Interlinkage between Constructs of Technology Acceptance Model (TAM)- A Study among E-Commerce Users in India

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Abstract
The study aims at testing Technology Acceptance Model (TAM) for e commerce in India based on four constructs of TAM i.e. perceived usefulness, perceived ease of use, behavioural intention to use and actual usage. For this purpose, 12 selected variables were chosen and the study is conducted with a sample size of 28 internet users using purposive sampling. All participants were internet users with varying internet experience of 1-3 years or more, residing in Delhi. A structured questionnaire was used for primary data collection. The analysis has been conducted using factor analysis and correlation analysis. The study concludes that each of these two constructs namely Perceived usefulness and Behavioural intention were related to actual use e commerce in India, while the other two constructs were not found to have significant relation with usage of e-commerce.
Keywords: E-commerce, online shopping, TAM, factor analysis, correlation.

INTRODUCTION

The rapid increase in business to consumer e-commerce activities has created a need to understand how and when people participate in e-commerce process. In this study consumer participation in e-commerce is treated as a technology adoption process and maps its suitability on popular TAM model. This study also aims at deriving a TAM based model for diffusion of innovation with special reference to e-commerce.

E-commerce applications - first developed as Electronic Funds Transference (EFT) in the early 1970s - is the process of buying, selling, or exchanging products, services, and information via computer networks (Turban and King, 2003). However, its spectrum is not limited to these simple transactions but also encompasses a wide range of business activities of particular importance to modern companies such as new approaches to market research, sales support, product and knowledge sharing and financial transactions (Kardaras and Papathanassiou, 2000). E-Commerce is a business concept that has brought numerous changes to the way organizations conduct their business and to the way consumers make their purchasing decisions (Shih, 2004; Barbonis and Laspita, 2005). It helps organizations to reduce costs, expand their businesses to national and international markets, achieve high rates in sales growth, introduce effective pull-type supply chain management to reduce inventories and overheads, and maintain business processes re-engineering (BPR) efforts.

For consumers the advantages of internet retailing include saving of time, better prices, more product choices, faster order processing, availability of goods 24 hours a day, 365 days per year, from almost any location, quicker delivery of digital products, experience by receiving a wealth of product information etc. (Barbonis and Laspita, 2005; Vijayasarathy, 2004; Turban and King, 2003). In addition, Turban and King (2003) underlines the benefits to society which stems from e-commerce such as allowing poor people to purchase products and services at lower prices, giving people from Third-World countries or rural and mountainous areas the chance to enjoy products and services which otherwise would be not available to them, and providing better quality and more flexible public services in shorter periods of time. Nevertheless, there are also many challenges, 'especially in the areas of store/interface design, order fulfillment, payment methods, and the safeguarding of customer information' (Vijayasarathy, 2004).

LITERATURE REVIEW

Internet and e-commerce are rapidly spreading new and very effective means of conducting commercial transactions. Along with the liberalization of commerce on a global scale, e-commerce is a product of the recent technological developments witnessed in the last decade.

E-commerce is described as production, presentation, selling, insurance, distribution and payment transactions of the goods and services in the electronic domain. (Goldsmith and Bridges, 2000; Crespo and del Bosque, 2008). Zwass (1996), described the e-commerce as to share the commercial information by preserving commercial transactions and relations conducted with telecommunication networks. Kalakota and Whinston (1997), stated to be defined it as the distribution of products and services via computer networks. Treese and Stewart (1998), referred the e-commerce as the usage of the universal internet for buying and selling of the goods and services. The simplest meaning of the e-commerce is described as buying and selling of the goods via internet (Shih, 2004; Bidgoli, 2002) which make information communication ever easier (Turban and King, 2003;

Çelik, 2009).

E-Commerce applications can make it easier for the country to better integrate with the global markets, the e-Marketplace. This has led the government, over the last few years to formulate liberal policies for the development and growth of the IT industry. There is a huge unexplored market in India and the existing security offerings are scarce and fragmented.

TECHNOLOGY ACCEPTANCE MODEL

Information Systems (IS) researchers have made significant efforts in building theories to examine and predict the determinant factors of information technology (IT) acceptance (Agarwal and Prasad, 1998; Agarwal and Prasad, 1999). Existing models of IT acceptance have their foundations from several diverse theories, most noticeably innovation diffusion theory, where individuals' perceptions about using an innovation are considered to affect their adoption behavior (Agarwal and Prasad, 1998; Moore and Benbasat, 1991; Rogers, 1995). Other important theoretical models that attempt to explain the relationship between user beliefs, attitudes, intentions, and actual system use include the theory of reasoned action (TRA) (Ajzen and Fishbein, 1980), the theory of planned behavior (TPB) (Ajzen, 1991), and the technology acceptance model (TAM) (Davis, 1989; Davis et al., 1989). Among these theories, TAM seems the most widely accepted among IT researchers due to the richness of recent empirical support (Agarwal and Prasad, 1997; Morris and Dillon, 1997). According to the TRA model, beliefs influence attitudes, which consecutively lead to intentions, then direct or make behaviors. The TAM model, originally developed by Davis from the theoretical foundation of TRA, adapts this belief-attitude-intention-behavior relationship to an IT user acceptance. Thus, the purpose of TAM is to explain and predict IT acceptance and facilitate design changes before users have experience with a system (Davis, 1989).

Figure 1: TAM (Davis & Venkatesh,1989)

Source: Davis et. al. (1989), Venkatesh et. al. (2003)
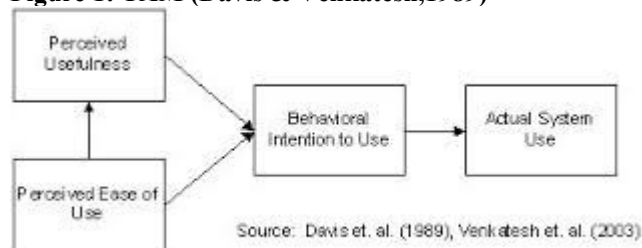
As illustrated in Figure , TAM predicts user acceptance based on two specific behavioral beliefs: perceived ease of use (PEU) and perceived usefulness (PU), which determine an individual's behavior intention (BI) to use an information technology (Davis et al., 1989). In addition, the effects of external variables on behavioral intention are mediated by these two factors.

Constructs of TAM

The four major constructs of the original TAM (Davis *et al*., 1989): the perceived usefulness (PU), the perceived ease of use (PEOU), the attitude and the intention (see figure 1). For Davis (1989), PU is the degree to which a person believes that using a particular system would enhance his or her job performance. In the context of e-commerce, Chau *et al*. (2000) declares that, in general terms, the 'purchase speed' and the 'convenience' of the websites are determinant factors of their usefulness. Additionally, Shih (2004) defined PU of e-shopping as the degree to which an individual believes that trading on the Web would enhance the effectiveness of his or her shopping. A second component of the TAM model is the perceived ease of use. Davis (1989) defined PEOU as the degree to which a person believes that using a particular system would be free of effort. Concerning e-commerce, PEOU is usually related to the navigational properties of the websites. Therefore, as the navigation around the site is getting better, the use of the site is getting easier (Van der Heijden *et al*., 2001). Moreover, Doob (1947, cited in Vijayasarathy, 2004), defined attitude as a person's tendency to show a confident response towards a concept or object, while Pavlou and Fygenson (2006, p.118) defined it as "the consumer's evaluation of the desirability of using a website to get information and purchase products from a Web vendor, respectively". Finally, in TAM, an individual's intention to use a system is proposed to be a precursor of actual usage (Venkatesh and Davis 2000; Vijayasarathy, 2004). The informational and purchasing related nature of the online transaction process, makes the description of the consumers' behaviour by the 'intention to use' construct, rather incomplete and unclear. In relation to the B2C e-commerce, Pavlou (2001) notes that the 'intention to transact' with a system is the dependent variable in the technology acceptance model, and is defined as "the consumers' intent to engage in any exchange of value with the B2C EC service provider" (Lui and Jamieson, 2003, p. 2).

Regarding the relationships among the above factors, a relative complexity is revealed. First of all, TAM integrates a causal relationship between ease of use and perceived usefulness, advocating that a system would be perceived to be more useful if it is easier to use (Vijayasarathy, 2004; Lui and Jamieson, 2003; Van der

Heijden *et al*., 2001). In addition, Shih (2004) and Featherman and Pavlou (2003), mentioned that PEOU and PU significantly and directly impact the attitude toward using a system. More specifically, in line with the postulates and empirical results of TAM, there is a positive correlation between the PU and the attitudes of a user toward a system (Shih, 2004; Ahn *et al*., 2004). Similar to PU, PEOU was found to be a positive and significant predictor of attitude (Vijayasarathy, 2004; Childers *et al*., 2001). Furthermore, Davis *et al*. (1989), Gefen and Straub (2000) and Liu and Wei (2003) stated that the PU would be positively related to the intention to transact with a system. and disregarded the impact of the mediating variable, attitude toward using. Lastly, attitude has long been shown through substantial empirical support to influence the behavioral intentions to use (Ajzen and Fishbein 1980; Ahn *et al*., 2004; Van der Heijden *et al*., 2001; Lui and Jamieson, 2003).

HYPOTHESIS UNDER STUDY
The following four hypothesis will be examined in this study.
H1: Perceived ease of use is positively related to perceived usefulness of e commerce.
H2: Perceived ease of use is positively related to behavioural intention towards use of e commerce.
H3: Perceived usefulness is positively related to behavioural intention towards use of e commerce.
H4: Behavioural intention towards use of e commerce websites is positively related to actual use e commerce sites.
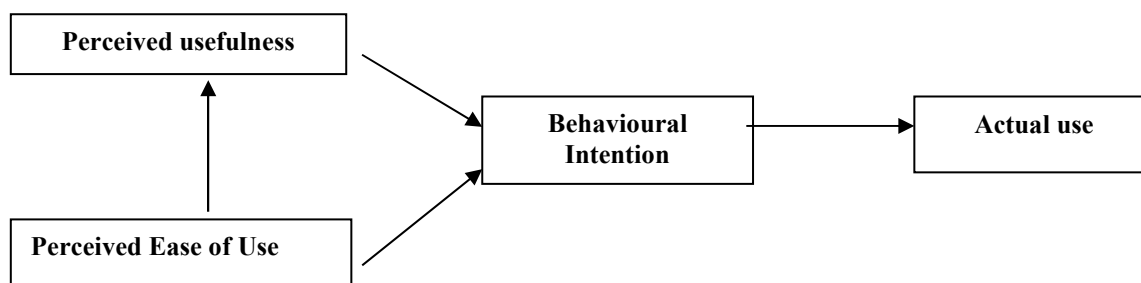
Extension to TAM Model
Apart from the basic constructs of TAM i.e PU, PEOU, BI many researches have proved extended factors to TAM which are necessary to judge user acceptance of e-commerce.

Some of them which are most talked about are discussed here. First and foremost the most apt extension to the TAM is user perception about the Risk involved in E-Commerce transactions (John P Wentzel et.al. (2011), Baur (1960), Bellman et al. (1989), Chen et al. (2006), Dimitrios I. Maditinos1 (2007)). Featherman and Pavlou (2003) mention that PR "is commonly thought of as felt uncertainty regarding possible negative consequences of using a product or service".

Compatibility is another factor which needs to be looked into (L.D. Chen (2002)) it refers to compatibility of using a virtual store with existing values and beliefs, previously introduced ideas and potential adopters needs.

Self efficacy relates to an individuals self belief or their personal ability to succeed in a particular situation, social Related to the role individual or groups play in relation to the individuals perception about a task or activity, fun and entertainment (John P Wentzel et.al. (2011).

Recent studies have advised five new TAM constructs to the existing TAM model. These five constructs are system quality, information quality, service quality , enjoyment and trust. When shopping online, consumers usually expect the web site to support them. For example, obtaining correct and accessible information on target products and services is essential for consumers. There are three factors in evaluating the quality level of a website, namely the perceived information quality, service quality and system quality. These three constructs define the success of a web site. The perceived information quality (PIQ), the perceived service quality (PSvQ) and the perceived system quality (PSQ) can positively or negatively affect e-commerce behaviour [Shih, 2004; Chang et al., 2005]. PIQ is assessed as the output quality of information systems. It is used to show the characteristics of the information. In the studies conducted in the literature, information quality was often used to measure the performance of information systems [Shih, 2004]. During e-shopping, companies and consumers share and exchange information, which results in coordination and communication. PIQ evaluates the quality of information provided through the network in a consumer-centred manner. It is assumed that PIQ will affect PU, PEOU and attitude.

RESEARCH METHODOLOGY
Sample and survey Instrument
The survey participants were adult of age group between 18-45 years of age. All participants were internet users

with varying internet experience of 1-3 years or more, residing in Delhi. Total 30 respondents were contacted out of which 28 turned up. Purposive sampling was used for selecting respondents who are internet users.

Research instrument consist of two section questionnaire, first section on demographics which contain questions on age, gender, and second section consist of 12 variables relating to four components of TAM model i.e. Perceived usefulness, perceived ease of use, For each construct, a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5), was used. The majority of this survey's questions were adopted from previous research instruments that have proved their validity and reliability (Vijayasarathy, 2004; Shih, 2004; Ahn *et al.*, 2004; Yu *et al.*, 2005). The correlation analysis and Factor analysis was conducted with the help of SPSS version 21.

The 12 Variables used are as follows:

V1- Using internet for shopping is frustrating.

V2- Learning internet for shopping was easy for me.

V3- I find it convenient to use e-commerce website to find what i want to buy.

V4- Buying on internet will save my time.

V5- Buying on internet will reduce my shopping cost.

V6- Shopping online will help me to accomplish information seeking more quickly than traditional stores of shopping.

V7- For me using internet for shopping is a good idea.

V8- The fact that i cannot touch and feel the product before buying makes me think twice before buying goods from internet.

V9- I like using internet for shopping

V10-I use internet frequently to do my shopping

V11- Whenever possible i use internet for shopping

V12- I will continue to shop online in near future

FINDINGS AND ANALYSIS
Reliability test
Reliability is one of the most important criteria for evaluating research instruments and refers to the internal consistency of the factors. The reliability of each scale of the four factors of the model (perceived usefulness, perceived ease of use, attitude toward using, and intention to use) was estimated by calculating Cronbach's alpha (α). The calculated Cronbach's alpha is 0.749 for 12 variables under study which is acceptable.

Results of Factor Analysis
Factor analysis is conducted to judge which variables constitute the four constructs of the model. KMO and Bartlett's Test was used to test whether factor analysis is a suitable technique for the study. It was found that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.690 and the Bartlett's Test of Sphericity is 155.46 found significant at 5% level. This proves that factor analysis is an appropriate test for the study.

Table 1: Result of Factor Analysis (factor loadings)

Items/ Variables	FACTOR 1 (Actual Usage)	FACTOR -2 (Behavioural intention)	FACTOR-3 (Perceived ease of Use)	FACTOR-4 (Perceived Usage)
V7	.726			
V9	.809			
V10	.728			
V12	.839			
V3		.775		
V5		.734		
V6		.592		
V11		.532		
V2			.813	
V8			.838	
V4				.910

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization; Rotation converged in 8 iterations; Total Variance Explained = 75.946%

Table-1 provides the results of factor analysis conducted with Principal component analysis with varimax rotation that converged in 8 iterations, as found from SPSS analysis. All the twelve variables were found to be grouped under four components/factors which are named as Actual usage (factor-1), Behavioural intention (factor-2), Perceievd ease of use (factor-3) and Perceived usage (factor-4).

For testing the four hypothesis under study, correlation analysis was done between each of the four constructs/ derived factors to find out the kind of relationship they possess with each other. The results of

correlation (as given in table-2) shows highest coefficient/strongest correlation of 0.701 between Actual usage and behavioural intention, which is found to be significant at 0.01 level. Similarly , the correlation between actual usage and perceived usage was also positive and significant with value of 0.504, followed by correlation coefficient of 0.462 found significant between behavioural intention and perceived usage. The correlation between other pairs of factors/constructs of TAM was not found to be significant.

Table-2: Correlation table

	Actual Usage	Behavioural Intention	Perceived Ease of use	Perceived Usage
Actual Usage	1.0	0.701**	0.009	0.504**
Behavioural Intention	0.701**	1.0	-0.177	0.462**
Perceived Ease of use	0.009	-0.177	1.0	0.012
Perceived Usage	0.504**	0.462**	0.012	1.0

** Correlation is found significant at the 0.01 level

Figure-1 below show the relation between each of the four construct of Technology acceptance model (TAM).

Figure-1: Relationship between TAM constructs
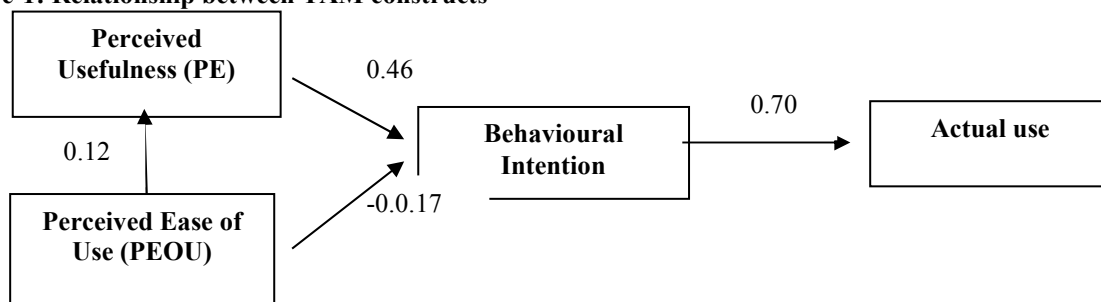
Testing of Hypothesis

As per our analysis PEOU is correlated with PU with coefficient of 0.12 which shows positive but very weak relationship and it is also not significant at p value .477 >.01 & thus the hypothesis that both of them are positively correlation is not proved. Again the relationship between perceived usefulness and attitude towards use shows a positive relationship with value of r = .462 and it is significant at p value .007<.01 so we accept our hypothesis that both of them have positive relationship among them. PEOU shows a negative relationship with Behavioural intention to use with negative value of r -.17 which is insignificant at p value .184 > .01. Lastly, Behavioural intention showed very strong and positive relationship with value of r = .70 which is significant at p value .000 < .01 so we accept our hypothesis that both of them have strong and positive relationship. These results are depicted below in table-3

Table-3: Results of Hypothesis test

Null Hypothesis	Decision
H1 : Perceived ease of use is positively related to perceived usefulness of e commerce	Rejected
H2 : Perceived ease of use is positively related to behavioural intention towards use of e commerce.	Rejected
H3 : Perceived usefulness is positively related to behavioural intention towards use of e commerce.	Accepted
H4: Behavioural intention towards use of e commerce websites is positively related to actual use e commerce sites.	Accepted

CONCLUSION

As can be seen from table-3, First two hypotheses in this study are being rejected based on analysis and the other two are accepted. User acceptance of e-commerce depends on various factors like demographic characteristics of the people under study, economic status of the people, lifestyle, technology accessibility, trust on technology etc. so results may vary from place to place. One of the limitation of this study is the sample size of 28 respondents and the survey being conducted in the capital city of Delhi. An extension of this work may look in demographic spread of respondents with a larger sample, and the study could look into various categories of product buying through e-commerce portal.

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Questionnaire: User acceptance of e-commerce in India

Age
- ○ ☐ Under 18
- ○ ☐ 18-24
- ○ ☐ 25-34
- ○ ☐ 35-44
- ○ ☐ 45 above

Family Income
- ○ ☐ <50000 pm
- ○ ☐ 50000-100000 pm
- ○ ☐ 100000- 300000 pm
- ○ ☐ 300000-500000 pm
- ○ ☐ 500000 above

Education (Mark Highest)
- ○ ☐ 12
- ○ ☐ Graduation
- ○ ☐ Post Graduation

Gender
- ○ ☐ Male
- ○ ☐ Female

Degree of internet usage experience
- ○ ☐ Under 1 year
- ○ ☐ 1-3 years
- ○ ☐ over 3 years

1. Using internet for shopping is frustrating.
- ○ ☐ strongly agree
- ○ ☐ agree
- ○ ☐ neutral
- ○ ☐ disagree
- ○ ☐ strongly disagree

2. Learning internet for shopping was easy for me.
- ○ ☐ strongly agree
- ○ ☐ agree
- ○ ☐ neutral
- ○ ☐ disagree
- ○ ☐ strongly disagree

3. I find it convenient to use e-commerce website to find what i want to buy.
- ○ ☐ strongly agree
- ○ ☐ agree
- ○ ☐ neutral
- ○ ☐ disagree
- ○ ☐ strongly disagree

4. Buying on internet will save my time.
- ○ ☐ strongly agree
- ○ ☐ agree

○   neutral

○   disagree

○   strongly disagree

5. Buying on internet will reduce my shopping cost.

○   strongly agree

○   agree

○   neutral

○   disagree

○   strongly disagree

6. Shopping online will help me to accomplish information seeking more quickly than traditional stores of shopping.

○   strongly agree

○   agree

○   neutral

○   disagree

○   strongly disagree

7. For me using internet for shopping is a good idea.

○   strongly agree

○   agree

○   neutral

○   disagree

○   strongly disagree

8. The fact that i cannot touch and feel the product before buying makes me think twice before buying goods from internet.

○   strongly agree

○   agree

○   neutral

○   disagree

○   strongly disagree

9. I like using internet for shopping

○   strongly agree

○   agree

○   neutral

○   disagree

○   strongly disagree

10. I use internet frequently to do my shopping

○   strongly agree

○   agree

○   neutral

○   disagree

○   strongly disagree

11. Whenever possible i use internet for shopping.

○   strongly agree

○   agree

○   neutral

o   ☐ disagree

o   ☐ strongly disagree

12. I will continue to shop online in near future.

o   ☐ strongly agree

o   ☐ agree

o   ☐ neutral

o   ☐ disagree

o   ☐ strongly disagree