, software, and data) and user support services in the context of IS research. TNC can affect users' perceptions of the technology. Prior studies have examined the impacts of TC and TNC in information use, and have indicated that both TC and TNC directly affect TTF (Goodhue and Thompson, 1995; Dishaw and Strong, 1999). In general, government employees will be assigned to tasks that differ in content and complexity. Also, employees must already be utilizing technology at work while e-government is being implemented in government. Thus, the following hypotheses are proposed:

**H3:** TC will affect the TTF of employees.

**H4:** TNC will affect the TTF of employees.

TTF is defined as "the degree to which a technology assists an individual in performing his or her portfolio of tasks" (Goodhue and Thompson, 1995, p. 217). Utilization can be considered "the behavior employed to complete tasks" (Goodhue and Thompson, 1995, p. 218). In test of the TPC model, TTF positively affected the utilization of IS, and performance impacts are a function of both TTF and utilization (Goodhue and Thompson, 1995). Furthermore, the link between TTF and performance was also found in related IS research. According to Goodhue et al. (2000), higher TTF results in better user performance. Goodhue and Thompson (1995) also found that TTF positively affects performance. At any given level of IS, technology with higher TTF will lead to better performance. Additionally, DeLone and McLean (1992) pointed out that utilization of technology impacts individual performance. Earlier findings (Lucas, 1975; Goodhue and Thompson, 1995; Lucas and Spitler, 2000) indicated that utilization of IS has a significant positive influence on performance. Likewise, there also exists a positive relationship between utilization and performance for the government's employees in the implementation of e-government. To summarize, the following hypotheses are proposed:

**H5:** TTF will positively affect the utilization of IS.

**H6:** TTF will positively affect the performance of employees.

**H7:** The utilization of IS will positively affect performance.

## 3. Design and method of research

### 3.1 Instrument development

All research variables in this study were measured using multi-item scales. Likert seven-point scales ranging from "strongly disagree" to "strongly agree" were used for all questions, except for the items measuring demographic information such as gender, age, education level, and computer experience. Scales for TC were adapted from those developed and used by Goodhue (1995). Goodhue (1995) followed Fry and Slocum's (1984) suggestion and combined the dimensions of Perrow (1967) and Thompson (1967) to successfully measure non-routineness tasks (NRT) and interdependence tasks (IDP). Four items for TNC were adapted from those developed by Goodhue (1995). CSE was assessed using the four-item scale developed and validated by Compeau and Higgins (1995b). Scales for TTF were adapted from those used by Goodhue and Thompson (1995) and by Goodhue (1998). Twelve constructs were used to measure TTF: the right level of detail (RLOD), accuracy (ACCU), compatibility (COMP), locatability (LOCA), accessibility (ACCE), meaning (MEAN), assistance (ASSI), ease of use of hardware and software (EUSH), systems reliability (RELY), currency (CURR), presentation (PRES), and confusion (CONF). There were a total of 32 items, which consisted of the twelve constructs of TTF. Utilization referred to studies from Davis et al. (1989) and Thompson et al.

(1991) and was measured by three statements developed specifically for this study. Finally, performance was combined with conceptual definitions of both DeLone and McLean (1992) and Goodhue and Thompson (1995) to develop five items for this study. The items used in the study are listed in the Appendix. In order to avoid ambiguity in the survey, this study invited two Ph.D. scholars in information management, two Ph.D. scholars in business management, and ten employees who have been working in the Taipei City government for more than five years. These persons assessed whether the survey captured the desired phenomena and verified that important aspects had not been omitted. After appropriate modification, the formal survey was conducted.

## 3.2 Sampling method and data collection procedure

The provision of e-service to the public by the Taiwanese government has progressed rapidly. Taipei has distinguished itself among city governments in the implementation of e-service. Therefore, this study regarded population as the employees who used IS and worked in the Taipei government. According to the organization structure data announced by the Taipei City government's Department of Personnel Taipei City in 2007 (Department of Personnel, Taipei City Government, 2007), the government is composed of 29 units. This study recognizes the employees in these 29 units as the research population. Since different units will have different scopes of duty, each unit was treated as a stratified variable. Stratified proportion sampling was used to take the required sample. The population consisted of 3,546 persons; questionnaires were distributed to 1,239 individuals. Initial inspection was then performed on the returned questionnaires. Obvious arbitrary answers as well as incomplete questionnaires were removed, leaving 847 valid questionnaires, with an effective response rate of 68.36%. Furthermore, in order to ensure that the sample proportion taken by the stratified proportion sampling method matched the population, the Chi-square goodness-of-fit test was used for verification. The Chi-square test revealed not statistically significant because the *P*-value=0.426; that is, the sample proportion matches the population proportion in this study. The related data is shown in Table 1.

**Table 1**: Population portion and sample portion

| Departments | population portion (%) | sample portion (%) |
|---|---|---|
| Department of Civil Affairs | 2.23 | 2.48 |
| Department of Finance | 3.55 | 3.66 |
| Department of Education | 4.94 | 4.96 |
| Department of Economic development | 3.84 | 3.90 |
| Department of Transportation | 3.86 | 4.01 |
| Department of Public Works | 3.69 | 3.78 |
| Department of Social Welfare | 3.13 | 3.31 |
| Department of Labor | 1.78 | 1.89 |
| Department of Health | 6.80 | 5.43 |
| Department of rapid transit systems | 14.04 | 14.17 |
| Taipei Feitsui Reservoir Administration | 1.80 | 2.01 |
| Department of Environmental Protection | 3.72 | 3.78 |
| Department of Urban Development | 5.02 | 4.01 |
| Department of Cultural Affairs Bureau | 2.00 | 1.42 |
| Department of Police | 14.35 | 14.52 |
| Department of Fire | 4.35 | 3.78 |
| Department of Compulsory Military Service | 1.92 | 1.42 |
| Department of Budget | 3.53 | 3.90 |

| | | |
|---|---|---|
| Department of Personnel | 1.64 | 1.53 |
| Department of Ethics | 1.44 | 1.42 |
| Department of Land | 4.34 | 3.90 |
| Department of Information | 1.97 | 1.77 |
| Hakka Affairs Commission | 0.59 | 0.59 |
| Research, Development, and Evaluation Commission | 1.41 | 3.78 |
| Urban Planning Commission | 0.37 | 1.42 |
| Administrative Appeals Commission | 1.10 | 0.71 |
| Rules and Regulations Commission | 0.87 | 0.35 |
| Indigenous People Commission | 0.71 | 1.06 |
| Civic Worker Training Center | 1.02 | 1.06 |

## 4. Data analysis and results

### 4.1 Descriptive statistics

Among the participants, 52.3% of the respondents were male while 47.7% were female. Most of the respondents (39.1%) were between 40 and 50 years of age. Most of the respondents (46.8 %) held university degrees, and 22.7% reported holding master's or doctoral degrees. In addition, 80.2 % of respondents reported having more than five years of computer experience. Detailed data from respondents are shown in Table 2.

**Table 2:** Sample demographics

| Measure | Items | Frequency | Percent (%) |
|---|---|---|---|
| Gender | Male | 443 | 52.3 |
| | Female | 404 | 47.7 |
| Age | 20 or under | 2 | 0.2 |
| | 20–30 | 156 | 18.4 |
| | 30–40 | 261 | 30.8 |
| | 40–50 | 331 | 39.1 |
| | 50 or above | 97 | 11.5 |
| Education | Junior high school or under | 3 | 0.4 |
| | High school | 52 | 6.1 |
| | College | 204 | 24.1 |
| | University | 396 | 46.8 |
| | Masters or above | 192 | 22.7 |
| Computer experience | 1 year or under | 11 | 1.3 |
| | 1–2 years | 31 | 3.7 |
| | 2–5 years | 126 | 14.9 |
| | 5–10 years | 324 | 38.3 |
| | 10 years or above | 355 | 41.9 |

 

## 4.2 Assessing the reliability and validity

Reliability and validity of the proposed research model were tested by Cronbach's alpha and factor analysis, respectively. First, we conducted an exploratory factor analysis to confirm the multi-dimensional constructs TC and TTF. A principal components factor analysis with orthogonal rotation by the varimax method was conducted to test the validity. Factors with eigenvalues greater than one were extracted. The original TC construct included dimensions of NRT and IDP. But, only one factor was extracted from TC, which explained 67.11% of the total variance and resulted in a high Cronbach's alpha value of 0.88. Thus, we combined NRT and IDP into one TC construct. Further, the analysis produced only seven factors in TTF construct, and the allocations of the items were not consistent with the dimensional structure of TTF proposed by Goodhue and Thompson (1995). One of the factors combined three items: ACCU3, RELY2, and CURR1. Moreover, the Cronbach's alpha for this factor is 0.69, which does not exceed the threshold of 0.7 (Nunnally, 1978). Since this factor is somewhat ambiguous and has lower reliability, the three items were all dropped. Both RELY1 and RELY3 were also dropped because of lower reliability. The remaining questions were reconstructed into six distinct factors of TTF: data reliability (DR), data accuracy (DA), representation (REPR), compatibility (COMP), ease of use of hardware and software (EUHS), and confusion (CONF). These factors are shown in Table 3. Data reliability combined the original four structures: LOCA, ACCE, MEAN, and ASSI to form a new construct. Data accuracy combined the original two structures: RLOD and ACCU, while REPR combined three items: CURR2, PRES1, and PRES2. Furthermore, the other three factors were the same as the original constructs. These six factors accounted for 74.871% of the variance.

**Table 3:** Results of factor analysis (note*: s*uppress absolute values <0.3)

| Scale items | Factor1 (DR) | Factor2 (DA) | Factor3 (REPR) | Factor4 (COMP) | Factor5 (EUHS) | Factor6 (CONF) |
|---|---|---|---|---|---|---|
| ACCE2 | **0.790** | | | | | |
| ACCE3 | **0.784** | | | | | |
| LOCA3 | **0.761** | | | | | |
| MEAN2 | **0.725** | | 0.317 | | | |
| LOCA2 | **0.714** | | | | | |
| ASSI1 | **0.709** | | 0.343 | | | |
| MEAN1 | **0.706** | | 0.305 | | | |
| ASSI2 | **0.701** | | 0.375 | | | |
| ACCE1 | **0.667** | 0.339 | | | | |
| ASSI3 | **0.661** | 0.307 | 0.332 | | | |
| LOCA1 | **0.511** | | | | | |
| RLOD2 | 0.414 | **0.787** | | | | |
| RLOD3 | 0.386 | **0.784** | | | | |
| RLOD1 | 0.340 | **0.769** | | | | |
| ACCU1 | 0.345 | **0.718** | 0.324 | | | |
| ACCU2 | 0.362 | **0.679** | 0.344 | | | |
| CUR2 | 0.366 | | **0.768** | | | |
| PRES1 | 0.334 | | **0.762** | | | |
| PRES2 | | | **0.722** | | | |
| COMP2 | | | | **0.907** | | |
| COMP3 | | | | **0.897** | | |
| COMP1 | | | | **0.812** | | |
| EUHS2 | | | | | **0.836** | |
| EUHS3 | 0.422 | | | | **0.681** | |
| EUSH1 | 0.425 | 0.335 | | | **0.670** | |
| CONF2 | | | | | | **0.905** |
| CONF1 | □ | □ | □ | □ | □ | **0.887**□ |
| Eigenvalues | 12.760 | 2.785 | 1.317 | 1.209 | 1.085 | 1.060□ |
| Percentage of variance explained | 25.804 | 14.590 | 10.610 | 9.179 | 8.101 | 6.586 |
| Cumulative percentage | 25.804 | 40.394 | 51.004 | 60.184 | 68.285 | 74.871□ |
| Cronbach's alpha | 0.939 | 0.930 | 0.856 | 0.870 | 0.870 | 0.867 |

Construct validity, including convergent and discriminant validity, can be evaluated by examining the factor loadings from the factor analysis. The criteria used to identify and interpret the factors were as follows: each item should load 0.5 or greater on one factor and 0.5 or below on the other factors, and the difference between each other factor should be less than 0.1. Construct validity for all constructs (CSE, TC, TNC, TTF, and utilization) was tested with the varimax method using factor analysis. All of the variables fit the criteria for construct validity. The results of the factor loadings and reliability are shown in Table 3 and Table 4.

**Table 4:** Factors loadings and reliability

| Constructs | Items | Factors loadings | Cronbach's alpha |
|---|---|---|---|
| TC | NRT1 | 0.782 | 0.876 |
| | NRT2 | 0.859 | |
| | NRT3 | 0.869 | |
| | IDP1 | 0.859 | |
| | IDP2 | 0.726 | |
| TNC | TNC1 | 0.800 | 0.834 |
| | TNC2 | 0.808 | |
| | TNC3 | 0.845 | |
| | TNC4 | 0.817 | |
| CSE | CSE1 | 0.876 | 0.906 |
| | CSE2 | 0.882 | |
| | CSE3 | 0.872 | |
| | CSE4 | 0.905 | |
| utilization | UTIL1 | 0.915 | 0.903 |
| | UTIL2 | 0.921 | |
| | UTIL3 | 0.908 | |

## 4.3 Results

Multiple regression analysis was used in this study to test the hypothesized relationships. The multicollinearity among independent variables may reduce any single independent variable's predictive power (Hair et al., 1998). A variance inflation factor (*VIF*) less than 10 indicates that there is no multicollinearity problem among the independent variables (Stevens, 2002). The diagnosis of multicollinearity for the regression model can use conditional index (*CI*). A *CI* less than 30 indicates a low multicollinearity problem (Belsley et al., 1980). We reviewed *VIF* and *CI* to ensure that no serious multicollinearity problem existed. Multicollinearity was not a serious concern in our proposed model, based on *VIF* and *CI*.

Table 5 presents the results of all regression models that were found to be statistically significant based on high *F* value. In Table 5A, TTF contains six structures. According to Goodhue and Thompson (1995), strong support would require that each of the six regressions of TTF be statistically significant. If more than half of the *P*-values are statistically significant, it can be concluded as moderate support for the hypothesis. If more than one but not more than half of the *P*-values are statistically significant, it is considered only to weakly support the research hypothesis. Table 5A reveals that adjusted $R^2$ (i.e. $R_a^2$) values ranged from 0.033 to 0.261. Further, we examined individual standardized beta coefficients of regression lines. Both TC and TNC were statistically significant in 4 out of the 6 regressions; CSE was statistically significant in only 2 out of 6 regressions. This implies that both Hypothesis 3 and Hypothesis 4 are moderately supported, while Hypothesis 2 is weakly supported. Moreover, the relationship between TC and TTF is negative, because 3 out of 4 significant beta coefficients were negative. TNC and TTF exhibited a positive relationship, as 4 significant beta coefficients were all positive. In Table 5B, 5 out of the 6 regressions were significant. Thus, Hypothesis 5 is moderately

supported. Finally, Table 5C shows that the value of $R_a^2$ is 0.711, which indicates high explanatory power. Four beta coefficients of TTF were significant, which moderately supports Hypothesis 6. Both the beta coefficient of CSE and utilization were positive and significant, proving Hypotheses 1 and 7 are supported. Table 6 summarizes all of the research hypotheses and test results.

**Table 5**: Results of multiple regression analysis

(A) Six multiple regression: TTF=f (TC, TNC, CSE)

| TTF | Standardized beta coefficients | | | *F*-value | $R_a^2$ |
|---|---|---|---|---|---|
| | TC | TNC | CSE | | |
| DR | 0.018 | 0.425** | 0.049 | 70.06** | 0.197 |
| DA | -0.121** | 0.509** | -0.059 | 100.70** | 0.261 |
| REPR | -0.001 | 0.186** | 0.196** | 32.14** | 0.099 |
| COMP | -0.182** | 0.01 | 0.060 | 10.60** | 0.033 |
| EUHS | 0.098** | 0.086* | 0.284** | 37.95** | 0.116 |
| CONF | -0.207** | 0.052 | 0.041 | 14.72** | 0.046 |

(B) Multiple regression: Utilization =f (TTF)

| | Standardized beta coefficients | | | | | | *F*-value | $R_a^2$ |
|---|---|---|---|---|---|---|---|---|
| | TTF | | | | | | | |
| | DR | DA | REPR | COMP | EUHS | CONF | | |
| Utilization | 0.407** | 0.195** | 0.361** | 0.033 | 0.355** | 0.087** | 123.29** | 0.465 |

(C) Multiple regression: Performance=f (TTF, Utilization, CSE)

| | Standardized beta coefficients | | | | | | | | *F*-value | $R_a^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | TTF | | | | | | | | | |
| | DR | DA | REPR | COMP | EUHS | CONF | Utilization | CSE | | |
| Performance | 0.148** | 0.119** | 0.137** | 0.023 | 0.026 | 0.044* | 0.550** | 0.195** | 261.22** | 0.711 |

denotes significant at the *p*-Value < 0.05 level

** denotes significant at the *p*-Value < 0.01 level

**Table 6:** Summary of research hypotheses and test results

| Research hypotheses | Test results |
|---|---|
| H1**:** CSE will positively affect the performance of employees. | supported |
| H2: CSE will positively affect the TTF of employees. | weakly supported |
| H3: TC will affect the TTF of employees. | moderately supported |
| H4: TNC will affect the TTF of employees. | moderately supported |
| H5: TTF will positively affect the utilization of IS. | moderately supported |
| H6: TTF will positively affect the performance of employees. | moderately supported |
| H7**:** The utilization of IS will positively affect the performance of employees. | supported |

## 5. Discussion

This study found a negative relationship between TC and TTF, and a positive relationship between TNC and TTF. These results are supported by previous research results (Goodhue, 1995; Goodhue and Thompson, 1995; Dishaw and Strong, 1999). According to the discussion of TPC model by Goodhue and Thompson (1995), different tasks must be supported by different technology tools. In addition, if technology can truly support the task, there should be a positive relationship between TC

and TTF. Because of the negative relationship between TC and TTF in this study, according to Goodhue and Thompson's suggestions (1995, p. 230), Taipei government managers should adopt three possible methods: (1) Discontinue or redesign systems or policies; (2) embark on training or selection programs to increase the ability of users, or (3) redesign tasks to better utilize IT potential. Additionally, CSE is found in the present study to play the dual antecedents of performance and TTF. The former directly affected performance, while the latter weakly supported TTF. Moreover, the result revealed that CSE indirectly influenced employee performance through TTF. As was consistent in prior research, CSE was a determinant of system use and reflected the employee performance (Compeau and Higgins, 1995b; Compeau et al., 1999). Therefore, we suggest that when the government recruits new employees, it should consider the CSE and computer skills of the job applicant. The government should also enhance the computer ability of present employees when it administers on-the-job training. In this study, employee performance is significantly affected by the TTF, CSE, and utilization. Moreover, the beta coefficient of utilization is 0.55, which is much larger than other coefficients (see Table 5C). This indicates that utilization has a greater effect on performance than TTF and CSE. One reason for this might be that, under the requirements of e-government, employees can obtain related help through the use of IS, which in turn boosts performance. Therefore, increasing utilization is believed to have a more direct effect on performance.

The contributions of this study can be described as follows. First, the TPC model provides a fundamental framework for a number of issues in IS research. Most researchers applied the TPC model to investigate the performance of private enterprises. Unlike previous studies, this study applied the TPC model in the newly emerging context of e-government and tried to investigate the effect of IS on employee performance. We believe that the results can be helpful in understanding the influential factors for employees when government promotes IS. Second, this study developed an extended TPC model as a way to understand what factors influence employee performance in the context of e-government. Moreover, the present study introduces CSE into the TPC model. The results indicated that CSE has both directly and indirectly influenced performance. Notably, in the context of e-government, it appears that performance impacts are a function of TTF, utilization, and CSE, not just TTF and utilization. The $R_a^2$ for performance impacts in our study were 71.1%; in the original TPC studies of Goodhue and Thompson, (1995), they were 16%. Our model, therefore, represents an excellent explanatory power for predicting performance impacts, with only a small increase in model complexity. These findings strongly suggest that our extended TPC model has a greater ability to explain performance impacts when employees use government IS. Finally, all conclusions in this study are supported by literature, verified by empirical study, and have adequate reliability and validity. By investigating factors influencing employee performance for the Taipei City government, the results of this study can be used by other governmental organizations as an effective method of inspecting performance. The TPC model is an excellent diagnostic tool for IS in a particular enterprise or organization. Researchers could employ these survey instruments to assess what factors influence employee performance.

## 6. Limitations and future research

This study left several issues to be addressed. First, the study captures a primarily cross-sectional view of model constructs. Perceptions will change over time as employees gain experience. Therefore, a longitudinal study would be helpful to promote understanding of the influencing factors of employee performance. Second, as the trend of e-government spreads, internal responsible units exist in the government to evaluate performance. To avoid reluctant answers and low return rates, we suggest that the responsible unit perform a general test to obtain more accurate and complete results. Third, the introduction of IT simplifies work flow and content while reducing the requirements of traditional operating procedure. As performance expectations increase, pressure on employees to perform is increasing accordingly (Attewell and Rule, 1984). For example, computer anxiety has been shown to have a significant relationship to IS-related constructs such as attitudes toward computers, usage behavior, and performance (Fishbein and Ajzen, 1975; Davis et al., 1989; Compeau and Higgins, 1995b; Stajkovic and Luthans, 1998; Fagan and Neill, 2004). Associated with this and worthy of consideration are additional interactive variables that have been shown to influence the performance. Finally, employee performance was measured by perceived performance in this study, which relied on subjective judgment. A stronger evaluation method might be to obtain a quantifiable standard and then to periodically track performance variations. We believe that this will help to reach a more accurate conclusion on employee performance. Still, the results obtained in this study will ultimately be valuable to researchers and managers.

## 7. Appendix: questionnaire

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| **Task Characteristics (TC)** (Reference: Goodhue, 1995) | | |
| Non-Routine Tasks (NRT) | NRT1 | I frequently deal with ill-defined business problems. |
| | NRT2 | I frequently deal with ad-hoc, non-routine business problems. |
| | NRT3 | Frequently the business problems I work on involve answering questions that have never been asked before. |
| Interdependence Tasks (IDP) | IDP1 | The business problems I deal with frequently involve more than one business function. |
| | IDP2 | The problems I deal with frequently involve more than one business function. |
| **Technology characteristics (TNC)** (Reference: Goodhue, 1995) | | |
| TNC1 | The information systems available to me for finding data what I need. | |
| TNC2 | The information systems available to me for accessing data what I need. | |
| TNC3 | I can find assisters when I need to help in information systems problems. | |
| TNC4 | I can find assisters in my department when I need to help. | |
| **Computer self-efficacy (CSE)** (Reference: Compeau and Higgins, 1995b) | | |
| I could complete the tasks using the information systems…. | | |
| CSE1 | if I could call someone for help if I got stuck. | |
| CSE2 | if I had a lot of time to complete the tasks for which the software was provided. | |
| CSE3 | if someone showed me how to do it first. | |
| CSE4 | if I had used similar packages like this one before to do the tasks. | |
| **Task-Technology Fit (TTF)** (Reference: Goodhue and Thompson, 1995; Goodhue, 1998) | | |
| The Right Level of Detail (RLOD) | RLOD1 | The information systems maintain data at the right level or levels of detail. |
| | RLOD2 | Sufficiently detailed data is maintained by the corporation or division. |
| | RLOD3 | The information systems maintain data at an appropriate level of detail for my purposes. |
| Accuracy (ACCU) | ACCU1 | The data in the information systems is accurate. |
| | ACCU2 | The data that I use or would like to use is accurate enough for my purposes. |
| | ACCU3 | There are accuracy problems in the data I use or need. |
| Compatibility (COMP) | COMP1 | When it's necessary to compare or aggregate data from two or more different sources, there may be unexpected or difficult inconsistencies. |
| | COMP2 | There are times when supposedly equivalent data from two different sources is inconsistent. |
| | COMP3 | Sometimes it is difficult or impossible to compare or aggregate data from two different sources because the data is defined differently. |
| Locatability (LOCA) | LOCA1 | It is easy for me to determine what data is available and where. |
| | LOCA2 | It is easy to locate corporate or divisional data on a particular issue, even if I haven't used that data before. |
| | LOCA3 | It is easy to find out what data the corporation maintains on a given subject. |
| Accessibility (ACCE) | ACCE1 | It is easy of access to desired data for me. |
| | ACCE2 | I can get data quickly and easily when I need it. |
| | ACCE3 | It is easy to get access to data that I need. |
| Meaning (MEAN) | MEAN1 | On the reports or systems I deal with, the exact meaning of data elements is either obvious, or easy to find out. |

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|---|---|---|
| | MEAN2 | The exact definition of data fields relating to my tasks is easy to find out. |
| Assistance (ASSI) | ASSI1 | I can ease of getting help on problems with the data. |
| | ASSI2 | I am getting the help I need in accessing and understanding the data. |
| | ASSI3 | It is easy to get assistance when I am having trouble finding or using data. |
| Ease of Use of Hardware and Software (EUHS) | EUHS1 | I can ease of doing what I want to do using the system hardware and software for accessing and analyzing data. |
| | EUHS2 | It is easy to learn how to use the computer systems that give me access to data. |
| | EUHS3 | The computer systems that give me access to data are convenient and easy to use. |
| Systems Reliability (RELY) | RELY1 | The systems I used are reliable. |
| | RELY2 | The systems I use are subject to frequent problems and crashes. |
| | RELY3 | I can count on the systems to be ”up” and available when I need it. |
| Currency (CURR) | CURR1 | I can't get data that is current enough to meet my needs. |
| | CURR2 | The data is up-to-date enough for my purposes. |
| Presentation (PRES) | PRES1 | The data that I need is displayed in a readable and understandable form. |
| | PRES2 | The data is presented in a readable and useful format. |
| Confusion (CONF) | CONF1 | There are so many different systems or files, each with slightly different data, that it is easy to understand which one to use in a given situation. |
| | CONF2 | The data is stored in so many different places and in so many forms, and it is easy to know how to use it effectively. |
| **Utilization (UTIL)** (Reference: Davis et al., 1989; Thompson et al., 1991) | | |
| UTIL1 | I think the information systems are suitable for my task. | |
| UTIL2 | It would be much better for me to use the present information systems rather than other information systems. | |
| UTIL3 | I think the present information systems should be main facility tools in further tasks. | |
| **Performance (PERF)** (Reference: DeLone and McLean, 1992; Goodhue and Thompson, 1995) | | |
| PERF1 | The information systems provide helpful guidance in performing tasks. | |
| PERF2 | Using information systems improve the quality of the tasks I do. | |
| PERF3 | Using information systems improve my tasks performance. | |
| PERF4 | I successfully use the information systems to perform my tasks. | |
| PFER5 | Using information systems increases my productivity. | |

## References


Attewell, P., and Rule, J. (1984) “Computing and Organizations: What We Know and What We Don't Know”, *Communications of the ACM*, 27(12), 1184-1192.

Bandura, A. (1977) “Self-efficacy: Toward a unifying theory of behavioral change'', *Psychological Review*, 84, 191-215.

Bandura, A. (1982) “Self-efficacy mechanism in human agency”, *America Psychologist*, 37(2), 122-147.

Bandura, A. (1986). *Social foundations of though and action.* Englewood Cliffs, NJ: Prentice-Hall.

Belsley, D. A., Kuth, E., and Welsch, R. E. (1980). *Regression diagnostics: Identifying influential data and sources of collinearity.* New York: John Wiley.

Chalmers, P. A. (2003) “The role of cognitive theory in human–computer interface”, *Computers in Human Behavior*, 19(5), 737-758.

Compeau, D. R., and Higgins, C. A. (1995a) “Application of social cognitive theory to training for computer skills”, *Information Systems Research*, 6(2), 118-143.

Compeau, D. R., and Higgins, C. A. (1995b) "Computer self-efficacy: Development of a measure and initial test", *MIS Quarterly*, 19(2), 189-211.
Compeau, D. R., Higgins, C. A., and Huff, S. (1999) "Social cognitive theory and individual reactions to computing technology: A longitudinal study", *MIS Quarterly*, 23(2), 145-158.
Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. (1989) "User acceptance of computer technology: A comparison of two theoretical models", *Management Science*, 35(8), 982-1003.
DeLone, W. H., and McLean, E. R. (1992) "Information System Success: The Quest for the Dependent Variable", *Information System Research*, 3(1), 60-95.
DeLone, W. H. (1988) "Determinants of Success for Computer Usage in Small Business'', *MIS Quarterly,* 12, 51-61.
Department of Personnel, Taipei City Government. (2007). Organizations of the Taipei City Government. Retrieved December 10, 2008 from http://www.taipei.gov.tw/cgi-bin/SM_theme?page=4219f57c
Dishaw, M. T., and Strong, D. M. (1999) "Extending the technology acceptance model with task-technology fit constructs", *Information & Management*, 36(1), 9-21.
Dishaw, M.T., and Strong, D. M. (August 2002) "Extending the task-technology fit model with self-efficacy constructs", *Proceedings of the Americas Conference on Information Systems.* 1021-1027.
Fagan, M. H., and Neill, S. (Winter 2003-2004) "An empirical investigation into the relationship between computer self-efficacy, anxiety, experience, support and usage", *Journal of Computer Information Systems*, 44(2), 95-104.
Fishbein, M., and Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research.* Reading, MA: Addison-Wesley.
Fry, L. W., and Slocum, J. W. (1984) "Technology, Structure, and Workgroup Effectiveness: A Test of a Contingency Model", *Academy of Management Journal*, 27(2), 221-246.
Goodhue, D. L. (1995) "Understanding User Evaluations of Information Systems", *Management Science*, 41(12), 1827-1845.
Goodhue, D. L., and Thompson, R. L. (1995) "Task-Technology Fit and Individual Performance", *MIS Quarterly*, 19(2), 213-236.
Goodhue, D. L. (1998) "Development and Measurement Validity of a Task-Technology Fit Instrument for User Evaluation of Information Systems", *Decision Science*, 29(1), 105-138.
Goodhue, D. L., Klein, B. D., and March, S. T. (2000) "User evaluations of IS as surrogates for objective performance", *Information & Management*, 38(2), 87-101.
Grover, V., Jeong, S. R., and Segars, A. H. (1996) "Information systems effectiveness: The construct space and patterns of application", *Information & Management*, 31, 177-191.
Hair, J. T., Anderson, R. E., Tatham, R. L., and Black, W. C. (1998). *Multivariate Data Analysis with Readings* (5th ed.). New Jersey: Prentice-Hall International.
Heeks, R. (1999). *Reinventing Government in the Information Age-International practice in IT-enabled public sector reform*. London and New York: Routledge.
Iivari, J., and Ervasti, I. (1994) "User information satisfaction: IS implementability and effectiveness", *Information & Management*, 27(4), 205-220.
Johnson, R. D. (2005) "An empirical investigation of sources of application-specific computer-self-efficacy and mediators of the efficacy-performance relationship", *International Journal of Human-Computer Studies*, 62(6), 737-758.
Lee, C.-C., Cheng, H. K., and Cheng, H.-H. (2007) "An empirical study of mobile commerce in insurance industry: Task–technology fit and individual differences", *Decision Support Systems*, 43(1), 95-110.
Lucas, H. C. (1975) "Performance and the Use of an Information System", *Management Science*, 21(8), 908-919.
Lucas, H. C., and Spitler, V. (2000) "Implementation in a world of workstations and networks", *Information & Management*, 38(2), 119-128.
Marakas, G. M., Yi, M. Y., and Johnson, R. D. (1998) "The multilevel and multifaceted character of computer self-efficacy: toward clarification of the construct and an integrative framework for research", *Information Systems Research*, 9(2), 126-163.
Nunnally, J. (1978). *Psychometric theory.* New York: McGraw-Hill.
Osborne, D., and Gaebler, T. (1992). *Reinventing Government: How the Entrepreneurial Spirit Is Transforming the Public Sector.* Reading, MA: Addison-Wesley.
Perrow, C. (1967) "A Framework for the Comparative Analysis of Organizations", *American Sociological Review*, 32(2), 194-168.
Research, Development, and Evaluation Commission Executive Yuan Taiwan, R. O. C. (2001). E-Government Action Plan. Retrieved December 13, 2008 from http://www.rdec.gov.tw/public/Attachment/711616423771.pdf
Stajkovic, A. D., and Luthans, F. (1998) "Self-Efficacy and Work-Related Performance: A Meta Analysis", *Psychological Bulletin*, 124(2), 240-261.
Stevens, J. (2002). *Applied Multivariate Statistics for the Social Sciences* (4th ed.). Mahwah, New Jersey: Lawrence Erlbaum Associates.
Thompson, J. D. (1967). *Organizations in Action*. New York: McGraw-Hill.
Thompson, R. L., Higgins, C. A., and Howell, J. M. (1991) "Towards a Conceptual Model of Utilization", *MIS Quarterly*, 15(1), 125-143.
Tony, D., and Ian, B. (2000) "Reinventing Government in New Zealand: how core government function benefited from market-type measurement", *World Bank Viewpoint,* 16886, 1-4.

West, D. M. (2007). Global e-Government. Center for Public Policy, Brown University. Retrieved December 12, 2008 from http://www.insidepolitics.org/egovt07int.pdf

West, D. M. (2008). Global e-Government. Center for Public Policy, Brown University. Retrieved December 20, 2008 from http://www.brookings.edu/~/media/Files/rc/reports/2008/0817_egovernment_west/0817_egovernment_west.pdf

Wood, R., and Bandura, A. (1989a) "Impact of conceptions of ability on self-regulatory mechanisms and complex decision making", *Journal of Personality and Social Psychology*, 56(3), 407-415.

Wood, R., and Bandura, A. (1989b) "Social cognitive theory of organizational management", *Academy of Management Review*, 14(3), 361-384.

Yi, M. Y., and Davis, F. D. (2003) "Developing and validating an observational learning model of computer software training and skill acquisition", *Information Systems Research*, 14(2), 146-169.

 