Exploring Success Factors for Government Electronic Tendering System: Behavioral Perspectives from End Users

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Abstract

This study explores the key success factors for the electronic tendering system (ETS) through the behavioral perspectives from the end users. Based on the Theory of Planned Behavior (TPB), this study proposes an integrated model for the empirical examination of the users’ intention and behavior for using the ETS. The results show that users’ attitude, specifically their perceived usefulness and information accuracy of the ETS, most significantly affect both the end users’ intention and their actual behavior for the ETS usage. Substantial influences from their coworkers’ and supervisors’ attitudes and the facilitating conditions are also significant. Discussion and policy recommendations for promoting the ETS are then provided according to the empirical results.

Keywords: electronic government; electronic procurement; electronic tendering system; theory of planned behavior; end user satisfaction

1. Introduction

The Electronic Government (EG) program in Taiwan has focused on three types of online governmental services, viz., government to government (intra-agencies, G2G), government to citizens (G2C), and government to business (G2B). Among them electronic procurement has been one of the representative G2B actions for digitizing the procurement procedure in governmental agencies where inefficiency and even corruption have been underlying problems.

Driven by the Public Construction Commission (PCC) of Taiwan’s central government, a series of Internet-based e-procurement systems has been designed and implemented since 2000. The complete e-procurement system is composed of four sub-systems, i.e., Government Procurement Information System, Common Supply Contract System, Suppliers Catalog, Inquiry and Quotation System, and Electronic Tendering System (ETS). Each sub-system is responsible for different stages of the procurement procedures. The ETS supports the tasks of downloading and uploading electronic tender documents via the Internet. It also provides a unified and updated source about potential suppliers for various governmental agencies as well as maintains the most updated procurement information and requirement across governmental agencies for these potential suppliers. Therefore, the transparent procurement procedure powered by the ETS has been regarded as one of the most important merits embedded in the digital government.

From a pragmatic point of view, understanding the determinants of using information technology (IT) should ensure an effective deployment of IT resources in an organization. Thus, evaluating technology acceptance, especially from the behavioral perspectives of the ETS end users, has been critical for its promotion and strategic revision. Among the existing research on IT acceptance from the attitude/behavior perspectives, intention-based models such as Theory of Planned Behavior (TPB), have gained the attention from many researchers and are widely employed to provide an understanding of the determinant of technology usage.

This article, accordingly, intends to: (1) Propose an integrated model to explain and evaluate the end users’ behavior and attitude of the ETS usage; (2) Empirically examine the appropriateness of the proposed model; (3) Develop diagnostic tools to predict the ETS acceptance and facilitate design changes; and (4) Conclude with policy recommendations for promoting the ETS and the online governmental services in general.

In the following sections, we firstly review the literature of IT usage and propose a model for evaluating the ETS. The research design will then be introduced, followed by the data analyses, empirical results, and concluding remarks.

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2. A Behavior Model for Evaluating the ETS Adoption

In this section, the fundamental theories for technology acceptance, specifically the Theory of Planned Behavior (TPB) and Technology Acceptance Model (TAM), are introduced. We propose an integrated model and the testable hypotheses to examine the intention and behavior of ETS users. The proposed model and the derived hypotheses to be examined constitute our attempt to explore the key success factors for performing the ETS.

2.1 The Fundamental Theories and the Proposed Model

TPB provides comprehensive understanding of usage behaviors and intentions and serves our research as the theoretical background. A central proposition of TPB, which has received considerable empirical support, in the context of IT usage is that the users’ actual behavior ($B$) is determined by their behavioral intention ($BI$) to use the technology. That is, people tend to better adopt a new IT when they have more intention to use it. Equally important is another proposition about the so-called perceived behavioral control ($PBC$) that the actual usage behavior is also affected by whether the users have perceived sufficient control of capability and resources necessary to adopt the IT. The preceding influences from $BI$ and $PBC$ to the end users’ actual IT usage compose the right-hand part of our proposed model in Figure 1.

![Figure 1: The Proposed Model for Evaluating the ETS from End Users Perspectives](image)

The $BI$ for IT usage is then jointly determined by three conceptually distinct constructs based on TPB: attitude ($AT$) toward using the IT, subjective norm ($SN$), and perceived behavioral control ($PBC$). The case of adopting the ETS shows that the users’ intention to adopt ETS are affected, as in Figure 1, by: (1) their attitude toward ETS, which reflects their overall evaluation or satisfaction, (2) the subjective norm about ETS, which reflects their perceptions of social pressure affecting the IT usage, such as pressures from their supervisors and colleagues, and (3) the perceived behavioral control, which as theorized above reflects the beliefs regarding their control over the factors that may facilitate or impede the IT usage.

Our integrated model is further expanded to include the constructs and relations that might be important in IT usage. Firstly, we take a decomposition approach to belief structures, which are treated as...
monolithic in the traditional TPB model. As indicated in Figure 1, the users’ AT is determined jointly by their perceived usefulness (U) and perceived ease of use (EOU) of the ETS, as well as by their perceived accuracy (AC) of the information provided by the ETS. Secondly, the users’ PBC, according to the literature, is divided into (1) self-efficacy (SE), which reflects the users’ confidence in their knowledge and ability of mastering the computing technology required by the ETS, and (2) facilitating conditions (FC), which refers to the availability of the resources such as computers and the Internet access necessary to perform the ETS. Our proposed model is summarized in Figure 1 based on the previous decomposition arguments.

According to the Technology Acceptance Model mentioned previously, the users’ EOU is a direct determinant of their perceived usefulness of ETS. Finally, various studies suggest that the users’ EOU should be similar to SE and therefore can be defined as “judgments of how well one can execute courses of action required to deal with prospective situations.” In addition to the theoretical basis, there appears intuitive and practical bases to surmise that the users’ perceived ease of use and their self-efficacy for adopting IT are closely linked. Therefore, the perceived behavioral control in our proposed model in Figure 1 is jointly and positively influenced by the users’ perceived ease of use apart from their self-efficacy and facilitating conditions for adopting ETS.

In summary, the preceding theoretical arguments and our proposed model can be formally stated by the following system of simultaneous regression models. The subsequent hypotheses derived from the integrated models actually attempt to estimate the regression coefficients.

\[ B = w_1^*BI + w_2^*PBC \]
\[ BI = w_3^*AT + w_4^*SN + w_5^*PBC \]
\[ AT = w_6^*U + w_7^*EOU + w_8^*AC \]
\[ PBC = w_9^*SE + w_{10}^*FC + w_{11}^*EOU \]
\[ U = w_{12}^*EOU \]

2.2 Hypotheses Development for the ETS Usage

Based on the preceding theoretical arguments and the proposed model, the following hypotheses are developed for further empirical examination.

Hypothesis (1a)-(1b): The ETS usage behavior (B) is a function of behavioral intentions (BI) and perceived behavioral control (PBC) toward the ETS. The ETS users will have more actual ETS usage when they are more inclined to use it (1a) and more capable of acquiring available resources to help them use the ETS (1b).

Hypotheses (2a)-(2c): Attitude (2a), subjective norm (2b), and perceived behavioral control (2c) toward the ETS have significant positive impact on the behavioral intention (BI) to use the ETS. That is, the ETS users will be more inclined to use it when they have better overall satisfaction of the system (2a), perceive more social pressure to use the system (2b), and acquire more knowledge and resources for using the system.

Hypotheses (3a)-(3c): Attitude (3a) of the ETS usage is a positive function of the users’ perceived usefulness (3a), perceived ease of use (3b), and the system’s accuracy (3c). In other words, the users’ overall satisfaction depends on whether the ETS can provide useful functions (3a), user-friendly interfaces (3b), and accurate information (3c).

Hypotheses (3d)-(3f): The users’ perceived behavior control (PBC) toward the ETS usage is a positive function of their self-efficacy (3d), facilitating conditions (3e), and perceived ease of use (3f). That is, the users are more advantageous to use the ETS when they are equipped with more relevant knowledge (3d) and facilitating resources (3e), as well as when the ETS provides them with friendly interfaces (3f).

Hypotheses (4a): The users’ perceived usefulness of ETS is a positive function of their perceived ease of use of the system. The ETS with more user-friendly interfaces tends to make the users feel useful in terms of the functions available in the system.

3. Research Methods

Based on the preceding theories and hypotheses, this section details the subsequent constructs and questionnaire items, and the survey settings to collect the empirical data from the end users of the ETS.

3.1 Instrument Development

Table 1 shows the detailed constructs in the proposed ETS usage model. To ensure the content validity of the scales, the items selected must represent the concepts in the empirical model under
investigation. Therefore, the items selected for the constructs in our model are mainly adapted from prior studies to ensure content validity.

The questionnaire includes two major parts. The first part is composed of thirty-five relevant questions \( (X_1-X_{30}) \) and \( Y_1-Y_{15} \). The answers for all questions in the first part are coded as 7-point Likert Scale. The second part contains demographic information about the respondents, including age, gender, education, and years of experience in processing the procurement affairs. Items \( X_{10}, X_{11} \) in Table 1 stand for the independent variables that measure the theoretical constructs serving as predictors of the ETS usage in Figure 1. They include the four items for perceived ease of use \( (EOU, X_{11-}X_{13}) \), perceived usefulness \( (U, X_{1-}X_{3}) \), accuracy \( (AC, X_{5-}X_{12}) \), subjective norm \( (SN, X_{13-}X_{15}) \), self-efficacy \( (SE, X_{16-}X_{19}) \), and facilitating conditions \( (FC, X_{19-}X_{30}) \). There are another fifteen observable variables \( (Y_1-Y_{13}) \) for intermediate and ultimate dependent constructs including attitude \( (AT, Y_{1-}Y_{3}) \), perceived behavioral control \( (PBC, Y_{6-}Y_{8}) \), behavioral intention \( (BI, Y_{10-}Y_{12}) \), and actual behavior \( (B, Y_{13-}Y_{15}) \).

### 3.2 Survey Settings

Only a limited number of public administrators in Taiwan’s central governmental agencies and state-owned enterprises have used the ETS when the survey was performed. Our sample is composed of public officials who are responsible for procurement affairs and businessmen who may be interested in governmental procurement, both of whom are the presumed ETS users under our empirical examination. They are selected by the purposive sampling procedure by which we sampled from various private sectors, state-owned enterprises, e.g., Taiwan power company, and central government organizations. This is the best alternative for the standard probability sampling due to the early implementation stage for the ETS. The selected sectors should be the deemed representative as we are keenly aware of the potential bias.

Of all 445 questionnaires distributed, 158 valid questionnaires were returned, with an effective response rate of 35.5 percent. Among them 63.9 percent of the respondents were males. The majority aged between 30 and 49 years. Most of the respondents (82.9 percent) have college degrees, and 11.4 percent of whom have obtained master or doctoral degrees. In addition, the respondents have 16 to 20 years’ work experience in procurement affairs, and 56 percent of them reply that they have received various ETS training programs. The overall characteristics of the surveyed ETS users, therefore, have a sound background for adopting ETS in terms of their education, work experience, and training background.

### 4. Statistical Results and Discussions

In addition to descriptive statistical summaries, structural equation modeling was also utilized to test the integrated ETS model using SPSS and LISREL8 software packages with maximum likelihood estimation. This section shows the evaluations of ETS users in terms of individual measurements in Table 1, and the overall fitness of the proposed model.

#### 4.1 Evaluations for the ETS Usage

##### 4.1.1 Behavioral Factors

Table 1 summarizes the overall evaluation based on the individual questionnaire items in Table 1. Based on both the percentages and mean values, the results for actual behavior \( (B, Y_{11-}Y_{15}) \) of the ETS usage appear mixed although the users’ intention \( (BI, Y_{10}-Y_{12}) \) seems relatively more promising. To illustrate, there remains around 43.7% of the respondents with negative evaluations for using the ETS to handle the procurement tasks \( (Y_{13}) \) and with 43.0% less ETS preference compared to the traditional paper process \( (Y_{14}) \) in the future. And only 45.6% of the ETS users claimed that they frequently used the ETS \( (Y_{15}) \). Compared to the actual behavior, however, at least 70% ETS users show more intention to keep using the ETS in the future procurement tasks.

All results reported above are basically consistent with the status quo of the ETS and with the overall electronic procurement systems. That is, as one of the four subsystems, the ETS has been made available but yet to be promoted further. The success for promoting the ETS depends on whether the downstream and crucial electronic bidding system can be implemented. And as of now, the electronic bidding system as well as the accompanying payment mechanism such as e-wallet and e-procurement card, are still under small-scale pilot tests. It is plausible that the actual ETS usage is far less prominent than the users’ intention.

##### 4.1.2 Attitudinal Factors

The dependent measures of the attitudinal constructs \( (AT, Y_{1-}Y_{3}) \) stand for the overall satisfaction for the ETS usage. As a result, the ETS users generally reported positive experience from 60.1% to 74.0%
and a maximum of 15.8% dissatisfaction. This overall positive evaluation is also captured by three subsequent attitudinal constructs on perceived ease of use (EOU, X_1 – X_4), perceived usefulness (U, X_5 – X_8) and accuracy (AC, X_9 – X_12). The least satisfaction of the ETS usage points to the system bugs (X_9, 29.1%), which should shed light on where the improvement efforts and resources should be allocated.

Table 1: Detailed Constructs and Questionnaire Items ETS of Users' Evaluations

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Questions a</th>
<th>Positive (%)</th>
<th>Neutral (%)</th>
<th>Negative (%)</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y_1</td>
<td>Using the ETS makes me feel (very bad/very good)</td>
<td>62.7</td>
<td>21.5</td>
<td>15.8</td>
<td>0.85</td>
<td>1.46</td>
<td></td>
</tr>
<tr>
<td>Y_2</td>
<td>It is (very unpleasant/very pleasant) for me to use</td>
<td>60.1</td>
<td>25.9</td>
<td>14.0</td>
<td>0.93</td>
<td>1.37</td>
<td></td>
</tr>
<tr>
<td>Y_3</td>
<td>It is (very useless/very useful) for me to use</td>
<td>71.5</td>
<td>17.1</td>
<td>11.4</td>
<td>1.14</td>
<td>1.32</td>
<td></td>
</tr>
<tr>
<td>Y_4</td>
<td>I (extremely/dislike/extremely) like to use</td>
<td>64.5</td>
<td>22.8</td>
<td>12.7</td>
<td>0.88</td>
<td>1.31</td>
<td></td>
</tr>
<tr>
<td>Y_5</td>
<td>I feel (very negative/very positive) about the ETS</td>
<td>74.0</td>
<td>16.5</td>
<td>9.5</td>
<td>1.31</td>
<td>1.43</td>
<td></td>
</tr>
<tr>
<td>X_1</td>
<td>It is very easy to use the ETS</td>
<td>74.7</td>
<td>11.4</td>
<td>14.0</td>
<td>1.11</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td>X_2</td>
<td>It is very easy to learn how to use the ETS</td>
<td>74.1</td>
<td>13.9</td>
<td>12.0</td>
<td>1.15</td>
<td>1.35</td>
<td></td>
</tr>
<tr>
<td>X_3</td>
<td>The ETS instruction is very easy to understand</td>
<td>69.6</td>
<td>13.3</td>
<td>17.1</td>
<td>1.09</td>
<td>1.36</td>
<td></td>
</tr>
<tr>
<td>X_4</td>
<td>In general, the ease of use of ETS is very good</td>
<td>70.2</td>
<td>17.1</td>
<td>12.7</td>
<td>1.01</td>
<td>1.32</td>
<td></td>
</tr>
<tr>
<td>X_5</td>
<td>The ETS helps complete the tasks quickly</td>
<td>68.4</td>
<td>12.7</td>
<td>19.0</td>
<td>0.93</td>
<td>1.56</td>
<td></td>
</tr>
<tr>
<td>X_6</td>
<td>The ETS enhances efficiency of procurement</td>
<td>70.2</td>
<td>11.4</td>
<td>18.4</td>
<td>0.94</td>
<td>1.52</td>
<td></td>
</tr>
<tr>
<td>X_7</td>
<td>The ETS makes procurement much easier</td>
<td>70.3</td>
<td>10.8</td>
<td>19.0</td>
<td>0.91</td>
<td>1.46</td>
<td></td>
</tr>
<tr>
<td>X_8</td>
<td>Overall, the ETS is very helpful</td>
<td>82.7</td>
<td>16.5</td>
<td>10.1</td>
<td>1.18</td>
<td>1.28</td>
<td></td>
</tr>
<tr>
<td>X_9</td>
<td>The ETS has very few bugs in the system</td>
<td>53.1</td>
<td>17.7</td>
<td>29.1</td>
<td>0.48</td>
<td>1.51</td>
<td></td>
</tr>
<tr>
<td>X_10</td>
<td>The ETS provides precise information</td>
<td>65.2</td>
<td>19.0</td>
<td>15.9</td>
<td>0.94</td>
<td>1.39</td>
<td></td>
</tr>
<tr>
<td>X_11</td>
<td>The ETS helps me complete tasks accurately</td>
<td>63.3</td>
<td>19.6</td>
<td>17.1</td>
<td>0.82</td>
<td>1.33</td>
<td></td>
</tr>
<tr>
<td>X_12</td>
<td>Overall, the ETS is very reliable</td>
<td>67.1</td>
<td>20.9</td>
<td>12.0</td>
<td>0.94</td>
<td>1.36</td>
<td></td>
</tr>
<tr>
<td>X_13</td>
<td>My supervisor thinks that I should use the ETS</td>
<td>75.9</td>
<td>19.6</td>
<td>3.8</td>
<td>1.58</td>
<td>1.20</td>
<td></td>
</tr>
<tr>
<td>X_14</td>
<td>My colleagues think that I should use the ETS</td>
<td>65.8</td>
<td>25.9</td>
<td>8.3</td>
<td>1.21</td>
<td>1.38</td>
<td></td>
</tr>
<tr>
<td>X_15</td>
<td>My organization thinks that I should use the ETS</td>
<td>58.8</td>
<td>31.6</td>
<td>7.6</td>
<td>1.13</td>
<td>1.44</td>
<td></td>
</tr>
<tr>
<td>Y_6</td>
<td>When I use the ETS, I have (no/a lot of) difficulties</td>
<td>53.2</td>
<td>26.5</td>
<td>20.3</td>
<td>0.59</td>
<td>1.51</td>
<td></td>
</tr>
<tr>
<td>Y_7</td>
<td>Whether I use the ETS is completely within control</td>
<td>49.4</td>
<td>21.5</td>
<td>29.1</td>
<td>0.42</td>
<td>1.65</td>
<td></td>
</tr>
<tr>
<td>Y_8</td>
<td>I have enough knowledge to operate the ETS</td>
<td>58.9</td>
<td>19.6</td>
<td>20.5</td>
<td>0.78</td>
<td>1.60</td>
<td></td>
</tr>
<tr>
<td>Y_9</td>
<td>In general, I am capable of using the ETS</td>
<td>60.8</td>
<td>22.2</td>
<td>17.1</td>
<td>0.89</td>
<td>1.56</td>
<td></td>
</tr>
<tr>
<td>X_16</td>
<td>I have enough ability to use the ETS</td>
<td>81.0</td>
<td>8.2</td>
<td>10.8</td>
<td>1.54</td>
<td>1.36</td>
<td></td>
</tr>
<tr>
<td>X_17</td>
<td>I have enough knowledge to use the ETS</td>
<td>84.1</td>
<td>6.3</td>
<td>8.9</td>
<td>1.54</td>
<td>1.36</td>
<td></td>
</tr>
<tr>
<td>X_18</td>
<td>The ETS is easy to use on my own</td>
<td>80.4</td>
<td>10.1</td>
<td>8.2</td>
<td>1.61</td>
<td>1.36</td>
<td></td>
</tr>
<tr>
<td>X_19</td>
<td>I own enough required computer equipment</td>
<td>86.1</td>
<td>5.7</td>
<td>8.2</td>
<td>1.71</td>
<td>1.36</td>
<td></td>
</tr>
<tr>
<td>X_20</td>
<td>The Internet network is ease of access</td>
<td>82.3</td>
<td>7.6</td>
<td>10.1</td>
<td>1.63</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>Y_10</td>
<td>I intend to use the ETS to handle procurement cases</td>
<td>71.5</td>
<td>11.4</td>
<td>16.5</td>
<td>1.32</td>
<td>1.67</td>
<td></td>
</tr>
<tr>
<td>Y_11</td>
<td>I plan to use the ETS to complete the procurement</td>
<td>73.4</td>
<td>10.8</td>
<td>15.8</td>
<td>1.35</td>
<td>1.61</td>
<td></td>
</tr>
<tr>
<td>Y_12</td>
<td>In general, I intend to use the ETS (never/very likely)</td>
<td>70.3</td>
<td>10.1</td>
<td>19.7</td>
<td>1.20</td>
<td>1.70</td>
<td></td>
</tr>
<tr>
<td>Y_13</td>
<td>I use the ETS to handle the procurement tasks</td>
<td>45.6</td>
<td>10.8</td>
<td>43.7</td>
<td>0.04</td>
<td>2.33</td>
<td></td>
</tr>
<tr>
<td>Y_14</td>
<td>I prefer the ETS to the traditional paper process</td>
<td>43.1</td>
<td>12.7</td>
<td>43.0</td>
<td>0.06</td>
<td>2.19</td>
<td></td>
</tr>
<tr>
<td>Y_15</td>
<td>Frequency I use the ETS is (very low/very high).</td>
<td>45.6</td>
<td>16.5</td>
<td>28.0</td>
<td>0.15</td>
<td>2.23</td>
<td></td>
</tr>
</tbody>
</table>

* Questions Y_1~Y_15 and X_1~X_20 are coded as 7-point Likert scales (from −3 to +3) from “strongly disagree” to “strongly agree.”
4.1.3 Normative Factors

The respondents indicated very high support from their supervisors, colleagues, and organizations to use the ETS (SN, X_{13} – X_{15}). The results on the normative factors imply that using ETS is consistent with the organizational and social settings around the ETS users. It also means that the government’s plan and investment on the e-procurement and the overall e-government programs have received corresponding support from private firms outside and within the public sectors.

4.1.4 Control Factors

We found somewhat mixed results for the criterion variables of the control constructs (PBC, Y_6 – Y_9). For example, 20.3% of the ETS users replied that they had encountered difficulty in using the system. Around 20.5% of the users reported that they did not have sufficient knowledge to use the ETS; and 17.1% disagreed with their capability of using the ETS. Looking into the explanatory control constructs on self-efficacy (SE, X_{16} – X_{18}) and facilitating conditions (FC, X_{19} – X_{20}), we found that the respondents actually possess sufficient computer equipments and the Internet resources, with only 8.2% and 10.1% reporting the insufficient computing resources required by the ETS. The results also show that at least 80% of the surveyed ETS users are confident of their computing skills.

Although the preceding results for the individual questionnaire items have shed light on the overall evaluation of the ETS usage, further analyses will be necessary to understand how all the variables reported above interact with each other under our proposed model and individual hypotheses. The following two sections attempt to examine the model quality and hypotheses.

4.2 Quality of the Original and Revised Model

Confirmatory factor analysis was performed and the results indicated a good fit for the model and a high degree of scale reliability and convergent validity, except for some measures of perceived usefulness (U), accuracy (AC), and self-efficacy (SE). Based on the conventional procedures of structural equation modeling, the path coefficients of questionnaire items X_5 (The ETS helps me complete the procurement tasks quickly), X_9 (The ETS has very few bugs), and X_{17} (I have enough knowledge to use the ETS) in Table 1 are very small and insignificant, and thus dropped. Then we conducted the second confirmatory factor analysis on this revised model and assessed its scale reliability, convergent validity, and model fitting. The resulting path coefficients, standard errors, and their significance for the integrated model are shown in Figure 2.

Consequently, both the internal consistencies and the variance extracted for all the constructs exceed the cutoff values suggested in the literature. The results suggest a marginally good fit for our revised model, with chi-square statistics $\chi^2$(354, N = 158) = 389.2 with $p = 0.00$; goodness of fit index (GFI) = 0.75; normed fit index (NFI) = 0.90; comparative fit index (CFI) = 0.90; and root mean square error of approximation (RMSEA) = 0.079. The $R^2$ values for behavior, behavioral intention, attitude, subjective norm, and perceived behavioral control are acceptable ($R^2_B = 0.35; R^2_{BI} = 0.57; R^2_{AT} = 0.43; R^2_{PBC} = 0.38$). Based on these criteria, our revised model in Figure 2 is acceptable in terms of its degree of fitness to the empirical data based on the 158 ETS users. It therefore can serve as the model to examine the hypothesized relationships developed above.

5. Results for Hypotheses Testing

As indicated in Figure 2, all path coefficients in the integrated model are significant, with the exception of two paths, one from perceived ease of use to attitude, and the other from self-efficacy to perceived behavioral control.

5.1 Determinants of ETS Usage Behavior

As hypothesized in the Hypotheses (1a) and (1b), the intention of users to use the ETS and their perceived behavioral control have positive impact on the ETS usage behavior, with the standardized path coefficients 0.31 and 0.36, respectively. While consistent with most of the previous research findings, these results also suggest that the users’ computing skills and resources available – captured by their
perceived behavioral control – play an important role in affecting the users’ actual ETS usage together with their intention.

5.2 Determinants of ETS Behavioral Intention

Attitude, subjective norm, and perceived behavioral control positively affected behavioral intention based on their standardized path coefficients (0.43, 0.20, and 0.36, respectively) as shown in Figure 2. Thus, Hypotheses (2a)-(2c) are clearly supported. Table 2 below summarizes the total effects of all constructs in the model on the actual ETS usage and behavioral intention. As shown, compared with the subjective norm (total effect = 0.20) and perceived behavioral control (total effect = 0.36) in the same level, the users’ overall satisfaction (total effect = 0.43) has the most prominent impact on their intention to use the ETS.

![Figure 2: The Path Coefficients of the Integrated ETS Usage Model](image)

Note: All numbers are standardized with the standard errors in parentheses.

\[ p < 0.05 \]

### Table 2: Total Effects on Behavior (B) and Behavioral Intention (BI)

<table>
<thead>
<tr>
<th>Constructs</th>
<th>No. of Items</th>
<th>Internal Consistency</th>
<th>Variance Explained</th>
<th>Effect on Behavior (B)</th>
<th>Effect on Behavioral Intention (BI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral Intention (BI)</td>
<td>3</td>
<td>0.97</td>
<td>0.90</td>
<td>0.31</td>
<td>--</td>
</tr>
<tr>
<td>Attitude (AT)</td>
<td>5</td>
<td>0.95</td>
<td>0.85</td>
<td>0.13</td>
<td>0.43</td>
</tr>
<tr>
<td>Subjective Norm (SN)</td>
<td>3</td>
<td>0.86</td>
<td>0.80</td>
<td>0.06</td>
<td>0.20</td>
</tr>
<tr>
<td>Perceived Behavioral Control (PBC)</td>
<td>3</td>
<td>0.93</td>
<td>0.86</td>
<td>0.47</td>
<td>0.36</td>
</tr>
</tbody>
</table>
Perceived Ease of Use (EOU) & 4 & 0.92 & 0.81 & 0.02 & 0.07 & 0.07
Perceived Usefulness (U) & 3 & 0.93 & 0.90 & 0.03 & 0.1 & 0.1
Accuracy (AC) & 3 & 0.88 & 0.62 & 0.06 & 0.18 & 0.18
Self-Efficacy (SE) & 2 & 0.93 & 0.80 & -0.08 & -0.06 & -0.06
Facilitating Conditions (FC) & 2 & 0.78 & 0.90 & 0.15 & 0.16 & 0.16

Note: a - containing some path without statistical significance at 0.05.

The critical impact of perceived behavioral control on the actual ETS usage is confirmed in Table 2. As hypothesized in the model, the ETS users will have more actual usage when they have more intention and when they possess more computing capability and facilitating resources. Accounting for its direct and indirect effects on the actual ETS usage through BI, PBC has more impact (total effect = 0.47) relative to BI (total effect = 0.31) on the ETS usage.

5.3 Determinants of ETS Users Satisfaction

Hypotheses (3a)-(3c) attempt to capture the explanatory structure of the overall users’ satisfaction for using the ETS. As a result, their perceived usefulness, [Hypothesis (3a)], and accuracy of information that the ETS can provide [Hypothesis (3c)] have indeed significant impact on the overall satisfaction as hypothesized – with the path coefficients 0.24 and 0.41, respectively. However, the perceived ease of use [EOU, Hypothesis (3b)], namely, the friendly user interfaces, does not reach substantial direct influence on the users’ satisfaction with the path coefficient 0.095. Nevertheless, EOU does have indirect effect on the users’ satisfaction through its significant impact on perceived usefulness [(Hypothesis, (4a)) with the path coefficient 0.70). In other words, the friendly ETS system user interfaces do not directly affect the users' satisfaction. Rather, the friendly interfaces make the ETS users perceive the system helpful and thus have a virtual impact on their satisfaction indirectly.

5.4 Determinants of Perceived Behavioral Control

In our model, the perceived behavioral control conceptualizes the users’ availability of computing skills and resources necessary for using the ETS. The results in Figure 2 show that it is significantly determined by the facilitating conditions (with the path coefficient 0.32) and the perceived ease of use (with the path coefficient 0.47) as Hypotheses (3e) and (3f). Contrary to Hypothesis (3d) is the insignificant impact of self-efficacy (with the path coefficient 0.16). Our empirical evidences imply that the users computing knowledge and skills (i.e., SE) do not play an important role in the users’ overall grasp of available resources for adopting the ETS. A possible explanation may lie in the fact that around 83% of the respondents were of the age below 50 and possessed college or higher degree. In other words, computing knowledge and skills may be a hurdle they have already overcome, and hence not crucial any more.

6. Policy Implication

6.1 Effects of Independent Predictors

Total effects of the fundamental level of constructs, including perceived ease of use, perceived usefulness, accuracy, self-efficacy, and facilitating conditions, on the ETS behavioral intention and actual usage are reported in Table 2. The extent to which the users have computing facility and Internet access (i.e., FC) most importantly affects their actual ETS usage and intention, with total effect = 0.15 and 0.16, respectively. This implies the information and communication infrastructure still serves as a key success factor for adopting the ETS although Taiwanese government has been investing billions of dollars on the infrastructure since 1995 for promoting the e-government programs.

In addition, the important role of whether accurate information is provided (i.e., AC) confirms the bottom line of any successful and satisfactory information system. Compared with the relatively weak impact of perceived ease of use, whether the ETS is really helpful (i.e., U) or able to provide accurate information (i.e., AC) about the procurement tasks suggests that user-friendly interfaces may have limited power for adopting the ETS. That is, perceived ease of use may be less crucial once the users are satisfied with the interface design. Similar explanations may apply to the even surprising effect of self-efficacy, which may be a hurdle before the ETS users adopt the system. Once the hurdle gets eliminated, such as when the users possess sufficient computing knowledge and skills, it becomes less important. All the preceding results are largely consistent with previous findings in the literature, although their study did not explore the effects of information accuracy.
6.2 Perceived Behavior Control

Overall, our data analyses suggest that the augmented model (Figure 1) serves as an adequate model of ETS usage, accounting for a reasonable proportion of the variance in intention and behavior (Table 2). As shown in Figure 2, ETS usage behavior is positively influenced by the behavioral intention. Moreover, considering both the direct and indirect effects, the ETS usage behavior is most strongly determined by the users’ perceived behavioral control. The reason why PBC has such a significant effect on ETS usage may stem from the implementation status of ETS. While proceeding our investigation, the ETS was newly implemented in certain central government organizations and state-owned enterprises. The respondents had limited opportunities to accomplish their procurement affairs by the ETS. Consequently, the respondents may tend to discount their intentions in the formation of their behavior, relying more upon the availability of the resources necessary to perform the ETS. This finding is consistent with that reported by Taylor and Todd (1995b) in which the users with less experiences for the system to be adopted, PBC has less of an impact on intention, but had a significant influence on behavior.xv

In addition, the traditional paper-work tendering procedure remains functioning, which means the potential ETS users have alternatives even when they are adopting the ETS. This competing behavioral intention between using the original paper-work and the ETS may lead to less willingness to perform the alternative ETS. Such resistance to work-related change may also cause the users to emphasize the control information in the formation of the ETS usage.

6.3 Behavioral Intention and Policies

It is also important to recognize that behavior is also driven by behavioral intention, which on its own explains 31% of the variance in the ETS usage behavior (Table 2). The ETS behavioral intention is strongly determined by attitude toward the system, namely the users’ overall satisfaction and perceived behavioral control, whereas the influence of subjective norm is weaker but still important. These results suggest that providing the users with more allocable resources serve as a good promotion action for the ETS. In addition, improving the information accuracy and functionality of the ETS should be counted as another key success factors.

The influence of social pressures modeled as beliefs affected by supervisors, colleagues, and governments, positively explains subjective norm. This suggests that programs stressing normative influences via personal network and organizational culture as a part of public policy efforts to promote the ETS may be effective. For example, policy-makers might (a) design a campaign to “tell your employees/coworkers to keep up with the e-commerce trend and use the ETS”, and (b) provide training programs to educate top managers, and then encourage them to urge their organizations and employees to adopt the ETS.

7. Concluding Remarks

Overall, the ETS users evaluate positively for the behavioral intention. Attitude, namely, the overall satisfaction of ETS users, and its associated predictors play key roles, especially the perceived usefulness and information accuracy. Also important is the influences from the users’ colleagues and supervisors – the subjective norm for using the ETS. Our results also indicate that the decomposed Theory of Planned Behavior, reflected in our proposed model, provides sufficient understanding of behavioral intention by focusing on the factors that are likely to influence system use through the application of both design and implementation strategies. The preceding results and discussion confirm general applicability for the individual hypotheses and the overall model, and hence explicate the key success factors for promoting the ETS.

The data analyses, meanwhile, imply more worthwhile exploration. Firstly, it is clear that additional investigation is required to better understand the roles of perceived ease of uses and self-efficacy, both of which yield insignificant results.

Secondly, only the main effects are considered in our model. The “buy in” of a new technological application such as the ETS caused by one’s own attitude may be more sustainable. The socially communicated perceptions and beliefs may influence behavioral intention and actual usage of such applications. In the adoption and diffusion of collaborative systems and e-commerce systems, it is important to study how social influence shape attitudes of users.xvi Therefore, an alternative model with “crossover” effects from normative structure to attitude, from control structure to attitude and subjective norm is plausible.xvii
Lastly, although substantial efforts were made to solicit a wide variety of respondents, the study was limited by the purposive sampling procedure and sample size due to the early implementation stage of the ETS as mentioned earlier. Moreover, our sample mainly covered public administrators in central government organizations and state-owned enterprises. Further studies in various public sectors with the sampling issues will be valuable to assess generalizability of our research findings.

References


xi The questionnaire is developed in accordance with the design principles suggested by Ajzen (1991). See note 2.


xiii See note 3.

xiv Ibid.
Ibid.
