Consumer e-commerce acceptance: A replication study

Sarath Thulaseedharan Mallika[1]

Abstract: The E-commerce business is continuously growing and attracts the attention of practitioners as well as researchers. Its acceptance among consumers has been the subject of academic research for more than a decade now. In particular, the Technology Acceptance Model and latent factor analysis originally used for information system adoption show signs of high popularity in the e-commerce domain. Replication studies, on the other hand, have not received much attention. Despite the fact that replication guarantees progress in every scientific discipline, customer behaviour is no exception. In order to alleviate this undesirable condition and verify previous research in the field, we have selected a popular journal article from Ha and Stoel (2009) and re-searched their main model. To do that, an internet survey was conducted among 125 online consumers. Website design, customer service, privacy/ security, and shopping atmosphere/ shopping experience were the factors evaluated in this study with e-shopping quality as a second-order factor. Exploratory factor analysis revealed that latent factors do not load as previous research suggests thus we failed to replicate the model. Further, confirmatory factor analysis showed better results with decent reliability of the model. However, validity measures showed troubling values. Based on the findings, implications for future research are proposed in the conclusion.

Keywords: E-commerce acceptance, Technology Acceptance Model, Trust, Privacy, Replication, Shopping quality, Website

**JEL Classification:** M21

1 Introduction

Electronic commerce or e-commerce has continuously grown for decades. Due to the accessibility of internet connection, safer payments and more businesses going online, more and more customers are doing their shopping in this virtual environment. This is followed by the growth in sales of online vendors. Yet, the pace of online shopping acceptance is somehow uneven. To explore the reasons behind these differences, researchers are trying to describe factors influencing online shopping adoption in many countries and markets. A handful of studies attempt to explain consumer acceptance of e-commerce from the perspective of the technology acceptance model (TAM). It explains the ease of use and usefulness of technology influencing consumers' attitudes towards acceptance of technology and hence the use of it.

The TAM model originally used to explain and increase user acceptance of consumer systems has gotten considerable attention from academics. It is probably the most influential model on acceptance. It proposes a belief-attitude-intention-behavior causal relationship for explaining and predicting users' system acceptance. According to TAM, perceived usefulness and perceived ease of use determine a person's attitude toward using technology and the attitude then forms an intention to use and final behaviour. It has been widely used to explain e-commerce or online shopping adoption (Gefen et.al.2003; Pavlou 2003)

TAM represents the behaviour as the outcome predicted by perceived ease of use, perceived usefulness, and behaviour intention. Davis (1989, 1993) describes technology acceptance based on TAM as a three-stage process, whereby external factors like system design trigger cognitive responses such as perceived ease of use or perceived usefulness, which, in turn, form an affective response like attitude towards using technology, influencing user behaviour. The higher the affective response, the higher the likelihood that the behaviour will occur. The effect of perceived usefulness can have a direct impact on the actual use of the technology, but, perceived ease of use does not affect user behaviour directly. The model thus suggests that, if technology is expected to be easy to use, it is more likely to be considered beneficial and it will stimulate acceptance of that technology (Davis et al. 1989; Davis 1993).

---

[1] Silesian University in Opava, School of Business Administration in Karvina, Univerzitní nám. 1934, 733 40 Karviná 1-Fryštát, Czech Republic, mallika@opf.slu.cz.

Figure 1 Technology Acceptance Model
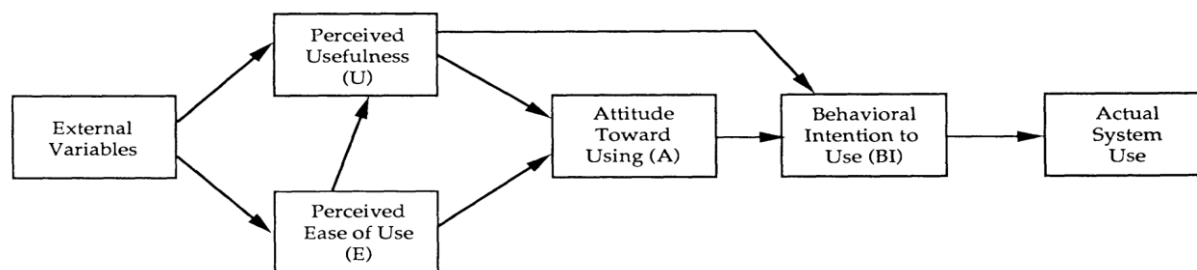
Source: Davis et al. (1989)

Individuals' decision to perform behaviour is the result of the analysis of the benefit that they expect to receive from the behaviour compared to the effort or costs they put in to perform the behaviour (payne & Payne 1985; Payne 1982).

Perceived usefulness is defined as an individual's perception of the extent to which the use of a particular technology improves performance. Perceived ease of use is the extent to which a person believes that a particular technology is easy to use (Davis 1989). Perceived ease of use also resembles the complexity factor, which is theorized as a barrier to innovation adoption in the innovation diffusion literature. It has been defined as the extent to which individuals find innovations difficult to understand and apply.

Previous studies have confirmed TAM as a robust framework for understanding user adoption of technology in various contexts, including banking technology (Adamson & Shine, 2003), m-commerce (Bruner & Kumar, 2005), telemedicine technology (Chau & Hu, 2001), etc. Despite the robustness of the TAM, some research has shown conflicting results regarding the impact of usability on attitudes. Researchers have suggested that persuasive factors such as usefulness, enjoyment, self-confidence, and achievement may influence a person's attitude toward using technology more than ease of use (Van der Heijden & Verhagen, 2004).

Although the widespread application of TAM confirmed the robustness of the theory, the authors of the model focused on increasing its predictive power. The rationale for extending the model is that there is a limited understanding of the conditions underlying user perceptions of technology use. Vijayasarathy (2004) argues that the variables in TAM are more suitable for decisions involving the selection of a few technology choices than for situations where users make voluntary decisions such as online shopping. Therefore, the original TAM variable may not sufficiently capture the key factors influencing consumers' attitudes toward the e-shop.

Since replication is a vital element of research (Graham et al. 2017), there were attempts to conduct such studies including the TAM model. Some of them have been successful (Melas et al. 2011) but some failed (Adams et al. 1992; Chau & Hu 2001; Barnett et al. 2006; Subramanian 1994). This means that for generalization we have to repeat the research again to confirm that the model is valid. Independent research teams should undertake subsequent verification and assess the interpretations and biases of the original researchers (Uncles & Kwok 2013). Moreover, to the best of our knowledge, there are no replications of the TAM model in e-commerce. Therefore, the objective of this paper is to verify the extended TAM model in the e-commerce context. We do it by replicating the final model of Ha & Stoel (2009) study which has attracted the attention of many scholars. It has been cited 621 times in Web of Science database as of 08 October 2023.

2 Methods

The general approach of this paper is replication research. Replications can be categorized based on the level of similarity with the original study. Uncles & Kwok (2013) describe differentiated close and exact replications. In exact replication, the study is done again within the same context of time, space and phenomena. Close replications allow alteration of one of these to some extent. For instance, collecting data in the same space on the same phenomena but in the first and later in the second quarter of the year. Lastly, differentiated replication allows for major changes in time, space and phenomena or combination. We have conducted the replication in different time and space (India 2022) compared to the original study (USA 2009). Therefore we can categorize our research as a type of differentiated replication.

Data were collected from people of all ages, gender, employment type, and level of education. The questionnaire consisted of 17 variables corresponding to factors of web design (WD), customer service (CS), privacy/security (PS), and atmospheric/experiential (AE). All variables except for demographic information were assessed using a 7-point Likert scale (1= strongly disagree, 7= strongly agree). Respondents were initially asked to name the e-commerce site they use quite often and asked to keep that retailer's name in mind while filling out the questionnaire. All the variables used in this

study were adopted from previous research (Ha & Stoel, 2009). On average, respondents spend about 7 minutes completing the survey.

A total of 125 responses were collected. The sample size is similar to some previous studies on TAM (Adams et al. 1992). 63 respondents were females which makes it 50.4% of the total respondents. 45.6% of the respondents fell under the age group of 26 to 30 years and 27.2% fell under the group of 20 to 25 years. Out of the 125 respondents, only 2 were over the age of 50. 92.8 % of the respondents were graduates and 65 respondents had a master's degree and above qualifications. Students accounted for only 10.4% of this survey and 10.4% of respondents were unemployed. 80 respondents were employed full time and 12 were self-employed.

Exploratory and Confirmatory factor analysis are used to examine the underlying factor structure of the data. But it plays quite different roles in terms of the purpose of given research: One is used for theory building and the other is used mainly for theory testing.

Exploratory factor analysis (EFA) is used to identify a set of latent or unobserved factors that reconstruct the complexity of the observed data in an essential form. By "essential form", it means that the factor solution extracted from EFA should retain all important information available from the original data. However, unnecessary and/ or redundant information and noises induced by sampling and measurement errors are removed (Henson & Roberts, 2006)

Confirmatory factor analysis (CFA) on the other hand is employed to test an existing theory. It is used when there is a strong model assumption and the relationships between the items are tested and the factors and related items are known (Bandalos & Finney, 2010).

EFA was performed using principal component analysis and the oblique rotation method (oblimin) was utilized as the presence of correlations across underlying e-commerce factors was presumed (Matsunaga, 2010). The minimum factor loading (factor-variable correlation) criteria were set to 0.50. The communality of the scale, which indicates the amount of variance in each dimension, was also assessed to ensure acceptable levels of explanation. A minimum eigenvalue of 1.0 was used as the criterion for the factor number decision. Later, CFA was performed using a free version of Smart PLS software.

3 Research results

Lets begin with the results of EFA. The overall significance of the correlation matrix was assessed using Bartlett's Test of Sphericity, which provides a measure of the statistical probability that the correlation matrix has a significant correlation among some of its components. The result was significant, $P < 0.001$, which indicated its suitability for factor analysis. The Kaiser-Meyer-Olkin measure of sampling adequacy (MSA), which indicates the appropriateness of the data for factor analysis, was 0.855. Data with MSA above 0.8 are considered appropriate for factor analysis (Kaiser & Rice, 1974)

The factor solution derived from this analysis yielded three factors for the scale, which accounted for 65.58% of the variation in the data. Scree plot, another technique to determine the number of underlying factors also shows a similar result (Fig.2)

Figure.2 Scree Plot
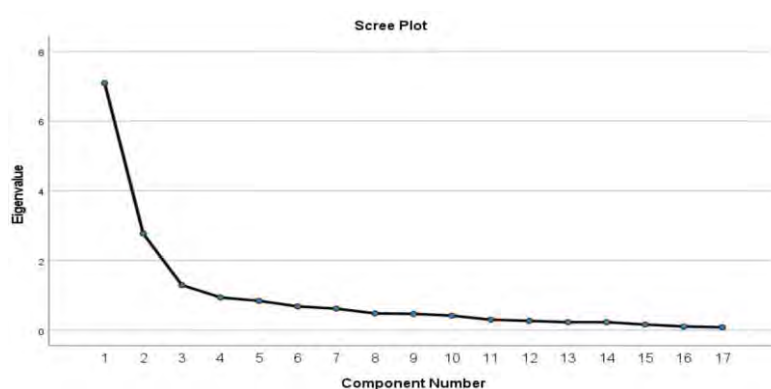
Source: own research

Exploratory factor analysis revealed that three factors can be used for measuring consumer acceptance of e-commerce. It is one less than expected when compared to the original study.

Table 1. Pattern Matrix

	Variable	Factor 1	Factor 2	Factor 3
	Pattern Matrix			
1	The site doesn't waste my time			0.735
2	I can go exactly what I want quickly			0.685
3	The organisation and layout facilitates searching for products			0.659
4	The site gives me enough information so that I can identify the item to the same degree as if I am in the store			0.588
5	The company is ready and willing to respond to customer needs	0.796		
6	The website has reasonable shipping and handling costs	0.516		
7	Customer service personnel are always willing to help you	0.847		
8	Inquiries are answered promptly	0.821		
9	When you have a proble, the website shows a sincere interest in solving it	0.849		
10	I feel like my privacy is protected at this site		0.882	
11	I feel safe in my transactions with this website		0.89	
12	I feel I can trust this website		0.867	
13	The website has adequate security features		0.934	
14	The company behind the site is reputable	0.711		
15	It is really fun to shop at this website			
16	The site almost says "come in and shop"	0.715		
17	Buying at this website is exciting for me		0.575	

Source: Own research

The above table shows us whether our items for a particular construct load well together or not. The first four items representing Web design load well together and variables 5 to 9 representing customer service also load together. Variables 10 to 13 load well together to their parent construct which is privacy/ security. However, we can see that variables 14 and 16 load to construct customer service and variable 17 loads to factor Privacy/ Security. Variable 15 doesn't show any loading at all. We expect those three variables to represent their own construct, experiential/atmospheric.

Further, the CFA has been calculated via Smart PLS software. Similarly to the original study (Ha & Stoel, 2009), there was a second-order construct used to convey a hypothesis that the first-order constructs are seemingly distinct but ultimately related by one common underlying higher-order construct. Figure 3 shows the final causal model with second-order construct alpha, the E-shopping quality. The model shows solid path coefficients between the first-order constructs and the alpha. Factor loadings are also significantly better compared to what we previously saw in exploratory factor analysis. However, Hair et al. (2019) recommend values higher than 0.708 for acceptable item reliability. Only two of the four items meet this criterion in the Website design construct (WD2 and WD3). In Customer service, Privacy/Security and Atmospherical/Experiential constructs at least one item does not meet the criteria (CS2, PS5 and AE2).

Fig.3 Causal model
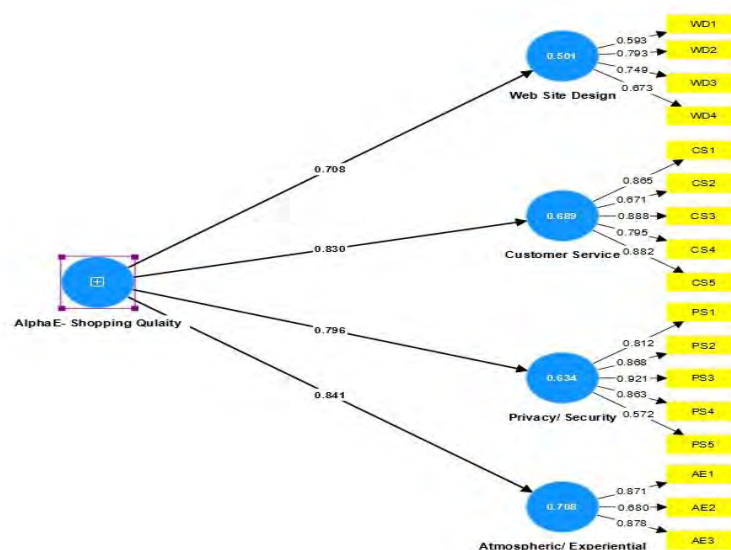
Source: Own research

Additionally, when the overall model reliability and validity was inspected, we can see several threshold violations as well (table 2). First, Cronbach's alpha score for website design shows a lower-than-acceptable result. Cronbach's alpha

should be at least 0.7 (Nunnally & Bernstein, 1994). Second, based on Jöreskog (1971), the composite reliability score for confirmatory research is 0.7 thus the parameter in website design does not meet these criteria as well. In the original study, Cronbach's alpha and AVE for Web Design were 0.89 and 0.73 respectively, for Customer service 0.89 and 0.70, for Privacy/Security 0.95 and 0.78, and last but not least for Atmospheric/Experiential 0.75 and 0.60.

Table 2 Construct reliability and validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
AlphaE- Shopping Qulaity	0.902	0.910	0.917	0.399
Atmospheric/ Experiential	0.742	0.768	0.854	0.665
Customer Service	0.879	0.888	0.913	0.680
Privacy/ Security	0.867	0.868	0.907	0.667
Web Site Design	0.659	0.676	0.797	0.498

Source: Own research

Further, the reliability and convergent validity of the model have been measured by Average variance extracted (AVE). As table 2 shows, there are two constructs violating the threshold of AVE being at least 0.5 (Bagozzi & Yi, 1988). It is a Website design and second-order construct E-shopping quality. Common praxis is to run the model again without problematic items, however, this is not the case for a replication study. The purpose here is to verify not modify.

4 Conclusions

Growth in the number of internet users, smartphone and computer owners, online shops, and secure payment providers positively contributed to the growth of e-commerce. Interestingly, some countries as well as industries and product categories experience different e-commerce adoption rates. To explain the factors behind e-commerce adoption in different contexts, the technology acceptance model gained popularity among scholars. However, TAM replication studies showed mixed results, and more research is needed. Therefore this paper replicated the extended TAM version used in the popular study by Ha & Stoel (2009).

Both exploratory and confirmatory factor analyses gives unsatisfactory results. Only three factors were generated by EFA compared to the theoretical four. Moreover, the items expected to represent Experiential/Atmospheric failed to load together. These items loaded onto a factor other than its underlying factor and one item did not load at all. Further, confirmatory factor analysis showed inconsistencies in comparison to the original study. Also, violations of the criteria for item loadings as well as construct validity and reliability were observed.

To conclude, this study failed to provide evidence of the model's reliability outside context other than the initial study. Interestingly, this study is one of the few with the goal of replicating previous research in the TAM literature within the e-commerce adoption topic. Since we have not verified the model, I would like to urge my colleagues to pursue more replications since these and only these can provide solid evidence of consumer behaviour.

This study surveys consumers from India only thus the generalization of findings to consumers outside India is problematic. Another major limitation of this study is the inadequacy of the sample size. Only 125 responses were collected which also impedes the generalization of the results. In the original study, the sample size was 298.

Acknowledgement

References

Adams, D.A., Nelson, R.R., & Todd, P.A. (1992). Perceived usefulness, ease of use, and usage of information technology: A replication. *MIS quarterly*, 227-247.

Adamson, I. & Shine, J. (2003). Extending TAM to measure end user computer satisfaction in a mandatory environment: A bank's treasury. *Technology Analysis and Strategic Management Journal*, 15(4), 441-454.

Bagozzi, R.P. & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the academy of marketing science*, 16(1), 74-94.

Bandalos, D. L., & Finney, S. J. (2010). *Exploratory and confirmatory factor analysis. Quantitative Methods in the Social and Behavioral Sciences: A Guide for Researchers and Reviewers*. New York, Routledge.

Barnett, T., Kellermanns, F.W., Pearson, A.W., & Pearson, R.A. (2006). Measuring information system usage: Replication and extensions. *Journal of Computer Information Systems*, 47(2), 76-85.

Bruner II, G.C. & Kumar, A. (2005). Explaining consumer acceptance of handheld Internet devices. *Journal of business research*, 58(5), 553-558.

Chau, P.Y. & Hu, P.J.H. (2001). Information technology acceptance by individual professionals: A model comparison approach. *Decision sciences*, 32(4), 699-719.

Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

Davis, F.D. (1993). User acceptance of information technology: system characteristics, user perceptions, and behavioral impacts. *International journal of man-machine studies*, 38(3), 475-487.

Davis, F.D., Bagozzi, R.P. & Warshaw, P.R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management science*, 35(8), 982-1003.

Gefen, D., Karahanna, E. & Straub, D.W. (2003). Trust and TAM in online shopping: An integrated model. *MIS quarterly*, 51-90.

Graham, C., Bennett, D., Franke, K., Henfrey, C.L. & Nagy-Hamada, M. (2017). Double Jeopardy–50 years on. Reviving a forgotten tool that still predicts brand loyalty. *Australasian Marketing Journal* (AMJ), 25(4), 278-287.

Ha, S. & Stoel, L. (2009). Consumer e-shopping acceptance: Antecedents in a technology acceptance model. *Journal of business research*, 62(5), 565-571.

Hair, J.F., Risher, J.J., Sarstedt, M. & Ringle, C.M. (2019). When to use and how to report the results of PLS-SEM. *European business review*, 31(1), 2-24.

Henson, R. K., & Roberts, J. K. (2006). Use of exploratory factor analysis in published research: Common errors and some comment on improved practice. *Educational and Psychological measurement*, 66(3), 393-416.

Johnson, E.J. & Payne, J.W. (1985). Effort and accuracy in choice. *Management science*, 31(4), 395-414.

Jöreskog, K.G. (1971). Simultaneous factor analysis in several populations. *Psychometrika*, 36(4), 409-426.

Kaiser, H. F., & Rice, J. (1974). Little jiffy, mark IV. *Educational and psychological measurement*, 34(1), 111-117.

Matsunaga, M. (2010). How to Factor-Analyze Your Data Right: Do's, Don'ts, and How-To's. *International journal of psychological research*, 3(1), 97-110.

Melas, C.D., Zampetakis, L.A., Dimopoulou, A. & Moustakis, V. (2011). Modeling the acceptance of clinical information systems among hospital medical staff: an extended TAM model. *Journal of biomedical informatics*, 44(4), 553-564.

Nunnally, J.C. & Bernstein, I.H. (1994). Psychometric theory 3E. Tata McGraw-hill education.

Pavlou, P.A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International journal of electronic commerce*, 7(3), 101-134.

Payne, J.W. (1982). Contingent decision behavior. *Psychological bulletin*, 92(2), 382.

Subramanian, G.H. (1994). A replication of perceived usefulness and perceived ease of use measurement. *Decision sciences*, 25(5-6), 863-874.

Uncles, M.D. & Kwok, S. (2013). Designing research with in-built differentiated replication. *Journal of Business Research*, 66(9), 1398-1405.

Van der Heijden, H. & Verhagen, T. (2004). Online store image: conceptual foundations and empirical measurement. *Information & management*, 41(5), 609-617.

Vijayasarathy, L.R. (2004). Predicting consumer intentions to use on-line shopping: the case for an augmented technology acceptance model. *Information & management*, 41(6), 747-762.