8. FACTOR STRUCTURE OF TECHNOLOGY ACCEPTANCE MODEL AND SELF-EFFICACY FROM VARIOUS INDUSTRY IN MALAYSIA PRINCIPLE COMPONENT ANALYSIS APPROACH

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Introduction

Computers are great invention that is used across discipline and industries. While technology in terms of machineries has been used since human civilization, computers become must have item in churning text, figures and graphics. In present situation computers are part of office stationeries and home appliances. Although availability and access is no longer an issue but people reactions to computers somewhat varies in terms of locale, importance and industries. Farmers may not use computers to tend the farm but use the computer to access the Net for updates on agricultural issues. Thus it becomes part of tools in agricultural sector.

In understanding people reactions toward computers Davis's Technology Acceptance Model-TAM (1989) is the most appropriately measurement model to use compared to Roger's Diffusion of Innovation Theory (1960). Computers, have been regarded as necessity, have passed the process of adoption namely Knowledge, Persuasion, Decision, Implementation and Confirmation as described in Roger's Diffusion of Innovation Theory (1960). While TAM on the other hand posits that technology will be accepted (use) if it is perceived to be useful and requires less effort to use it (ease of use).

Computer has been introduced to Malaysian users since 1960's thus would be users have been exposed to it (having the Knowledge). Users are no longer need persuasion to adopt it since computers are already in place (office and majority of Malaysian homes). Malaysian users are basically in the last stage of Roger's theory namely Confirmation, where they are continuously using it with continuous support and affirmation from the society in large.

Industry-wise, many researches have been conducted using TAM testing various technology and services adoption such as e-banking, internet usage, health and internet shopping. In Malaysia TAM has been used to study computers acceptance by small and medium sized company (Jantan, T.Ramayah & Chin, 2001), Internet shopping behaviour, and receptiveness of E-banking by Malaysian consumers (Koay, 2002). Fok (2001) incorporates self-efficacy in researching Internet acceptance among Malaysian while Ramayah, Dahalan and Mohamad and Siron (2002) incorporates gender, income and level of education into TAM in studying technology usage of managers in SME's in Malaysia. However these studies are more industry-type or service specific. A study on reactions of general employees from various industries is found to be lacking.

Technology Acceptance Model

TAM, although originated in Information Studies field, has been widely tested in

other areas. Previous research using TAM focuses more on measuring the attitude of users towards technology and the actual usage of the technology (Fusilier & Durlabhji, 2005; Schaper & Pervan, 2004).

The basic concept underlying User Acceptance Model are individuals reactions towards technology, how they perceived that the technology is beneficial to them and how easy can they use the technology. If individual reacted positively to the new technology, chances are they will use the technology but if their reactions are negative, they may avoid the technology. These positive or negative reactions created and intention to use or not to use the technology which later become the moderating factor in determining the actual use or no use of the technology. In adopting TAM, various variables have been added which include social influence, motivation, efficacy, anxiety and outcome expectation

A study among librarians' attitude and their Internet usage was conducted by Spacey, Goulding and Murray (2004). Finding indicated that positive attitude towards technology has strong correlation with actual use of the Internet and intention to use the Internet. System specific wise, Money (2004) concluded that TAM can be used as a foundation to measure users' acceptance of and actual use of new system, in his case the Knowledge Management System. While users from different orientation normally assumed to be reacting differently towards new technology, Havelka (2003) has proven otherwise. In his research he found out that students from both Management Information System major and Business major have the same positive attitude level towards technology indicating subject specialization does not influence students perception on the ease of use and the usefulness of technology. Thus this has an implication on other forthcoming research whether employees from different industries possess the same attitude towards technology.

Other study uses TAM in the context of social influence in technology acceptance. Social influences that generate a feeling of compliance to use the new system, seems to have negative influence on users' attitude toward use of the new system. However, when social influences generate a feeling of internalization and identification on the part of the user, they have a positive influence on the attitude toward the acceptance of the new system (Malhotra and Galleta, 1999). Saade and Kira (2006) had in their research added affect and anxiety as other variables that impacted perceived usefulness and perceived ease of use of undergraduate students using web-based learning program.

To further improve TAM's predictive value for computer usage, an additional behavioural construct, *Computer Self-Efficacy* was included as one of the construct to be measured. Although computer self-efficacy has been included as external variables to TAM model previously, but the studies were more of situational specific as in predicting Web usage in Australia as well as internet use in Malaysia (Fenech-online) and Fok. (2001). Thus the need to test self-efficacy construct to employees from various industries in Malaysia.

Method

Participants

The participants consisted from working adult from various industries in Kuala

Lumpur, Malaysia. Although the population would be rather large but for the purpose of this research, the study adopted Steven (1996) which suggested 15 participants for each items measure would be adequate. Therefore since the survey questionnaires had 31 items, an estimated 465 sample or more should be sufficient.

Measures

A pool of 31 items consisted of 25 items which was selected from an instrument adopted and adapted from a research done by Kiraz and Ozdemir in 2006 and another 6 items was self-constructed to measure the computer self-efficacy. Each item, suggestive of a specific dimension, to which the respondent indicates his or her response on a 7-point response scale, represents an indicator. Each indicator was worded in a manner to capture the meaning attached to one of the four dimensions, the underlying factors that explained the pattern of responses. Theoretically, the latent factor for the first ten items was perceived usefulness, the subsequent 7 items assessed the ease of use dimension and the next 8 questions assessed the anxiety dimension. The rest of the items assessed the self-efficacy dimension.

The questionnaire was divided into two parts, Part A (demographic an computer usage) and Part B (variables on usefulness, ease of use, self-efficacy and anxiety) Kiraz and Ozdemir (2006) use the items to measure the relationship between educational ideologies and TAM of Pre-service teachers at Middle East Technical University, Turkey. Respondents were asked to indicate their agreement or disagreement on a 7 –point Likert scale with 1= strongly disagree to 7 = strongly agree.

To further establish the psychometric value of the employees' acceptance of technology, the questionnaires were subjected to content-related validation. To content-validate the items, the instrument was administered to a purposive sample of 10 "judges" comprising of 5 lecturers and 5 PhD candidates. These judges were requested to validate and comment on whether the items would correspond to the underlying dimensions. Based on these comments, the items were reworded and included in the present study.

Procedure

The undergraduates of business administration programme in Management Information System (MIS) classes were asked to administer the questionnaires at their respective working environments. Since they are from various industries, these populations provided a varied sample population. Verbal instructions were also given to participants in whom it was emphasized that they are free to withdraw and they should not force any of their colleagues to answer the questionnaires.

Data Analysis

A principal component analysis with varimax rotation was run to examine the underlying structure of TAM questionnaires. Only those factors with eigenvalues greater than 1.0 were retained; this produced an initial 4-factor solution. Most of the 31 items loaded substantially on the 4 factors and these factors were interpretable. Items were

assigned to factors based on the highest loadings (minimum acceptable loading of .40). Any item which is loaded to more than one factor (cross-loading) will be discarded and would not be considered to represent any of the factors. In addition, reliability was performed on each of the four factors.

Results

Demography of the Respondents

The sample consisted of 638 participants from various industries which were collected by Business Studies undergraduates. These students are working adult pursuing studies on part-time basis. Participants were moderately distributed with 48% (308) male and female accounted for 52% (330). Their age ranged from 18 to 58 years old with an average age of 29 years old. The proportion of industries are varied with banking 11.4% (73), construction 3% (18), education 19.1% (122), engineering 2.8% (18), public service 11% (70), health 10.3% (66), Hotel, 3.4% (22), manufacturing 4.9% (31) , telecommunication 8% (51) and other industry 26.1%. Although the computation for sample population was rather large, Steven (1997) suggested 15 samples per item was adequate.

Initial Factorial Analysis

The analysis used is Principal Component Analysis (PCA) where varimax rotation was conducted to determine the construct validity of the data collected from both undergraduate and postgraduate students. The analysis adopted an exploratory approach where no assumed structure is to be confirmed.

In identify the underlying dimensions by the variables, the factors analysis was conducted on the inter-variable correlations matrix. This is a data reduction technique used to determine if there is a smaller number of underlying dimensions which account for the major sources of variation in the participants' responses.

Prior to assessing assumptions, a visual inspection was done by looking at the Correlation Matrix to see patterns of relationship among the items. The table shows that a considerable number of correlations were greater than 0.3, which means that the matrix was suitable for factoring and suggested the appropriateness of the principal component analysis for the data.

In assessing assumptions for correlated variables in the initial solution, three tests were conducted. First, for Bartlett's Test for Sphericity, it was found that χ^2 (638) = 14,378, p =.001. The result shows statistically significant correlation among items.

Secondly, the overall Keiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.957, demonstrating that the sample was sufficient to support PCA and since it is greater than 0.7, it shows that there was good correlation among the items.

Next, the measure of Communality of items (see table 2) indicates that a majority of scores are 0.50 and greater. It can be stated that the results of all the statistically test above pointed to the appropriateness of using PCA in the study.

Factor Structure of TAM and Self-efficacy

The four-factor solution obtained from principal components analysis with varimax rotation accounted for 67.6% of the total variance explained of TAM questionnaires. It was found that 3 items were loaded to more than one factor (Q15, Q18 and Q19) and these items were discarded for further analysis. The Rotated factor matrix is presented in table 1 below.

Table 1: Rotated Component Matrix(a)

	Component			
	1	2	3	4
Q1	.848			
Q2	.856			
Q3	.823			
Q4	.820			
Q5	.852			
Q6	.814			
Q7	.836			
Q8	.749			
Q9	.791			
Q10	.816			
Q11			.670	
Q12			.663	
Q13			.629	
Q14			.611	
Q16			.663	
Q17			.598	
Q20				.721
Q21				.748
Q22				.807
Q23				.714
Q24				.450
Q25				.511
Q26		.715		
Q27		.786		
Q28		.742		
Q29		.708		
Q30		.581		
Q31		.544		

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 6 iterations.

The *first factor* is labelled as *Perceived Usefulness*, while *the second factor* is labelled

Ease of Use. The *third factor* was named *Anxiety* and the *forth factor* was labelled as *Self-Efficacy*. These four factors consist of 28 items altogether which retained for further analysis which accounted for modest 67.6% from the total variance explained.

Reliability

The reliability test was conducted using Cronbach's Alpha (α) Reliability Test. All alpha coefficients were satisfactory (ranging from .72 to .97, indicating that the newly formed subscales are internally consistent. The details of the reading are presented in Table 2:

Table 2: Cronbach's Alpha for 4-factor Analysis

Factors	Cronbach's Alpha
Perceived Usefulness	.9662
Ease of Use	.9118
Anxiety	.7231
Self-Efficacy	.8654

Discussion

The factor structure obtained in this investigation documents that TAM questionnaires is a multidimensional scale tapping into various dimensions of technology acceptance. It further established the construct of self-efficacy by validation by principal component analysis. To consider the substantive interpretation of the four-factor solution, these dimensions will be briefly examined in terms of the degree to which they are reflective of prominent themes. The TAM questionnaires as well as self-efficacy had a specific purpose in empirically demonstrated the ability of these instrument in measuring technology acceptance and their self-assessment of level of confidence in using computer as a tool of productivity.

Since computer and ICT play a major role in almost every industry, it is an important tool in enhancing the working environment. The age of ICT had a profound impact to various industries that it was considered that the impact of information and technology might determine the nation's capability in terms of socio-economic dimensions. Tapscott, D. (1996) elaborated that the success of any nation lies not only of the natural resources but on the usage of information through the use of ICT that determines who will have competitive advantages over the other.

In conclusion, the present investigation showed relevance in establishing the psychometric characteristic of the instrument in documenting and determining the validity and reliability. However, further empirical study should be done to enhance and evaluate the instrument so as to be tested specifically within an industry with specific technology requirement.

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