An Empirical Study on Information Technology Acceptance for e-Commerce Back-office Systems in Developing Countries

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***Abstract*—**Gains promised by the introduction of e-commerce back-office systems are not easily realized due to poor technology acceptance, especially in developing countries. This study aims to analyze factors which affect information technology acceptance in developing countries. A research model based on TAM is proposed, and it is empirically tested for the hypotheses of factors which affect the acceptance behavior. The result shows that antecedents such as user training influence the technology acceptance in different ways. This study may help accelerate the adoption of back-office systems in developing countries.

Index Terms—Technology Acceptance, Structural Equation Modeling, e-Commerce Systems

I. INTRODUCTION

The introduction of information technology into organizations has delivered gains such as enhanced productivity and cooperative communication. However, several barriers still exist to this efficiency, one of which is the fact that new technology is not easily accepted by users. Motivating people to use innovation is an important issue. Therefore, investigating the situation of technology acceptance and identifying the factors which affects the adoption process are the researchers' main concerns.

Researchers devoted their time and efforts in conducting extensive studies that focus on explaining the acceptance of information technology. Along with front-office systems such as online shopping, back-office systems have been the target of information technology acceptance studies. Those works target systems like sales management systems, human resource management systems and ERP [1, 2, 3]. However, most of the studies have been done for developed and industrialized countries where IT acceptance is thought to be good. Little study has been conducted for technology acceptance in developing countries.

In this research, an empirical study for information technology acceptance in a less developed environment is performed. First, a research model based on technology acceptance model (TAM) is proposed. TAM is a popular paradigm for empirical studies in technology adoption of IT areas [4]. Then, the model is empirically tested using data collected from sales management system users of a developing country. The goal of this study is to identify and evaluate factors which affect the technology acceptance in less-developed IT environment such as developing countries.

II. REVIEW ON PREVIOUS RESEARCH

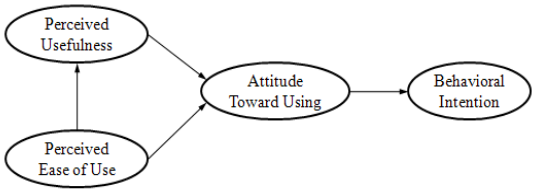

Fig.1 Parsimonious TAM Model

Among the possible influencing factors on technology use, Davis identified fundamental variables suggested by previous research dealing with the cognitive and affective determinants of computer acceptance, and he formulated TAM as a background for technical acceptance research [4]. He suggests that two determinants are of particular importance: perceived usefulness (PU) and perceived ease of use (PEOU). Fig.1 shows a parsimonious form of TAM. PU is the tendency of people to use or not use a

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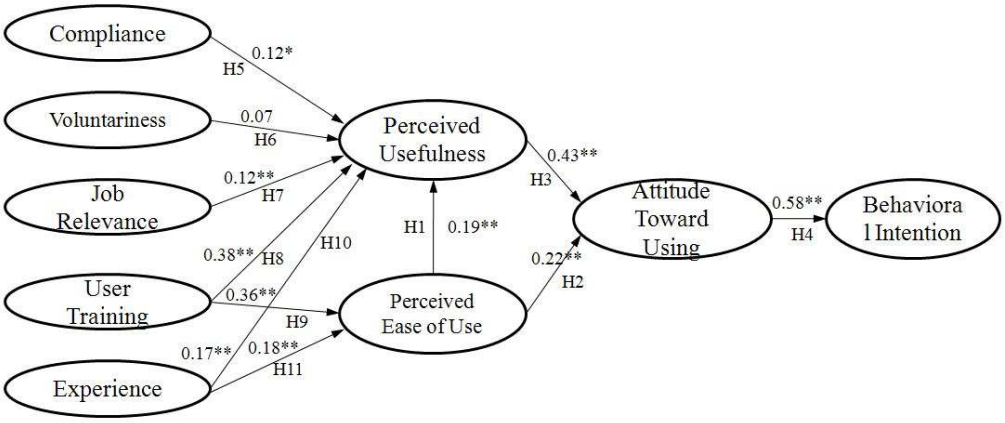

Fig. 2 Proposed Research Model

technology to the extent they believe it will help them perform their job better. PEOU is how difficult the technology is perceived to use. Over the years, strong empirical support has accumulated in favor of TAM. Perhaps the best contributions in predicting and explaining user acceptance of computer technology in organizational contexts have been made by TAM [5].

Various TAM-based research works for back-office systems have been well documented in [6]. The factors which affect technology acceptance include attitude, commitment and involvement of management, sophistication of technology, ability to measure the benefits, and integration of these systems into business strategy. And much of the research reveals that organizational obstacles are more important than technical barriers in technology acceptance for e-commerce back-office systems. Organizational obstacles are related to structural issues such as poor relations between functional departments and information technology strategy.

III. RESEARCH METHOD

A. Research Model

Fig. 2 depicts the research model proposed in this research. The proposed model consists of constructs and associated hypotheses (Table 1). It is based on the TAM theory, and the TAM part contains the hypotheses H1 through H4.

An individual adopts the induced behavior not because he believes in its substance but because he expects to gain rewards or avoid penalty or punishment. This concept is called compliance. The compliance belief is important in technology acceptance because users are explicitly or implicitly requested to perform duties. The direct compliance effect will take effect whenever an individual perceives that a superior agent wants him or her to perform a specific behavior and the agent has the ability to reward or punish [7]. This leads to the hypothesis H5 that compliance positively affects a user's perceived usefulness.

Table 1 Hypotheses to be Tested

No.	Hypothesis	Remarks
H1	PEOU ⟶ PU	
H2	PEOU ⟶ Attitude towards Using	
H3	PU ⟶ Attitude towards Using	
H4	Attitude ⟶ Behavioral Intention	
H5	Compliance ⟶ PU	
H6	Voluntariness ⟶ PU	
H7	Job Relevance ⟶ PU	
H8	User Training ⟶ PU	
H9	User Training ⟶ PEOU	
H10	Experience ⟶ PEOU	
H11	Experience ⟶ PEOU	

Another factor that can be related to user's acceptance is voluntariness. It is the degree to which an individual perceives that he or she has a choice to use or not to use the technology. It is argued that, in practice, users may perceive different degrees of voluntariness [8]. Hence, this study hypothesizes H6. Job relevance is a cognitive judgment that exerts a direct effect on perceived usefulness [5]. It increases the likelihood of accomplishing goals of successful acceptance. In other words, job relevance is a function of importance of an employee's job that is related to the set of tasks the system is capable of supporting, which leads to the hypothesis H7.

User training is also an important antecedent. Training users is a major prerequisite for usage. It will reduce ambiguity and help develop knowledge for future effective usage. It is said that training should

mirror the usefulness of the technology and provide users with the necessary procedural knowledge to operate the focal system, enhancing its perceived ease of use [9]. In addition, user training will also include corporate goals and increase employee's motivation to adopt the technology [10]. Therefore, the hypotheses H8 and H9 are included in the proposed model. Finally, experience affects the acceptance behavior.

Since a back-office system is basically a computer program, previous computer usage experience is likely to stimulate the use of computer-based information system. Atkin and LaRose found that users' acceptance of technology is highly associated with their use of other functionally similar technologies [11]. A user's prior computer experience is anticipated to serve as the basis for judgment about the level of acceptance in using a new system. Hence, the hypotheses H10 and H11 are proposed.

B. Measures and Sample Data

To measure the constructs of a model, questionnaire items are surveyed. Properly designed questionnaire can ensure the validity of a measurement model. For that purpose, many of the measures of this work have been adopted from previous works (Table 3). 9 constructs were measured with 33 measures using 5-point Likert-type scale questionnaire. Before the survey sheets were distributed, they had been reviewed by experts to verify the validity. They confirmed that the questionnaire items are clear and understandable to respondents. Then a pre-test was carried out with 30 managers to check the validity and reliability.

As the population to be surveyed, a group of employee's from a merchandising firm in Luzon, Philippines has been selected. They use a sales-related back-office system for their job. Out of 270 survey sheets distributed to them, 229 have been collected, representing 88% return. The mean age of respondents is 30 ranging from 21 to 55 years old. The majority of the respondents are female with a total of 133 (72%) compared to 96 male (28%). And most of them are less than 6 months old in the firm, which means that the portion of experienced users is relatively low.

IV. ANALYSIS AND DISCUSSION

Structural equation modeling (SEM) takes a confirmatory, rather than exploratory, approach for the data analysis. Whereas traditional multivariate procedures are incapable of either assessing or correcting for measurement error, SEM can provide estimates of these parameters. Also, the former methods are based on observed measurements only, while SEM can incorporate both unobserved and observed variables. In this study, for SEM analysis, a two-step approach is taken, where the measurement model is first examined, testing the reliability and validity of the questionnaire, and then the structural model is analyzed to test the model's hypotheses.

A. Measurement Model

Reliability is the extent to which the respondents answer the same question in the same way each time [12]. Internal consistency reliability, measured with Cronbach's alpha, is the most widely used scale, and thus adopted in this study. A value of 0.70 or higher indicates sufficient reliability. Table 2 shows the results obtained using SPSS. All Cronbach's alpha values of the constructs are above 0.7, with 0.973 the largest one achieved for the experience variable. Also, the deleted cronbach's alpha values for each construct, which should not fluctuate, are all satisfactory. Therefore it can be said that the questionnaire used has good reliability.

Table 2 Cronbach's α and deleted α's

Construct	Cronbach's α	Deleted α 's
Compliance	0.914	0.865 ~ 0.902
Voluntariness	0.943	0.888 ~ 0.935
Job Relevance	0.965	0.946 ~ 0.961
User Training	0.855	0.783 ~ 0.800
Experience	0.973	0.959 ~ 0.972
PU	0.969	0.953 ~ 0.964
PEOU	0.972	0.955 ~ 0.973
Attitude	0.903	0.838 ~ 0.913
Behavioral Intention	0.839	0.770 ~ 0.786

The validity of the measurement model is evaluated using the principal component analysis (PCA). PCA is a method that reduces data dimensionality through covariance analysis between factors. As such, it is suitable for data sets in multiple dimensions, such as a large experiment in gene expression. In the context of SEM, it can be used to check a model's validity. The factor loading values with varimax rotation are presented in Table 3, which show the loadings of items on related factors and cross-loadings of items on other factors. All items have high loadings on their related factors and have low loadings on the unrelated factors, demonstrating that the measures have good convergent and discriminant validity [13].

Table 3 Measurement Factor Loading

Construct	Meas. Var.	Factor Loading Values	Ref.
Compliance	COMP3	0.865	[14]
	COMP1	0.825	
	COMP2	0.820	
	COMP4	0.763	
Voluntariness	VOL3	0.844	[5]
	VOL2	0.837	
	VOL1	0.834	
Job Relevance	JREL3	0.895	[5]
	JREL4	0.873	
	JREL2	0.857	
	JREL1	0.853	
User Training	UTR1	0.654	[10]
	UTR2	0.637	
	UTR3	0.573	
Experience	EXP1	0.923	[6]
	EXP4	0.918	
	EXP2	0.898	
	EXP3	0.882	
PU	PU4	0.797	[5]
	PU1	0.790	
	PU3	0.782	
	PU2	0.706	
PEOU	PEOU3	0.922	[5]
	PEOU2	0.907	
	PEOU4	0.886	
	PEOU1	0.871	
Attitude	ATU1	0.856	[3]
	ATU4	0.851	
	ATU2	0.654	
	ATU3	0.637	
Behavioral Intention	BI2	0.819	[3]
	BI1	0.800	
	BI3	0.784	

B. Structural Equation Model

The structural equation model shows the causal relationship between constructs or latent variables. In this study, LISREL software package has been used with maximum likelihood estimation. LISREL can estimate the measurement model and the structural model at the same time. The result reveals that ten out of eleven hypotheses of the proposed model are significant with the data (Fig.2). The detailed standardized path coefficients and associated significance level (Wald statistic) are presented in Table 4. The factor user training most strongly affects both PU and PEOU, thus becoming the primary determinant of the intention to use. R^2 of PU, PEOU, attitude and intention are estimated to be 0.66, 0.23, 0.33 and 0.34, respectively. R^2 is the percentage of variance explained by the estimated model, and is recommended to be more than 0.2 [15]. The result is satisfactory.

Table 4 Goodness-of-Fit Indices

Hypothesis		Path. Coeff.	Wald Statistic
H1	PEOU→PU	0.19	3.82**
H5	Compliancet→PU	0.12	2.01*
H6	Voluntariness→PU	0.07	1.11
H7	Job Relevance→PU	0.12	2.10*
H8	User Training→PU	0.38	4.09**
H10	Experience→PU	0.17	3.25**
H2	PEOU→ATU	0.22	3.22**
H3	PU→ATU	0.43	6.34**
H4	ATU→BI	0.58	8.12**
H9	User Training→PEOU	0.36	4.67**
H11	Experience→PEOU	0.18	2.46**

In covariance analysis like SEM, hypothesized models reflect approximation to reality. To judge whether the fit is adequate, a large number of goodness-of-fit indices have been proposed [16]. Those adopted in this study are presented in Table 5. One of the most popular index, the chi-square statistic, often referred to as either badness of fit or a lack of fit measure, has a limitation in that it overestimates chi-square values for larger sample, and thus the ratio of chi-square to degrees of freedom (χ^2/df) or the normed chi-square is utilized in this paper. The ratio of chi-square to degree of freedom (χ^2/df) is 2.56, which falls within the acceptable range. To evaluate the fit of the model further, indices such as the normed fit index (NFI) and the standardized root mean square residual (SRMR) were assessed in addition to the chi-square test. The result shows that the proposed model has a good fit with the sample data.

Table 5 Goodness-of-Fit Indices

Index	Value	Criterion	Remarks
χ^2/df	2.56	5.0 ~ 2.0	Acceptable
RMSEA	0.083	0.0 ~ 0.10	Acceptable
GFI	0.76	0.0 ~ 1.0	Acceptable
AGFI	0.71	0.0 ~ 1.0	Acceptable
NFI	0.95	≥ 0.95	Satisfactory
NNFI	0.97	≥ 0.95	Satisfactory
CFI	0.97	≥ 0.95	Satisfactory
RMR	0.087	0.0 ~ 1.0	Acceptable
SRMR	0.082	0.0 ~ 1.0	Acceptable

C. Discussion

The findings of this work reinforce the role of PU and PEOU as the fundamental determinants of user behavior of information technology acceptance. This is in agreement with other TAM-based studies. Also, the effect of compliance to PU is significant. This supports the general belief that, if it is mandated by the organization, users will certainly use the system.

Initially, the usefulness of the system may be dictated by the organization, but eventually users will realize its tangible benefits. This is thought to be a common attitude of employees in developing countries, and thus explains the reason why the strength of influence is not so strong.

Another significant antecedent is job relevance. It affects PU moderately. Commonly, users will question the usefulness of a system to their jobs before making use of it. A similar attitude is found in developing countries, where users tend to realize it as time goes. Experience is also significant to both PU and PEOU. Implementation of back-office systems may still be on its beginning stage in developing countries, but being familiar with the basic know-how of computer related applications will speed up the technology acceptance process.

User training is found to have the strongest influence on PU and PEOU, which complies with the results of previous work. It has been found that training increases employee's motivation to adopt technology [10]. It is especially so in developing countries because an average user's ability to appreciate the usefulness is relatively low, which means that training can be more effective. The only antecedent that resulted insignificant in this study is voluntariness. Users in developing countries may not be so accustomed to work morality or motivation like users of developed countries, due to reasons such as low wage. Therefore they may reluctantly use the system whether he or she thinks the system is useful for the tasks or not, which leads to the statistical insignificance.

V. CONCLUSION

Most of the works on technology acceptance for back-office systems have been done for developed countries where IT acceptance is thought to be good. Little has been conducted for developing countries. This study aims to analyze factors which affect information technology acceptance in developing countries. In this study, a research model based on TAM has been proposed, and empirically tested for the hypotheses of factors which affect the acceptance behavior. The result shows that most of the hypothesized antecedent factors such as user training, experience and compliance influence the technology acceptance. The only insignificant result is the influence of voluntariness to PU. The way in which antecedents affect PU and PEOU are somewhat different from that of the research works conducted for developed countries, which this study aimed to clarify.

This result may help accelerate the adoption of back-office systems in developing countries. However, in order for the promise to be fully realized, further research is needed. One of the research issues to be addressed in the future for generalization would be to apply the proposed model to different environments. Also, additional antecedents such as computer self-efficacy, management commitment, self-identity and innovativeness may also play an important role in user attitude and beliefs. Future study needs to include some of them in the research model to make the model more comprehensive. Finally, it would be desirable to conduct a longitudinal study by taking into consideration the time periods of system use. An experienced user who has used the technology for a long period may show quite different attitude toward the system usage.

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