An investigation on factors affecting task-technology fit and performance of sales personnel under e-government

—a G2E verification study by taking Taipei City Government as an example

Abstract

As information technology and internet keeps moving forward fast, how to provide the public with e-service has become important strategies for providing renovation and innovative service in many countries; provide convenient service to the public is the most expectable item in the government renovation plan for the service provided by government, in association with internet equipment. Taiwan government goes with world trend to promote aggressively e-government construction based on the entire country and has obtained very good result and reputation. However, the past e-government related researches focused too much on three aspects such as: government to government (G2G), government to business (G2B) and government to citizens (G2C), the effect of government to employees (G2E) was discussed less, therefore, this study is based on G2E as a topic and takes the internal personnel of Taipei City government in the best city of Taiwan, meanwhile, Task-to-Performance Chain (TPC) is used as the main architecture of the model combined with factors such as perceived ease of use and perceived usefulness and computer self-efficacy to obtain 847 effective samples through layered proportion sampling method, in addition, multiple regression method is used to investigate factors affecting Task-Technology Fit (TTF) and performance of internal personnel in Taipei City Government.

The study results show that task characteristic, technology characteristic and computer self-efficacy will all affect TTF and recognition usefulness has higher effect on level of use than perceived ease of use. Three variables such as: task-technology fit, computer self-efficacy and level of use all have effect on the performance, among them, the level of use has the highest effect; in this study, verification method is used to verify a real example of the application of TPC in G2E. Based on the above conclusions, many practical opinions related to TTF and performance are proposed, these opinions will be very useful reference and standard for Taipei City Government or any government organization which is planning to promote e-service.

Keywords: E-government, G2E, Task-Technology Fit (TTF), Task-to-Performance Chain (TPC), computer self-efficacy (CSE), performance

1. Preface:

The concept of e-government originates from a new proposal for open discussion internationally dated back to 1987, through many years of development and implementation, it has become an important strategy in the implementation of re-inventing and innovative services in many countries; in a report announced by US government in 1993 named "Reengineering Through Information Technology"[1] provides a more solid concept on e-government. Along with the advancement in internet technology, how to provide e-service to the public has become a trend and is in wide-spread progress worldwide. The providing of convenient service to the public by the government, combined with internet, is the most expectable item in the re-inventing plan of the government. To keep up with the world trend, Taiwan government, under the planning provided by the Research, Development and Evaluation Commission of Executive Yuan, has promoted e-government construction of the entire country in several sessions. After the full implementation of Midterm e-Government Implementation Plan[2] in 1998, combined with a reference to the experiences of implementing e-government in European and US countries, "e-Government Action Plan[2]" is further made in April 2001 to help the implementation of internet service through the originally existed internet environment. After obtaining initial result and in order to enhance national competitiveness and to realize the vision of high technology, Executive Yuan further passed Challenge 2008- Council for Economic Planning and Development[3]" in May 2002, our government plans to make a "digital Taiwan" before 2008 to turn Taiwan into the No. 1 e-service country in Asia based on a core of e-government.

In recent years, the e-government directions implemented by many countries include four areas: government to government (G2G), government to business (G2B), government to citizens (G2C), government to employees (G2E). However, in the past researches related to e-government, most are focused on three directions such as: G2G, G2B, G2C, there are very few of them investigating the effect of G2E. The main purpose of G2E is to investigate how personnel in the government use administrative resource to enhance government's administrative efficiency and efficacy[4]; if after the implementation of e-government, the performance of internal employees can be enhanced, we believe that the efficiency of government service can be relatively enhanced, that is, good service quality is based on good service performance; a research team leaded by Director of Taubman, Center for Public Policy in Brown university, USA, professor Darrell West[5], has used 24 indexes to perform evaluation on June and July 2005 on 1797 web sites across 198 countries worldwide, after a statistical analysis, Taiwan was ranked no. 1 worldwide. In 2002, 2004 and 2005 for an e-government evaluation activity, Brown university ranked Taiwan as no. 1 for the third time; in a report provided by World

Economic Forum[6] (WEF) on March 2005 has pointed out that the degree of application of internet by Taiwan government ranks no. 5 worldwide, we can clearly see some results shown by the expanded information investment in recent years by Taiwan government. In all the city governments in Taiwan, the best city－Taipei, has the most distinguished performance in the implementation of e-service. Based on the above mentioned points, Task-to-Performance Chain (TPC) combined with other factors are going to be used in this study to investigate factors affecting task-technology fit (TTF) and performance (PEF) of internal employees in Taipei City Government? Meanwhile, corrective actions will be proposed based on the diagnosed factors to the management level of Taipei City Government to be used as reference in management.

2. Literature review

The main purpose of this study is to investigate factors affecting task-technology fit (TTF) and performance (PEF) of internal employees in government after the implementation of e-service. Therefore, the meaning of e-government, the evaluation and investigation of performance and the theoretical architecture of TTF model are going to be described respectively as in the followings:

2.1. The meaning of e-government

At the end of 20 century, David & Ted[7] proposed the concept of " Reinventing Government and concept of enterprise-oriented government to lead the re-inventing direction of government. Tony & Ian [8] also pointed out that the renovation of government is due to its bad efficiency. Government should emphasize on the performance of each department, this is the duty of manager. Government should reduce expenses, increase efficiency and authorize each department to do its job so as to enhance government ' s performance. Heeks[9] also thinks that one of the core topics of government renovation is the enhancement of administrative efficiency. Based on the above statements, the role played by government should be changed along with the development in knowledge and technology, therefore, developed countries such as England, US and Japan proposed new government renovation plans one after anther. Taiwan government proposed in 1998 " Government Re-Inventing Plan " [10], then passed " e-Government Action Plan " [2] in year 2000, the new government renovation direction and administration development direction are thus confirmed; Taipei City Government activated in 2002 the “Taipei e-services online[11]”, it is one of the units among all the city governments here in Taiwan with most distinguished effectiveness and performance and with the most aggressive attitude in implementing e-service.

E-government means that the government, use information technology and through the use of different information equipment, let enterprise and the public be able to receive related services at any places and any time; the main purpose is to build a government " Exist everywhere and ready to serve at any time " , that is, to reduce cost, enhance efficiency and create a high performance government oriented toward customer, finally, national competitiveness can be enhanced and the goal of serving the public can be achieved. From the angle of view of technology, e-government is closely related to the application of technology; from the angle of view of production, e-government means the improvement on the operation of government, this is an inevitable trend for the future. In the high degree of e-government, many related personnel are for sure to be affected, the implementation of a new innovative policy must reach a consensus among most of the personnel within the organization and get supported from them, e-government tries to improve the old method of dealing with business used by these personnel, through the help of modern information technology and the advancement in internet and communication technology, public people can now receive faster, multiple element and more popular services, most importantly, enterprise and any individuals can now receive services from government conveniently at any time and any places through any channels.

2.2. Computer self-efficacy

The concept of self-efficacy was first proposed by Bandura[12], it means a belief possessed by an individual on his/her capability to execute certain job, Busch[13] thinks that self-efficacy means a belief possessed by an individual on judging his/her chance of successfully executing certain act; self-efficacy originally belongs to a social recognition and theory, but it has been cited in recent years to explain human's behavior on the use of computer, it is called Computer self-efficacy(CSE)[14], self-efficacy is related to personal belief and behavior, relatively, it will also affect individual's computer use and adaptation capability, Compeau & Higgins[15] thinks that CSE means individual ' s evaluation on his/her capability to use computer, Gist[16] thinks that CSE is a confidence on individual ' s computer capability, these capabilities can be used to complete certain job; Hill, Smith & Mann[17] think that CSE will affect internal and external behavior performance of individual's use of computer; Marakas[18] thinks that CSE will affect the adoption and performance on technology by the user. From the above researches we know that during the use of information system, CSE will have certain degree of influence on the internal thought and external behavior of an individual..

2.3 Perceived ease of use and perceived usefulness

There are many factors which might affect the reception or not of information technology by the users. Technology Acceptance Model[20,21] (TAM) developed based on Theory of Reasoned Action[19] (TRA) is one of the most commonly used models to explain and diagnose the attitude and behavior when the user faces new information system. TAM is proposed by Davis[20] in 1989, the major purpose of this model is to propose general explanation on the behavior of technology user based on simplest theory; therefore, through one set of stable beliefs, the attitude of technology user is explained, meanwhile, it can be extended and applied to different computer systems and users. This model provides a theoretical basis, it can be used to understand the effect of external factors on the internal belief, attitude and intention of the users. Through these factors, the effect is extended to the use status of technology. The most important two beliefs in the model are " perceived ease of use " (PEU) and " perceived usefulness " (PU). Davis[20] defined PEU as " The use of ease recognized by the user for the use of the system " , when the user recognizes the ease of learning of the new system, he/she will have more willing on the use of the system. PU is defined as " the subjective expectation probability from the user when he/she uses special application system to enhance the task performance or learning performance " , that is, when the user recognizes the usefulness of the system, he/she will have higher willing to adopt the system; besides, PEU will have positive effect on PU too, that is, when PEU becomes higher, PU will be relatively enhanced. Use TAM to explain the acceptance of information system has been verified by many researches[22-25]; extended or modified researches based on TAM as the major theoretical model also existed everywhere[26-29]. Davis et al.[21] use the following three points to explain their view points on the use of computer technology, we cite them as in the followings: (1) We can predict the behavior of using computer of an user through user ' s willing. (2) PU is the most important deciding factor for the willing of people to use computer. (3) PEU is a second important deciding factor for people's willing to use computer. From the above explanations, we know that PEU and PU can be seen as the pre-factors of the behavior of use.

2.4. Evaluation of performance

The relationship between information system and performance and the measurement method and standard of the information system performance is always the focus concerned by many people in the information management, Gallagher[30] tries to investigate the performance of information system based on financial view point;

however, no clear results are obtained. Similarly, for data which is not left with record or is not quantifiable, we find they are difficult to be evaluated or analyzed; some results conclude that information system is related to individual and organization performance[31], however, in some studies, the survey questionnaire developed for measuring performance has been proved to have very good reliability and effectiveness[32-34].

In recent years, there are two mainstreams in the topic of investigating information system performance, they are investigated respectively in the angle of utilization (UTL) or TTF; some scholars based their view points on UTL think that "the attitude and belief of the user can be used to predict the behavior of use of information system" [20,21,35-38] (see Fig.1). Scholars based their view points on fit think that " the fit between task and technology has distinguished effect on performance " [39,40,41] (see Fig.2), however, the above two statements all have their drawbacks; to the researches based on the view points of use and for many users of information system, they use the system just for the need of their jobs instead of coming from their willing, there is thus no relationship between the behavior of use and the belief or attitude of the user, the enhancement in performance might be due to high fit between task and technology instead of causing by the increase of use[42]; based on the fit theory, fit does have certain degree of effect on performance, however, if the information system is not actually used, there is no place for the for the generation of performance. Therefore, Goodhue & Thompson[42] think that if these two points are combined, the factors affecting personal performance can then be fully displayed, this is called Technology-to-Performance Chain (TPC) or " Task-Technology Fit model " (see Fig. 3).

2.5. The investigation of TTF model

Goodhue & Thompson[42] proposed in 1995 an integrated model which combines "theories of fit" and "Utilization", the upper part of this model is "theories of fit" and the lower part is "theories of attitudes and behavior", this theory thinks that personal performance will be affected by TTF and UTL in the same time, and relative feedback action will be generated after performance is generated, this feedback will change the expectation of user on the result which in turn leads to the change on use quantity and use frequency by the user. Therefore, when the enterprise introduces information technology to support user ' s task, the user can use TTF model to check if the fit between the function provided by the technology and the task design is good or not. This is to understand its effect on performance and decide how to improve technology function and task characteristic; or a training course can be designed targeting on the user to enhance the performance of related personnel.

The core concept of TTF model is TPC, this theory thinks that if the technology is going to help performance, the premise is that technology must be accepted and be able to cause people ' s willing to use it, besides, there must be a good fit between technology and task. Good performance can be displayed only when the technology used can support the task. Goodhue & Thompson[42] defines the concept in this model as:

Task Characteristics (TAC): It includes all the activities from input to output process during the processing of task by using information technology. The task characteristic can be distinguished from two facets such as: non-routineness and interdependence.

Technology Characteristics (TEC): Technology can be seen as the tool used by individual in executing task, it includes computer system such as software, hardware and data as well as related training, and the user-supporting services such as help on getting online. For information technology, it not only includes special technology tool which supports the task but also includes supporting service of the entire information system and computer department.

Individual Characteristics: Individual Characteristics can be seen as the characteristics of an individual in using the technology to assist himself/herself in completing his/her own task. Here personal characteristics means training received, computer experiences and post-natal motive.

TTF: TTF is defined as " The assistance from technology for an individual to complete special task " . That is, to investigate the inter-fit among task characteristics, technology characteristics and individual characteristics.

UTL: It means the behavior degree when someone is using technology in executing a task. Some researches use frequency of use, the difference of using software for the evaluation[21,38].

Performance (PEF): Goodhue & Thompson[42] think that when the fit is high, both frequency of use and performance will be enhanced, besides, performance will be affected by TTF and UTL in the same time. Here performance includes the enhancement in efficiency, the enhancement in efficacy and the enhancement of work quality.

After the construction of TTF model, in order to more effectively evaluate the fit between the task and technology and factors affecting personal performance, Goodhue[34] developed in 1998 a measurement table based on task and technology basis and through the use of literature review and interview method. Then questionnaire survey is used to obtain the data and to analyze and verify the reliability and effectiveness of the measurement table, finally, the survey questionnaire is reduced to 32 questions and 12 facets, these are called TTF measurement table.

3. Research model and hypothesis:

3.1 Research model

The main architecture of the model in this research is based on TPC of Goodhue & Thompson[42], a research model is obtained after appropriate correction and after the adding of possible affected factors, this is as in Fig.4.

3.2 Research hypothesis

TAC means factor or attribute related to the task, both task complexity and system complexity will affect the willing of participation and satisfaction[43-45] of the user. Different users will have different task complexity due to different units. Goodhue & Thompson[42] think that task characteristics can be simplified into two dimensions of "non-routineness task (NRT)" and "interdependence task (IDP)". Besides, in the study of Goodhue & Thompson[42], they think that TAC will affect TTF. When technology can really support a task, TTF will rise, at this moment, a positive relationship existed between task and TTF, on the other hand, a negative relationship exists; internal employee of Taipei City Government will have different task content and complexity depending on the department. In order to understand the fit between technology and task when e-government is implemented in Taipei City Government, we do not subjectively judge the positive or negative relationship between TAC and TTF, we only think there is a relationship existed between both and propose a first research hypothesis.

H_1: TAC will affect TTF

Technology can be seen as a tool to complete a task used by someone, Goodhue & Thompson[42] think technology include the computer system used by the user (hardware, software and data) and the service to support the user (training and assistance). Goodhue[46] thinks that the information system used by an organization should be able to achieve the task requirement of an user, and the main claim is to receive in-time assistance from personnel in the information department. If the information system can not cope with the task complexity of the user and the in-time data needed, it will then reduce the work efficiency of the user. Integrate the above points and the TTF model from Goodhue[46], Goodhue & Thompson[42], we propose a second research hypothesis.

H_2: TEC will affect TTF in positive way

In the past few decades, several researches focused on the investigation of the relationship between self-efficacy and behavior[47-49]; in the research of Stajkovic & Luthans[50], it pointed out that the higher the self-efficacy, the higher the capability to

execute a task and an efficient task strategy is more probably developed. Compeau & Higgins[15] use many factors to predict the use of computer, they found that CSE is the most important variable in predicting the use of computer; in recent years, many researches have been used to verify the relationship between CSE and the use of information system[51-53]. CSE can be seen as an judgment if the user can apply the related technology on the work, the higher the CSE, the higher the fit theoretically, we thus propose the following hypothesis.

H_3: CSE will affect TTF in positive way

The concept of TTF has already included the investigation of PEU[46], however, in the study of Goodhue[60,61], he thinks that TTF can be used to predict "Facilitating Conditions" recognized by the user, and "accessibility" is the major factor in deciding "Facilitating Conditions", we can thus know that the concept of "Facilitating Conditions" here and the concept of PEU in TAM model is similar. From the researches of Mathieson and Keil[62] and Dishaw and Strong[23], we can know that TTF has distinguished positive relationship to PEU. To summarize the above, we propose the fourth research hypothesis.

H_4: TTF will affect the PEU of sales personnel

Davis[20] found in his research that the usefulness of technology can be obviously predicted. In other researches, it was also found that if technology provides a good fit to the task, the user will then recognize the usefulness of the technology on the task[34,42]. Dishaw & Strong[23] combine TAM and TTF models, they find that task and technology fit will affect PEU and PU, which in turn affect the use of information system; theoretically, the higher the fit, the higher the recognition on the usefulness of the system from the user, therefore, we propose the fifth research hypothesis.

H_5: TTF will affect PU of sales personnel in positive way

Davis[20] in the model of TAM, proposed two important beliefs of PEU and PU, PEU can be seen as individual's perception on the ease of use of the system, PU can be seen as individual's perception of the use of special system to enhance the work efficacy. Many researches use TAM model for verification, the direct effect of PEU on PU[63,64,20] has been proved. If the related sales personnel in government organization can provide a system easy to use through e-government construction process, we believe that the work efficiency is going to be enhanced, we thus propose hypothesis 6.

H_6: The PEU of sales personnel will affect PU in positive way

In the study of investigating use, in most of the situations, the attitude and beliefs of the users are used to predict the use of information system[20,36,38]. In a study performed by Goodhue[60,61], he finds that the use of information system will be affected by some pre-factors; in a study by Davis et al.[21], he thinks that PEU and PU in the model of TAM

will have certain effect on the use of information system. Under e-government, it is an inevitable trend for the government personnel to do business using information system. Therefore, this pre-factor can be explained by PEU and PU, theoretically, PEU and PU will have positive effect on UTL. To summarize the above points, we propose research hypothesis 7 and 8.

H_7: The PEU of sales personnel will affect UTL of information system in positive way.

H_8: The PU of sales personnel will affect the UTL of information system in positive way.

In a study regarding the relationship between self-efficacy and performance by Stajkovic & Luthans[50], he thinks that a very strong positive relationship existed between self-efficacy and task performance and self-efficacy is a predicting factor which can more effectively predict work performance; related and similar researches all show the similar result[54-58]. Harrison[59] thinks in his research that there is a distinguished relationship between CSE and use of performance; other researches also show that CSE has positive relationship to computer performance[15,16,18]. To summarize the above descriptions, we propose research hypothesis 9.

H_9: CSE will affect PEF in positive way

The display of PEF includes the enhancement of efficiency, the enhancement of efficacy and the enhancement of work quality. Some research reports study if the display of data will affect PEF and the conclusion obtained is related to task fit[65,66], that is, whether technology will affect PEF or not will depend on the demand; Vessey[67] also proposed similar research, he thinks that if the display of data (technology) can not be fit to the task, the performance and quality of decision making will be lowered. Similarly, some researches strongly support the connection relationship between cognitive fit and performance[40], Goodhue[46] thus proposed the point that TTF will affect the performance of PEF in positive way. The effectiveness of information system can be displayed only after it has been used, the use of information system is a channel that information technology affects PEF[68] ; Goodhue & Thompson[42] thinks that TTF and UTL will affect in the same time the performance of PEF, that is, when the task to technology fit is high, in addition to the enhancement of the rate of use of the system, the performance will be enhanced too, therefore, we propose research hypothesis 10 and research hypothesis 11.

H_{10}: TTF will affect PEF in positive way.

H_{11}: The UTL of information system will affect PEF in positive way.

4. Design and method of research:

4.1 Preparation of survey questionnaire

After the confirmation of research model and hypothesis, related literature is referred to for the preparation of survey questionnaire. Except the basic data of person who answers the questions in the survey questionnaire, other questions are evaluated by Likert 7 point quantity (from very disagreed to very agreed), finally, the reference source and literature basis of the question item are described respectively as in the followings:

TAC: Goodhus & Thompson[42] defined the task in a broad sense as "a behavior that an individual converts input into output", personnel in different departments of the organization will have different task characteristics due to different nature of task. Goodue & Thompson[42] thinks that if task category is investigated in the point of view of task complexity, it becomes very difficult to deal with and effective measurement in verification research turns difficult too. Other aspect such as the relationship between task characteristic and complexity has been investigated in related researches[69-71], and the effect on the use of information system by TAC has been widely discussed and studies too[74-76]. Goodhue[46] adopts the TAC suggested by Fry & slocum[70] combined with the facets proposed by Perrow[75] and Thompson[76], two facets such as NRT and IDP 2 are successfully measured and these two facets are easier to be evaluated by the method of survey questionnaire in verification research. In this study, the literature of Goodhue & Thompson[42] regarding the question items in the survey questionnaire of NRT and IDP are referred to. Some research topics of this study are taken into account and used to revise them.

TEC: In the study of Goodhue & Thompson[42] see technology as the tool for individual to complete a task and the hardware and software of an entire information system and the service of a computer department are all included into the research model; Goodhue[46] thinks that the major goal of the information system used in an organization is to complete the requirements in a task and personnel from information system should provide in-time assistance, therefore, the information system of an organization should include: a system module which is highly integrated and possesses common interface, the popular level of computer work station, the proportion of information assistance personnel and the degree of dispersion of information assistance personnel. This study makes questions based on the above mentioned 4 facets to evaluate TEC under e-government.

CSE: CSE means individual's subjective judgment on his own capability of using computer[77], therefore, what we concern should be the subjective judgment[78] on his/her own capability perceived by someone when he/she is in any situations related to computer; Compeau & Higgins[15] specifically emphasize on the judgment of CSE, it is not individual's practical computer operational skill, instead, it is the capability perceived by an individual to complete a task by using computer, these capabilities can be used to complete certain task. This study refers to the survey questionnaire prepared by Compeau & Higgins[15] and a survey questionnaire related to CSE is thus made.

TTF: The theory of TTF originates from the cognitive fit model of Vessey[67], this model sees that when the assisted tool to solve a problem fits to the task to be dealt with, the work complexity can then be reduced effectively and the performance can be enhanced; however, for a research based on UTL, the attitude and belief of the user is used to predict UTL[20,37.38] of the information system. Goodhue & Thompson[42] develop TTF theory by combining two concepts such as: "the attitude and belief of an user can be used to predict the behavior of using information system" and "the fit between task and technology has distinguished effect on performance". Goodhue[34] developed in 1998 a TTF measurement table which contains 12 facets, they are: the right level of detail (RLD), accuracy (ACR), compatibility (CPT), locatability (LCT), accessibility (ACS), meaning (MEN), assistance (AST), ease of use of hardware and software (EUHS), systems reliability (STR), currency (CUE), presentation (PRT), confusion (CFS). This study is going to modify the above mentioned 12 facets and put them into the survey questionnaire to evaluate TTF.

PEU and PU: TAM is a model developed by Davis[20] based on TRA, this model targets specifically on the behavior of the use of technology, its major purpose is to use general theory to explain the acceptance on new technology by an user; Morris & Dillon [24] think that TAM model can provide researcher a simpler and cost-saving method to predict the success level of a system. Davis[20] introduces two cognitive beliefs into TAM model, they are PEU and PU respectively; PEU is defined by Davis as" the ease of use of technology perceived by the user", and PU is defined as "the help on task performance and future that can be provided by using such technology subjectively thought by the user". This study uses the survey questionnaire used by Davis[20] for the measurement of PEU and PU, then the subject of this study is referred to and appropriate modification is made so as to prepare a survey questionnaire of this study.

UTL: UTL means the behavior of an individual in using technology in the job. In the past researches regarding the use, most are based on attitude and belief to predict the degree of use of the information system; among them, the most frequently used model to predict the behavior of use of the information system is TAM[61,21,25,79,80] model. In this study, the survey questionnaire used by Davis[20] is used as a paradigm, after appropriate modification, to measure UTL.

PEF: Whether the performance is improved or not can be judged from the enhancement of efficiency or the enhancement of efficacy and the enhancement of work quality. There are two major investigation directions in the past studies regarding the relationship between information technology and individual performance, one of the investigations is based on the view point of the use of technology[20,37,38,38,31], another is based on the view point of the fit[65,67,41]; however, Goodhue & Thompson[42] combine the use and fit theories

and propose an integrated model, this study then refers to the literature published by Delone & Mclean[31] and Goodhue[34] et al to prepare a survey questionnaire to measure an individual's performance.
All the preparation of survey questionnaire and method of evaluation are listed in Table.1.

In order to avoid any ambiguity in the survey questionnaire which might lead to a wrong answer and in turn affect the reliability and effectiveness of the survey questionnaire, this study thus invites two scholars who have PHD degree in information management, two scholars who have PHD degree in business management and two personnel working in the city government for more than 5 years, a total of 6 persons, to perform pretest of the survey questionnaire. Then the content is examined and appropriate modification is done, a pilot test is run after no error is found; in the mean time, in order to ensure the questions of survey questionnaire have certain degree of reliability and effectiveness, 50 personnel in city government is selected first by in this study as the sample of pilot test, after the test; after both the reliability and effectiveness of the survey questionnaire of this study are found to meet the standard, formal test is then performed.

4.2 Sampling method and data collection procedure
According to the organization structure data announced by the Department of Personnel in Taipei City Government[81] (Department of Personnel), we know that there are 29 units belong directly to and underneath Taipei City Government, we use the employees in these 29 units as the research mother group; since different units will have different business scope and different work content in their respective work, therefore, we use unit as stratified variable, Stratified Proportion Sampling is used to take the required sample; the number of the mother group is about 3546 persons according to the data, and in March 2006 for a period of one month, this study has sent a total of 1199 survey questionnaire, initial inspection is then performed on the returned and filled survey questionnaire. Obvious random and wrong answers and incomplete survey questionnaire with partly unanswered questions are deducted, a total of 352 ineffective survey questionnaire, the rest effective survey questionnaire has a total of 847, therefore, the effective answered rate is about 70.64%.

5 Data analysis and result
Statistical software spss 12.0 will be used as the analysis tool in this study and multiple regression analysis will be used to verify the model, the data analysis result and descriptions are as in the followings.

5.1 Good-of-fit test

In order to make sure the sample proportion for sample taken by stratified proportion sampling method can match the proportion f the mother group, χ^2 good-of-fit test is used in this study to verify if the proportion in the sample matches that in the mother group, null hypothesis in this test is ”the fit between sample proportion and mother group proportion is very good”; the related data is as shown in Table 2. If the obtained P-value=0.426, it is non-obvious, the null hypothesis is then accepted, this means that the sample proportion taken by this study is roughly the same as the mother group.

5.2 Sample basic information descriptions

The related basic information of persons answered is as shown in Table 3, from the data, we can see that male persons interviewed are somehow more than female persons interviewed, there is about 69.9% of persons with ages above 30 years old, there is about 69.5% of persons with education level higher than university, a proportion as high as 80.2% in persons interviewed with more than five years of experiences of using computers.

5.3 Reliability and effectiveness analysis

The purpose of reliability analysis is to test the consistency or stability of evaluation tool. Hair[82] points out that the reliability of single question item can be represented by the factor loading amount of individual observation variable to potential variable, he also suggests that the factor loading amount should be larger than 0.5; if any question item has value smaller than 0.5, it should be deleted and a new test should be re-launched. According to the above standards, ACR3, LCT1, STR2, CUE1 and CUE2 in this survey questionnaire are all to be deleted, among them, question items in CUE facet in TTF all get deleted; therefore, only 11 facets are left in the original 12 facets of TTF. Second, in order to understand if internal consistency is possessed by question item in the same facet, we use Cronbach's α for the evaluation; according to the view point of Nunnally[83], reliability is possessed if α is above 0.7. All facet α values in this study are larger than 0.7 and most of them are even larger than 0.8, this means that this survey questionnaire has very good internal consistency. Effectiveness means the correctness of an evaluation tool, the higher the effectiveness, the higher the probability that the parameter to be measured can be correctly measured. The survey questionnaire and measurement table in this study are prepared by referring to related literature and previous survey questionnaire prepared by scholars, besides, it is settled down by discussing with people in the related fields, this means that certain degree of appropriateness is contained in the questionnaire, that is, it has certain content effectiveness. In the convergent effectiveness part, it can be judged by

the factor loading amount of the corresponding question item in the facet, all the question items in this study are larger than 0.6, this means that the survey questionnaire in this study has certain degree of convergent effectiveness, for all the related data, please refer to Table 4.

According to the suggestions by Goodhus & Thompson[42], similar models are more suitable to be analyzed by multiple regression analysis. Multiple regression analysis is used in this study to process data and both independent variables and dependent variables of each regression model are as in the followings:

TTF=f(TAC,CSE,TEC)

PEU=f(TTF)

PU=f(PEU,TTF)

UTL=f(PEU,PU)

PEF=f(TTF,UTL)

Where TTF contains 11 facets-RLD, ACR, CPT, LCT, ACS, MEN, AST, EUHS, STR, CUE, PRT, CFS, TAC contains two facets-NRT, IDP. In addition to using F value to test the explanation power of the entire model and t value to test the individual β coefficient, variance inflation factor (VIF) is also used to test if multiple collinear properties exist. When VIF<10, it means the model does not contain collinear property, this helps not to misjudge the results from the model. After the inspection, we know that all VIF values are all smaller than 10, this means that there is no collinear issue existed in the regression formula, the results of other regression analysis are as shown in Table 5 to Table 9.

According to Goodhue & Thompson[42], they think that if all the statistical values of each facet of TTF all reaches obvious level, it can be seen as a strong support of the research hypothesis; if more than half of the statistical values of each facet reach obvious level, it is called moderate support, otherwise, it is called low support. According to the results in Table 5, all the entire explanation power of 11 regression lines reaches obvious level, three sets of adjusted R^2 values are smaller than 0.3, others are all larger than 0.3, the result is so-so if a view based on social science's angle is taken. Take a look at individual situation, in NRT, 6 facets are obvious, among them, 5 are of negative values, 1 is of positive value, besides, the facet that displays obvious property and is of positive value is CFS, that is, the more NRT, the higher CFS. Generally speaking, the more NRT, the lower TTF; in IDP aspect, only three facets are obvious and two facets such as RLD, STR have positive effect, CPT has negative effect. To conclude, we know that hypothesis 1 is correct and is of moderate support, wherein NRT has higher effect and will affect

TTF in a negative way, this conclusion is the same as those of Dishawhr& Strong[23] and Goodhue & Thompson[42], in their researches, they all think that when NRT demand increases, TTF will be lowered; then take a look on β coefficient of TEC, 11 facets are obvious, this means hypothesis 2 is correct and is of strong support, finally, if we take a look from β coefficient of CSE, only one β coefficient is not obvious, hypothesis 3 is thus correct and can be seen as of strong support.

From Table 6 we can see that regression line which uses PEU as dependent variable and the P-Value of the entire model are obvious, adjusted R^2=0.473, this means the explanation power of the entire model is not bad; in the individual parameter part, only β coefficient of EUHS, STR and PRT are obvious, but not more than half of them, therefore, hypothesis 4 can be seen as of low support; from the data in Table 7, the explanation power of the model is pretty good, adjusted R^2 reaches 0.667, β coefficients of 6 TTF facets are obvious, hypothesis 5 is thus of moderate support; moreover, the coefficient of independent variable PEU is 0.528 and obvious, hypothesis 6 is thus correct. For hypothesis 7 and 8, we can see from the data in Table 8 that the P-Value of the entire model is obvious, adjusted R^2 =0.652, both the coefficients of independent variables PEU and PU are all obvious, moreover, PU has higher degree of effect on UTL than PEU, therefore, hypothesis 7 and 8 all get supported.

Finally, we use Table 9 to investigate the last three hypotheses, the P-Value of the entire model is obvious, adjusted R^2 =0.705, this means the whole explanation power is not bad, in TTF part, 3 β coefficients are obvious, this means hypothesis 10 is of low support, β coefficient of UTL and CSE are all obvious, therefore, hypothesis 9 and 11 all get supported. Moreover, the β coefficient of UTL is 0.576, this is much larger than other coefficients in Table 9; this means UTL has higher effect on PEF than TTF and CSE. Finally, we put all the deduction results of all the above research hypotheses in Table 10.

6. Discussion

Goodhue and Thompson[42] , in their discussion of TTF model, mentioned that different tasks need to be supported by different technology tools, besides, when the gaps between technology and work become smaller, TTF will rise, that is, if technology can really support task, there should be a positive cause-effect relationship between task and TTF; from the hypotheses 1 result of this study, NRT in TAC will have more influence than IDP and it is a negative influence on TTF; the reason why this happens might be due to bad fit between technology and task which in turn does not cause any reduction of the gap between each other, therefore, if the gap between technology and task needs to be reduced, we can focus on NRT, according to the suggestions from Goodhue[34] , we should

do in the following three directions (1)discontinue or redesign systems or policies (2)embark on training or selection programs to increase the ability of users (3)redesign tasks to task better advantage of information technology potential.

From the conclusions resulted from hypothesis 4 and 5, we know that TTF have higher effect on PU than on PEU. Take the personnel worked in Taipei City Government as an example, under the requirement of e-government, theoretically, the hope that information system can help on dealing with the task (PU) will be higher than the hope that information system is easy to use (PEU); therefore, the design of information system should take the ability to help processing the task as the first priority; then through the use of educational training to enhance employee's familiarity with information system, or through the use of the system to let employee change their feeling from familiarity into ease of use; in the effect on UTL by PU and PEU, we see that PU has higher effect than PEU, this result matches the former deduction. In the current study, CSE has obvious effect on TTF and PEF, this means a self recognition on computer capability will be reflected on the use of information system and task performance, therefore, if related computer technology and knowledge can be enhanced, we believe that it will definitely have certain degree of help on the enhancement of task performance.

If we take a look on the research result, PEU will affect PU and UTL in positive way, PU will affect UTL in positive way too; this conclusion matches the research performed by Davis[20], it represents that PU and PEU in the TAM model are also applicable to information system in this study and possess certain explanation power. In the part that affects PEF, CSE, TTF and UTL all show effect on PEF, however, UTL has the strongest effect. The major reason might be, under the requirement of e-government, employees can obtain related helps through information system which in turn will help PEF, therefore, enhancement of the UTL of employees is believed to have more direct enhancement effect on PEF, however, the enhancement of UTL of employees can be done from the PEU and PU mentioned above, we believe that it should have distinguished effect.

The contribution of this study can be described fourfold. First, in e-government related researches, most emphasize on G2G, G2B and G2C, G2E field is rarely discussed, this study adopts another angle of view based on G2E, it tries to investigate the effect of information system on internal employees under e-government, we hope that the result can be helpful to researches in related field. Second, this study uses TTF model combined with PEU and PU in TAM model and the CSE perceived by an individual to perform a complete investigation targeting at factors of TTF and PEF. As said by Dishaw & Strong[23], integrated model has higher prediction and explanation power, the adjusted R^2

of integrated model in this study is as high as 0.705, this not only verifies the conclusion of Dishaw & Strong[23], but also finds another possible affecting factor-CSE. This finding can provide later researchers possible affecting factors in related researches. Third, this study takes Taipei City Government which has good e-government performance as the target to investigate related factors of TTF and PEF for the internal employees of e-government. In addition to performing practical verification on TTF measurement table and fit theory, these results can also be used by government organization as an effective method in inspecting the fit and performance of information system. Here we obtain some useful conclusions, for example, from the research we know that CSE has certain degree on performance, therefore, we suggest that when government organization examine and recruit new personnel, they should consider the computer skill of the person who apply the job, or when on-job training is executed, the enhancement of computer skill of internal employees should be taken into account; however, UTL has higher effect on PEF than TTF and CSE, but UTL will be affected by PU and PEU, wherein PU has higher effect, therefore, during the design of information system, PU should be taken into account; increase the rate of use of the system first, then the fit between the task and technology is used an assisted tool to enhance TTF combined with the CSE recognized by an individual, the entire performance can finally be enhanced. Finally, all the conclusions in this study have all been investigated by literature and verified by practice; these conclusions are similar to those of Goodhue & Thompson[42] and have certain degree of reliability. The opinions resulted from these conclusions should be able to be used as a reference and basis for Taipei City Government and other organizations which are interested in implementing e-government in improving information system and enhancing the performance of employees.

7. Limitations and future directions of the research

Since this survey questionnaire is based on the employees of Taipei City Government as the test targets, whether the results can be applied in different countries or organizations of different nature should be further verified. Next, in the test process of the survey questionnaire, since it is not enforcing whether to answer the questions or not, there might be still unavoidable errors existed although the survey questionnaires have been sorted and tested with reliability and effectiveness after the return of the survey questionnaires. Furthermore, there is only one month for the survey questionnaire test in this study, the data obtained is thus of cross-sectional type and nature; although the relationship between variables are easier to be investigated in this study, however, for the TTF and PEF change perceived by internal employees of the organization is still difficult

to be traced in a long time basis, therefore, whether the tested results obtained in short term can match the results obtained from a long term basis is beyond the capability of verification of this study.

In the future study, we suggest to perform in the following four directions: (1) Since e-government is the trend the government in each country has to face in the future, normally speaking, related responsible units exist in the internal organization of the government, therefore, in order to avoid the reluctant answer and low returning rate, we suggest the responsible unit to perform a general test in order to obtain more accurate and complete result to be used as basis for management and reference for improving the information system. (2) Since there are as high as 12 facets in original TTF and are mostly applied to private enterprises, we thus suggest that exploratory factor method can be used first in the future so as to reduce TTF facet. Try to reduce the model explanation complexity first, then use verifying factor method to investigate related factors affecting TTF and PEF, we believe that good results are going to be obtained. (3) The introduction of information technology simplifies work flow and content, in addition to reducing the requirement on the professional knowledge and skills of the worker, it also makes the work boring, therefore, work pressure accompanies if high performance requirement has to be faced at the same time, this might in turn affect TTF and PEF; besides, computer anxiety caused by the negative attitude hold toward the use of information system is seen as an important factor[85] retarding the implementation of e-government, therefore, in addition to the factors mentioned in this research, there might be other factors which could have negative offsetting effect. Therefore, when a model is built, it might be good to take into account related literature and practical situation, add in appropriate time the possible affecting factors. (4) During the measurement of performance in this study, the measurement method used is a self-perception performance, such method is a subjective judgment which is somehow not the objective standard expected by general government organizations; a better evaluation method might be to make a quantifiable standard by the auditing unit and to track or record the performance change in a periodical way. We believe that this will help to reach a more accurate conclusion on the change of performance.