The Actual Usage of ERP Systems: An Extended Technology Acceptance Perspective

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Implementing the ERP system is one method of minimizing cost and maximizing profit to increase competitive advantage. However, numerous factors influence ERP implementation success, including user resistance. This study thus attempts to explain behavioural intention and actual usage of ERP implementation based on the technology acceptance model (TAM). The model also incorporates additional behavioural constructs, top management support, computer self-efficacy (CSE) and computer anxiety. The Lisrel package of structural equation modelling is used in this study to verify the causal relationships between variables. Analytical results demonstrate that top management support strongly and positively affects CSE, perceived usefulness and perceived ease of use. However, CSE had an insignificant affect on perceived usefulness, but was found to directly influence perceived ease of use. Meanwhile, perceived usefulness influenced behavioural intention, but does not significantly affect actual usage. Perceived ease of use was found to directly affect behavioural intention. Finally, behavioural intention positively and directly affects actual usage. The implications of these findings for researchers and practitioners are discussed.

Keywords: Computer self-efficacy, computer anxiety, top management support, technology acceptance model, structural equation modelling.

ACM Classification: H.4

1. INTRODUCTION

Minimizing the cost and maximizing the profit is necessary to enhance competitive advantage, and implementing the ERP system is one means to achieve these objectives. An enterprise resource planning (ERP) system is a packaged business software system that provides a totally integrated solution for organizational information-processing needs, and efficiently and effectively manages resources (materials, human resources, finances, etc.) (Shih, 2006). Implementing an enterprise resource planning system generally is expensive and risky, and thus researchers and companies have been trying to find factors that influence the information system success. In fact, as described by Amoako-Gyampah and Salam (2004) numerous factors influence information system success, especially individual acceptance or resistance. In this area, technology acceptance model (TAM; Davis, 1989) is one of the most widely used models for explaining the behavioural intention and actual usage, and can improve our understanding of how influence on actual usage should help increase the probability of successful ERP implementation.

Manuscript received: 21 February 2008
Communicating Editor: Vincent Lee

Two particular beliefs, namely perceived usefulness (PU) and perceived ease of use (PEOU), are crucial in the TAM for predicting information technology user acceptance behaviour. Besides, recent empirical studies have also focused on explaining the influence of external variables on user beliefs regarding ERP systems (e.g., Amoako-Gyampah and Salam, 2004; Shih, 2006; Amoako-Gyampah, 2007). Amoako-Gyampah (2007) examined the influence of perceived usefulness, user involvement, argument for change, prior usage and ease of use ERP system usage intention. According to Amoako-Gyampah, users perception of usefulness, ease of use of the technology, and the users' level of intrinsic involvement all affect their intention to use the technology. Shih (2006) also incorporates computer self-efficacy into TAM to improve the predictive value of the original TAM mode.

Furthermore, computer anxiety is an individual characteristic that impacts user perceptions of perceived ease of use (Venkatesh, 2000; Brown and Town, 2002) and perceived usefulness (Igbaria and Iivari, 1995). Previous studies have considered different external variables, but only adopted the individual perspectives, such as user beliefs. In fact, organizational factors, such as top management support may significantly impact actual usage of ERP implementation (e.g., Somers and Nelson, 2001; Akkermans and van Helden, 2002). Somers and Nelson (2001) identified top management support as the top ranking of the ERP CSFs. Sohal *et al* (2001) showed that insufficient top management support as one of the greatest impediments to IT success. Moreover, top management support may increase with an increasingly hostile industry environment (Kearns, 2006).

Accordingly, this study thus built upon previous research by incorporating the determinant of top management support as the external factor affecting computer self-efficacy, computer anxiety, perceived ease of use, perceived usefulness and actual usage of ERP implementation. The Lisrel package of structural equation modeling was used to assess overall model fit and verify the causal relationships between variables. Furthermore, for purposes of cross validity, this study adopted the suggestion of Cudek and Browne (1983), using cross-validation to assess model fit. The majority of respondents were randomly assigned to a calibration sample of 130, while the remainders were assigned to a validation sample.

The remainder of this paper is organized as follows: Section 2 summarized the previous research on ERP system, the technology acceptance model and computer self-efficacy. Section 3 then proposes the research model and present hypotheses. Subsequently, Section 4 deals with measurement, data collection and research design and Section 5 summarizes the analytical results. Finally, conclusions are presented in Section 6.

2. RELATED WORK

2.1 Prior Research on ERP System

Recently, three review articles comprised all the prior research on ERP. The first is Esteves and Pastor (2001), who briefly summarized each journal and conference article and also provided a complete list of references during 1997–2000. Second, Botta-Genoulaz *et al* (2005) analyzed the literature for the years 2003 and 2004 to classify ERP systems research into six categories: ERP implementation, ERP optimization, ERP management, ERP software, ERP in supply chain management and case studies. Moon (2007) also conducted a review of work published in various journals on Enterprise Resource Planning (ERP) between January 2000 and May 2006. Her research aimed to understand the questions addressed by ERP, and six major themes were ERP implementation, using, extension, value, trends, and educations.

According to the related review of ERP research, ERP system implementation is one of the problems addressed by the literature. System implementation covers the issue of sociological and

cultural factors influencing on implementation success, the implementation steps and so on. In fact, human factors are often critical in the implementation phase. Moon (2007) demonstrated that most relevant articles (approximately 40% of the total) belong to this theme.

For example, Amoako-Gyampah and Salam (2004) evaluated the impact of one belief construct (shared beliefs in the benefits of a technology) and two widely recognized technology implementation success factors (training and communication) on PU and PEOU. The analytical results demonstrated that both training and project communication influence shared user beliefs regarding the benefits of the technology and also that the shared beliefs influence the PU and PEOU of the technology. Lander *et al* (2004) consider trust-building mechanism between team members and other actors of the project as major implementation issues. Moreover, Shih (2006) examines the ERP system user usage behaviour via the extended technology acceptance model with the incorporation of computer self-efficacy.

2.2 Technology Acceptance Model

The Theory of Reasoned Action (TRA) of Fishbein and Ajzen's (1975) and the Technology Acceptance Model (TAM) of Davis's (1989) provide a theoretical means of measuring beliefs and attitudes for predicting future behaviour patterns. The TAM was adapted from the TRA and provided a basis for previous research on IS dealing with IT related behavioural intentions and usage (e.g., Davis *et al*, 1989). Two particular beliefs, perceived usefulness (PU) and perceived ease of use (PEOU), are crucial in the TAM for predicting information technology user acceptance behaviour. Davis (1989) defined PU as "the degree to which individuals believe that using a particular system can enhance their job performance", and defined PEOU as "the degree to which individuals believe that using a particular system will be effortless". TAM postulated that computer usage is determined by behavioural intention to use a system, while system usage intention is jointly determined by individual attitude towards system use and individual perceptions of its usefulness. Among these beliefs, perceived ease of use is hypothesized to be a predictor of perceived usefulness.

2.3 Computer Self-efficacy

Bandura (1977) identified self-efficacy as relating to individual beliefs in their ability to perform a task, and is expected to influence task effort, persistence, expressed interest, and the level of goal difficulty selected for performance (Gist, 1987). Generally, individuals with high efficacy expectations are more likely to succeed in a given task (Oliver and Shapiro, 1993). Wood and Bandura (1989) indicated that high self-efficacy individuals work harder and longer than low self-efficacy individuals. Researchers have frequently found that performance improves with the self-efficacy level (Bandura *et al*, 1982).

Consequently, different types of self-efficacy are emerged from Bandura's research, such as computer self-efficacy (Compeau and Higgins, 1995) and Internet self-efficacy (Torkzadeh and van Dyke, 2001). Computer self-efficacy is defined by Compeau and Higgins (1995) as individual judgments regarding their computer skills. Computer self-efficacy is significant in the use of systems and even in helping individuals more easily acquire many of the skills associated with effective computer use. For example Venkatesh and Davis (2000) modeled and empirically tested the determinants of PEOU and found that individual computer self-efficacy is a strong determinant of PEOU, while objective usability influences ease of use only after direct experience with the system. Furthermore, Venkatesh and Davis (2000) implied that a training mechanism designed to improve user computer self-efficacy is more likely to gain user acceptance.

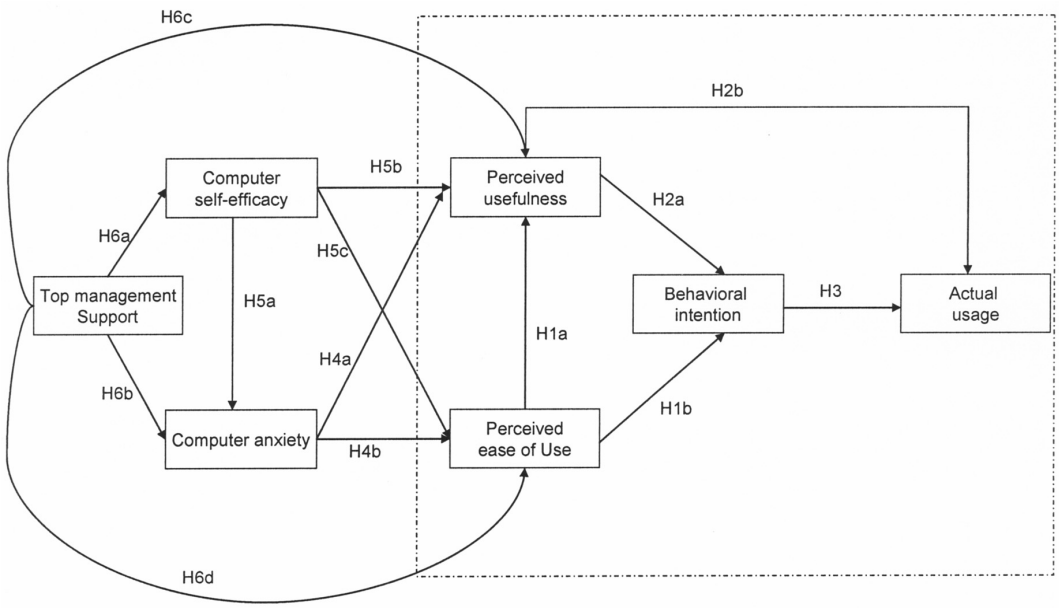

Figure1: The determinants and consequences of the proposed model.

3. PROPOSED MODEL —RESEARCH MODEL AND HYPOTHESIZES

Figure 1 shows the constructs and hypothesized links in the proposed model. This section presents theoretical arguments supporting the proposed paths, and subsequently present data from structural equation modeling to support these relationships. The area within the dotted line denotes the original TAM.

3.1 The Casual and Effect of TAM model

According to Davis (1989) and Davis *et al* (1992), perceived ease of use influences perceived usefulness, and perceived usefulness and perceived ease of use will influence behavioural intention and actual usage; finally, behavioural intention is also positively related to actual usage. Therefore, the following hypotheses were proposed.

H1a: Perceived ease of use positively and directly affects perceived usefulness.
H1b: Perceived ease of use positively and directly affects behavioural intention.
H2a: Perceived usefulness positively and directly affects behavioural intention.
H2b: Perceived usefulness positively and directly affects actual usage.
H3: Behavioural intention related to actual usage.

3.2 Computer Anxiety

Rosen and Weil (1992) defined computer anxiety as "anxiety about present or future interactions with computers … negative global attitudes about computers, their operation or societal impact … self-critical internal dialogues during actual computer interaction or when contemplating future computer interaction".

Venkatesh (2000) posits that computer anxiety is an individual characteristic that impacts user perceptions of perceived ease of use, especially during the early adoption period; Brown and Town (2002) found that computer anxiety significantly influenced perceived ease of use. Furthermore, Igbaria and Iivari (1995) found that computer anxiety negatively impacts constructs in a similar manner to perceived usefulness. In fact, individuals with lower anxiety are much more likely to interact with computers than people with higher anxiety. Therefore, hypothesis H4a and H4b are proposed.

H4a: Anxiety directly and negatively affects perceived usefulness.
H4b: Anxiety directly and negatively affects perceived ease of use.

3.3 Computer Self-efficacy

According to Wexler (2001), computer anxiety reflects general user concerns about whether they have the ability to succeed with a new system. Various studies have shown that computer anxiety influences, such as Torkzadeh *et al* (2006). Torkzadeh *et al* (2006) demonstrated that respondents with 'low' computer anxiety improved their self-efficacy significantly more than those with 'high' computer anxiety. However, Igbaria and Iivari (1995) indicated that anxiety may be considered as antecedent to low self-efficacy, and state anxiety is probably caused by low self-efficacy. Shih (2006) also showed that computer self-efficacy actually effects the perceived usefulness and perceived ease of use. Therefore, hypotheses H5a H5b and H5c are proposed.

H5a: Self-efficacy is negatively related to anxiety.
H5b: Self-efficacy is positively related to perceived usefulness.
H5c: Self-efficacy is positively related to perceived ease of use.

3.4 Top Management Support

As mentioned previously, ERP implementation has been the subject of a number of studies, some focused on identifying CSF (e.g., Somers and Nelson, 2001; Akkermans and van Helden, 2002). Somers and Nelson (2001) identified top management support as the top ranking of the ERP CSFs. Sohal *et al* (2001) showed that insufficient top management support as one of the greatest impediments to IT success. Moreover, top management support may increase with an increasingly hostile industry environment (Kearns, 2006). Wang and Chen (2006) showed that top management support indirectly enhances ERP system quality via communication effectiveness.

Recent research (e.g., Igbaria and Iivari, 1995) has identified different antecedents of computer self-efficacy (e.g., tool experience, training, and etc.) Igbaria and Iivari (1995) indicated that since individuals need more resources to increase their proficiency. Increased organizational support is expected to result in higher assessments of individual self-efficacy. In this study, the ERP system is also an important enterprise information system and thus this study assumes that top management support is a critical determinant of computer self-efficacy.

Furthermore, Igbaria (1993) and Igbaria and Iivari (1995) found that top management support was negatively related to computer anxiety. According to Davis *et al* (1989), management support affected perceived usefulness and perceived ease of use. Based on the above discussions, hypothesis H6a, H6b, H6c and H6d were proposed to test.

H6a: Top management support positively and directly affects computer self-efficacy.
H6b: Top management support negatively and directly affects computer anxiety.
H6c: Top management support positively and directly affects perceived usefulness.
H6d: Top management support positively and directly affects perceived ease of use.

4. RESEARCH DESIGN

4.1 Measurement

Technology Acceptance Model (TAM)

The published items related to attitude to use, perceived ease of use, and perceived usefulness (Davis, 1989) were used directly and with only minor changes to reflect the application of the system in the world. Furthermore, revised items were adopted from Shih (2006). This study separately assesses two measures of actual system use: the first is usage volume and refers to the number of hours per week a respondent reports using the ERP system, while the second, usage frequency, indicates reported weekly usage.

Computer Self-efficacy

A ten-item measure of computer self-efficacy was adopted from Compeau and Higgins (1995) for measuring individual perceptions of their ability to use a computer to accomplish an ERP task. Individual were asked to indicate the extent of agreement or disagreement with the following statements concerning the ERP system on a 5-point scale ranging from (1) strongly disagree to (5) strongly agree, including: "I would complete the job using the ERP system, if there was no one around to provide instructions."; "I would complete the job using the ERP system, even if I had never previously used a similar package."; and so on. A higher score indicated the higher individual confidence in using a computer.

Top Management Support

Top management support was assessed via six items asking respondents to indicate the degree of top management encouragement and resources allocation. The measure of top management support was developed by Igbaria (1990). The measure comprised six statements on a 5-point scale ranging from (1) strongly disagree to (5) strongly agree are used, including "I feel that top management support is agreeable to implement the ERP system.", "I feel that top management support is agreeable to fit the change in the ERP system"; and so on. Higher score indicated greater top management support.

Computer Anxiety

The measures of computer anxiety were developed by Brown and Town (2002). Four-item scales were used to measure computer anxiety with the statements to which subjects responded being as follows: "Working with a computer makes me nervous."; "Computers make me feel uncomfortable."; "Computers make me feel uneasy."; and "Computers scare me.". The response options were anchored on a 5-point Likert-type scale, ranging from (1) strongly disagree to (5) strongly agree. Lower score indicated lower level of computer anxiety.

4.2 Data Collection

The study samples are either implemented or the ERP system is used. Respondents were phoned in advance with interview requests, after which an interview, and then an interview format was used to record their responses. A total of 165 useable responses were obtained, with no missing date. 65% of the respondents belonged to the manufacturing industry, the remainder were information and service industry. Moreover, all respondents had experience of using ERP software, with 99% claiming at least 12 months of such experience. Furthermore, Table 1 listed the descriptive statistics for all the measured items described in Section 4.1.

Construct (code)	Items	Mean	S.D.
Self-efficacy			
Self1	No one told me how to use it before	2.68	0.99
Self2	Even if I never used before	2.82	1.11
Self3	Even if I only had manuscript	3.14	0.79
Self4	If I saw someone use it before	3.28	0.87
Self5	If someone gave me help	3.99	0.67
Self6	If someone helped me before I used it	4.01	0.68
Self7	If I had enough time to finish work	3.61	0.92
Self8	If there was online help	3.44	0.84
Self9	If someone showed me before	3.71	0.83
Self10	If I ever used it before	3.54	0.94
Top mgt. Support			
Sup1	I felt that they supported the system	3.90	0.86
Sup2	I felt that they were having highly intention to change	3.65	0.75
Sup3	The company will promote the system before implementation	3.74	0.88
Sup4	The company will communicate with users by seminar	3.53	0.91
Sup5	The company will provide training courses	3.17	0.99
Sup6	The company will revise the interface for me	3.21	1.01
Anxiety			
Anxiety1	Working with a computer makes me nervous	1.67	0.83
Anxiety2	Computers make me feel uneasy	1.57	0.91
Anxiety3	Computers make me feel uncomfortable	1.59	0.80
Anxiety4	Computers scare me	1.51	0.85
Perceive Usefulness			
PU1	ERP system would enable me to accomplish tasks	3.61	0.69
PU2	ERP system would improve my job performance	3.59	0.81
PU3	ERP system would increase my productivity	3.53	0.78
PU4	ERP system would enhance my effectiveness	3.61	0.81
PU5	ERP system would make it easier to do my job	3.66	0.84
PU6	ERP system is useful in my job	3.80	0.66
Ease of use			
PEOU1	Learning the ERP system is easy for me	3.52	0.85
PEOU2	Easy to get ERP system to do what I want to do	3.17	0.83
PEOU3	The ERP function is clear and understandable	3.16	0.87
PEOU4	ERP system is flexible to interact with	3.04	0.94
PEOU5	Easy to become skillful at using ERP system	3.32	0.90
PEOU6	ERP system is easy to use	3.28	0.95
Intention			
Int1	Intent to use it	3.87	0.79
Int2	Intent to recommend other companies	3.84	0.84
Usage			
Usage1	Usage amount	2.73	1.39
Usage2	Usage frequency	3.13	1.62

Table 1: Descriptive statistics each construct and item

5. ANALYSIS RESULTS

5.1 Measurement Model

The procedure was used to test the fitness of the measurement model and the hypotheses proposed in Section 3 was tested using the Lisrel package (Joreskog and Sorbom, 1993). A matrix of correlation between the variables was input to Lisrel using the maximum likelihood estimate. As suggested by Bagozzi and Heatherton (1994), each scale was divided to provide two indicators of each latent variable. In the analysis, equation errors for the determinants of intention were specified as free parameters, and co-variance of the independent constructs was permitted.

The test of construct validity is important for stabilizing the measure dimensionality during measure development (DeVellis, 1991). The fit of the indicator to the construct and construct reliability and validity was tested for the measurement model. First, composite reliability was calculated for each construct (listed in Table 2), which ranged from 0.71 to 0.96, and exceed the cutoff value of 0.7 in all cases (Nunnaly, 1967). Scale discriminant and convergent validity was then examined. Convergent validity is reflected in the magnitude of the trait loading (Byrne, 1998) all estimated standard loadings were significant at the $P \leq 0.01$ level, suggesting good convergent validity. To assess the discriminant validity, the extent to which different constructs diverge from one another, the criteria of Fornell and Larcker's (1981) were used, as follows: average variance extracted (AVE) for each construct should be greater than the squared correlation between constructs. The correlation matrix of the study's construct on the left-hand side of Table 2 showed that the measurement model met this condition.

5.2 Structural Model

The total coefficient of determination (TCD) R^2 for structural equations is presented here for clarity. Furthermore, t-statistics for examining the correlation between the latent constructs and correlation among latent constructs were used for path link testing. The T-statistics exceeded the critical value (1.96) for the 0.05 significance level and the 0.01 significance level (critical value = 2.576) (Reisinger and Turner, 1999).

Subsequently, five recommended fit indices, suggested by Hair *et al* (1995) and Steiger (1990), were employed to measure the overall model fit, and are summarized as follows: (1) Normed Chi-square (Chi-square/df), where the recommended level was between 1.0 and 2.0, was the most appropriate parsimonious fit measure of model fit; (2) Goodness-of-fit index (GFI), which is an indicator of the relative amount of variances and covariance jointly accounted by the model (a

	1	2	3	4	5	6	7
Top management support	0.66						
Computer self-efficacy	0.55	0.62					
Anxiety	-0.01	0.04	0.91				
Perceived usefulness	0.69	0.59	0.06	0.86			
Perceived ease of use	0.75	0.87	0.02	0.69	0.78		
Attitude	0.49	0.49	0.03	0.60	0.57	0.91	
Actual usage	0.31	0.29	0.02	0.41	0.34	0.47	0.74
Composite reliability	0.82	0.86	0.96	0.94	0.90	0.90	0.71

Table 2: Composite reliability, Inter-correlations and square root of the AVE of each construct

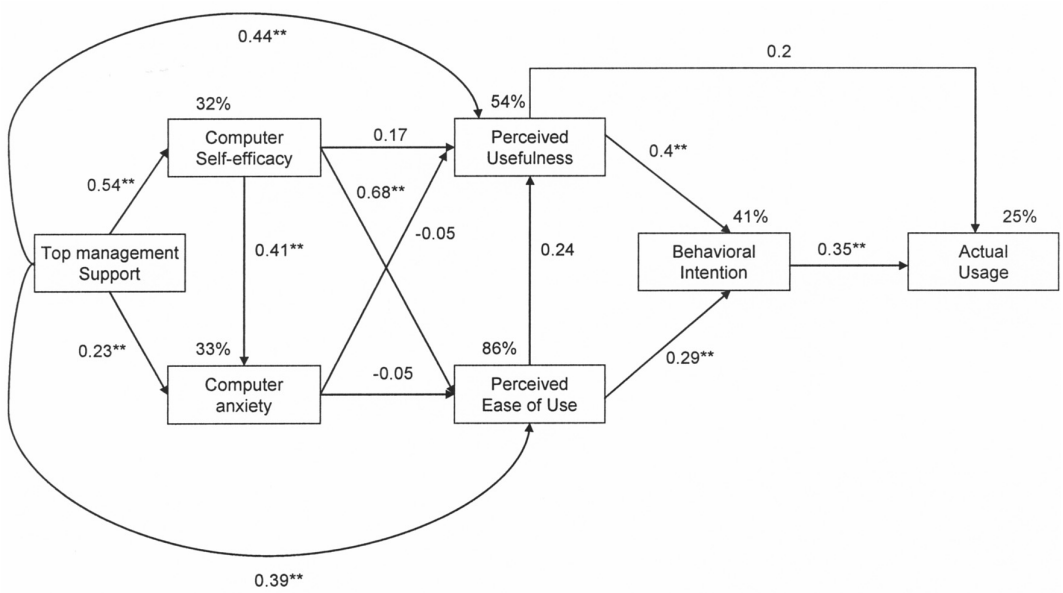

Figure 2: Path coefficients for each hypothesis for the extended model (: Level of significance = 0.01)**

marginal acceptance level is 0.9); (3) Root-mean-square error of approximation (RMSEA), for which the marginal acceptance level is 0.08; (4) Relative fit index (RFI) with marginal acceptance level of 0.9; and (5) Adjusted goodness-of-fit index (AGF), which takes values between 0 and 1: with a value closer to unity indicating better model fit. Finally, the direct, indirect and total effects of the variable on the endogenous variable are also discussed. In this case, the path coefficient corresponding to the arrow of Figure 1 represents the direct effects between the involved variables. Meanwhile, an indirect effect represents the effects through the intervening variables. Finally, the total effect indicates the sum of the direct and indirect effect.

5.3 Analytical Results of the Proposed Model

The fit statistics indicate that the TRA model provides a good fit to the data (χ^2_{560}= 745.35, p < 0.001; Norm Chi-square=1.33; CFI=0.92; NNFI=0.90; RMSEA = 0.051). In terms of predictive power, the variance in all four dependent variables (R^2_{BI}, R^2_{Usage}, R^2_{PU}, R^2_{PEOU}, R^2_{SE} and $R^2_{Anxiety}$) of the proposed model equals 0.41, 0.25, 0.54, 0.86, 0.32 and 0.33, respectively. The path coefficients are shown in Figure 2, which are as hypothesized in each case (p < 0.05 in all instances).

According to Table 3, the analytical result is consistent with Hypothesis 1b, perceived ease of use had a strong direct effect on behavioural intention. Furthermore, in accordance with Hypothesis 2a, perceived usefulness significantly and directly affected behavioural intention (β=0.4, p≤0.001). Hypothesis 2b that the relation between perceived usefulness and actual usage was not supported. Finally, consistent with H3, behavioural intention directly affected actual usage (β=0.35, p0.001). Table 3 also demonstrates that 41% of the variance of behavioural intention was explained by all antecedent variables and 25% of the variance of actual usage was explained by the model.

Computer anxiety, consistent with Hypotheses 4a and 4b did not significantly impact perceived usefulness and perceived ease of use (shown in Table 4). Computer self-efficacy is inconsistent with

	Behavioural intention (BI)			Actual usage		
Variables	Direct	Indirect	Total	Direct	Indirect	Total
Top Mgt. S.	–	0.49*	0.49	–	0.31*	0.31
C.S.E	–	0.32*	0.32	–	0.17*	0.17
Computer anxiety	–	0.02	0.02	–	0.02	0.02
PU	0.40*	–	0.40	0.20	0.14	0.34
PEOU	0.29*	0.10	0.39	–	0.19	0.19
BI				0.35*	–	0.35
R^2	41%			25%		

Table 3: Prediction of behavioural intention and actual usage

	Perceived usefulness (PU)			Perceived ease of use (PEOU)		
Variables	Direct	Indirect	Total	Direct	Indirect	Total
Top Mgt. S.	0.44*	0.25*	0.69	0.39*	0.35*	0.74
C.S.E	0.17	0.14	0.31	0.68*	-0.02	0.66
Computer anxiety	-0.04	-0.01	-0.05	-0.05	–	-0.05
PEOU	0.24	–	0.24			
R^2	54%			86%		

Table 4: Prediction of perceived usefulness and perceived ease of use

Hypothesis 5b strongly and directly affected perceived usefulness (β=0.17, p≤0.001). Top management support as hypothesized by Hypothesis 6c and 6d, strongly directly and indirectly affected perceived usefulness and perceived ease of use, respectively. Furthermore, consistent with Hypothesis 5c, computer self-efficacy had a strong direct effect on perceived ease of use. Inconsistent with Hypothesis 1a, perceived ease of use did not influence perceived usefulness.

The data in Table 5 demonstrates that top management support explained 32% of the variance and significantly and directly affected computer self-efficacy (Hypothesis 6a; γ=0.55, p≤0.001). This is inconsistent with Hypothesis 6b, that top management support did significantly but not negatively influence computer anxiety. In accordance with Hypothesis 5a, self-efficacy was found to significantly but not negatively affect computer anxiety.

5.4 Cross-validation in Covariance Structure Modeling

The Cross-Validation Index (CVI) proposed by Cudeck and Browne (1983) was used to test the proposed model. The computation of CVI measures the distance between the restricted and unrestricted variance-covariance matrix for the calibration sample. Based on these measurements,

	Computer	Computer anxiety		
Variables	self-efficacy (C.S.E)	Direct	Indirect	Total
Top Mgt. S.	0.54*	0.23*	0.23*	0.46
C.S.E		0.41*	–	0.41
R^2	32%	33%		

Table 5: Prediction of self-efficacy and computer anxiety

smallness of the CVI value provided a better estimate of the model predictive validity. According the analytical results, the Cross-Validation Index (CVI) = 44.35, and the 90 Percent Confidence Interval for CVI = (40.33; 48.59). The analytical results represented that the CVI value fell in the 90% interval of confidence, and thus the model can accurately locate specific parameter estimates.

6. CONCLUSION AND DISCUSSIONS

Improving understanding of how influence on actual usage can help increase the probability of successful ERP implementation, and this work extended previous research by incorporating the determinant of top management support as the external factor influencing computer self-efficacy, computer anxiety, perceived ease of use, perceived usefulness and actual usage of ERP implementation. Furthermore, this study also employed structural equation modeling to assess overall model fit to verify the causal relationships between variables. Finally, for cross validation, this study adopted the suggestion of Cudek and Browne's (1983) suggestion , using cross-validation to assess the model fit. Most respondents were randomly assigned to a calibration sample of 130, while the remainder were assigned to a validation sample.

Based on the analytical results, summarized in Table 6, this study found that top management support plays an important role in ERP implementation. Top management support strongly, directly and positively affects computer self-efficacy, perceived usefulness and perceived ease of use. Meanwhile, computer self-efficacy partially directly affects perceived usefulness and perceived ease of use. Regarding the TAM model, similar results to those of Shih (2006) were obtained, for example that perceived usefulness strongly and directly affected behavioural intention, but only insignificant and directly affected actual usage. Perceived ease of use directly affected behavioural intention. Finally, behavioural intention positively and directly affected actual usage.

In this case, computer self-efficacy was found to significantly but not negatively affect computer anxiety. However, as Igbaria and Iivari (1995) stated that computer anxiety is probably caused by low self-efficacy. Furthermore, computer anxiety is not significantly negatively related to perceived usefulness and perceived ease of use, inconsistent with the research of Brown and Town (2002) and Venkatesh (2000).

H1a	Perceived ease of use will have a positive direct effect on perceived usefulness.	NS
H1b	Perceived ease of use will have a positive direct effect on intention.	S
H2a	Perceived usefulness will have a positive direct effect on intention.	S
H2b	Perceived usefulness will have a positive direct effect on actual usage.	NS
H3	Intention will have positively related to actual usage.	S
H4a	Computer anxiety will have a negative direct effect on perceived usefulness.	NS
H4b	Computer anxiety will have a negative direct effect on perceived ease of use.	NS
H5a	Self-efficacy will be negatively related to computer anxiety.	PS
H5b	Self-efficacy will be positively related to perceived usefulness.	NS
H5c	Self-efficacy will be positively related to perceived ease of use.	S
H6a	Top management support will have a positive direct effect on self-efficacy.	S
H6b	Top management support will have a negative direct effect on computer anxiety.	PS
H6c	Top management support will have a positive direct effect on perceived usefulness.	S
H6d	Top management support will have a positive direct effect on perceived ease of use.	S

S: supported; PS: partial supported; NS: not supported.

Table 6: Summary of the results

To demonstrate why that computer anxiety was not significant related to perceived usefulness or perceived ease of use, 25 ERP users were interviewed in this study. According to interview results, 22 of 25 interviewees indicated that regulated training education had previously been conducted. Most users have computer usage experience and basic computer operating ability. Similar to Safford and Worthington (1999) and Chua *et al* (1999), this study also identifies training education and computer experience as critical factors for reducing computer anxiety. Besides, from the descriptive statistics of computer anxiety (listed in Table 1), this study found that an average of the four-items of computer anxiety were below 2, indicating lack of user agreement that they were anxious when working with computers. Finally, those may explain why these hypothesizes were not supported in this study.

The implications for researchers and practitioners, an extended version of TAM was proposed to improve the explanatory power of ERP implementation. For example, compared to the research of Shih (2006), the r-square of perceived usefulness and perceived ease of use were improved to the levels of 0.54 and 0.86, respectively, representing that top management support has highly contribution to the model. Similar to previous studies (e.g., Somers and Nelson, 2001), top management support was critical to ERP success.

However, like all research, this study has its limitations. One such limitation is that this study did not explore two way interactions involving certain constructs. Furthermore, this study built upon previous research (e.g., Igbaria and Iivari, 1995; enkatesh, 2000; Brown and Town, 2002; Igbaria and Iivari, 1995; Wang and Chen, 2006) by incorporating the determinant of top management support as the external factor affecting computer self-efficacy, computer anxiety, perceived ease of use, perceived usefulness and actual usage of ERP implementation. However, other significant factors need to be included to better understand the influences on perceived usefulness and perceived ease of use, such as personal features (e.g., innovativeness, and past adoption behaviour), system features (e.g., design and functionality), and organizational features (e.g., training) may be selected to predict technology acceptance. Consequently, further research is needed to explore more external variables to enhance the explanation of the actual usage.

ACKNOWLEDGEMENT

This research was supported in part by the National Science Council of the Republic of China under the grant NSC-96-2416-H-216-003.

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