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Exploratory Factor Analysis of Technology-Organization-Environment and E-Commerce Adoption among Urban Women Entrepreneurs

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Abstract

Research on Technology-Organizational-Environment (TOE) has been extensively conducted in various fields. However, research on TOE is still lacking in the context of e-commerce adoption, specifically in the context of urban women entrepreneurs. This study aims to develop an e-commerce adoption and TOE-related instrument that suits the context of Malaysian urban women entrepreneurs. The TOE instrument was adopted and adapted from previous researchers, and Exploratory Factor Analysis (EFA) was used to validate the construct. Using a simple random sampling technique, cross-sectional research of 110 urban women entrepreneurs in Selangor, Malaysia, was carried out. The required data was gathered via a structured survey. The final analysis found that five items were omitted. Based on EFA, this study finalized the instrument to twenty-six (26) items yielding only six dimensions, i.e., e-commerce adoption (3 items), relative advantage (3 items), compatibility (5 items), management readiness (4 items), competition intensity (6 items), and government support (5 items). The suggested instrument is reliable and appropriate for assessing e-commerce adoption and TOE, as evidenced by the high reliability standards shown in Cronbach's alpha for each component. The results have statistically proven that these items have a high level of validity and reliability and can be considered for future research to measure TOE in the context of urban women entrepreneurs in Malaysia.

Keywords: E-commerce Adoption, Environmental Context, Organizational Context, Technological Context, TOE Construct, Urban Entrepreneurs, Women Entrepreneurs

Introduction

E-commerce adoption has been deemed an economic success factor for Malaysia. In terms of its contribution to Malaysia's economic growth, the e-commerce sector has expanded tremendously. The Department of Statistics Malaysia's most recent figures show that the contribution of e-commerce to Malaysia's GDP increased from 5.9 percent (RM68.3 billion) in 2015 to 6.1 percent (RM74.6 billion) in 2016. E-commerce platforms are one of Malaysia's fastest-growing industries, producing USD3.7 billion in revenue in 2019 with more than 20 million users, and are projected to grow to USD5.7 billion by 2023 (Statista, 2019).

Some studies claim that the involvement of urban and rural entrepreneurs in the adoption of e-commerce is different (Awa et al., 2015; Haig, 2002). According to Osman (2001), SMEs must be located in a suitable area with a high-speed internet connection to adopt e-commerce. However, a more recent study by Rueschke and Mason (2020) found that there are no significant differences in the adoption of e-commerce between rural and urban enterprises. Their research found no empirical support for the notion that residential location could affect entrepreneurs' adoption of e-commerce. Similarly, the use of e-commerce among male and female entrepreneurs is also different. Some researchers mentioned that there is a significant gender difference in e-commerce (Yang & Lester, 2005), in which women are less interested in e-commerce compared to men. Therefore, this study will look at the factors that may influence e-commerce adoption among urban women entrepreneurs.

Many studies suggested that e-commerce adoption may be influenced by technology-organization-environment (TOE) factors (Eze et al., 2021; Feibert & Jacobsen, 2019; Gómez et al., 2022; Mahakittikun et al., 2021; Mujahed et al., 2022; Nguyen et al., 2022; Rahayu & Day, 2015; Rahman et al., 2022; Singeh et al., 2020). Most recent studies used TOE to measure the adoption of cloud computing (Mujahed et al., 2022), mobile banking (Mahakittikun et al., 2021), online retailing (Nguyen et al., 2022), cashless payment system (Rahman et al., 2022), and social media adoption (Eze et al., 2021). Therefore, this study needed to conduct an Exploratory Factor Analysis (EFA) to measure the reliability of the TOE instrument to be used in measuring e-commerce adoption on a more specific sample, which is Malaysian urban women entrepreneurs.

This paper is divided into five sections. The next section deals with the literature review on e-commerce adoption, technological context, organizational context, and environmental context. Section 3 explains the methodology. The results are shown in section 4. The last section concludes this study and includes future research recommendations and limitations of the paper.

Literature Review

E-commerce (electronic commerce) is the terminology for the information exchange that takes place through an electronic system or computer network like the internet (Hajli et al., 2014; Huseynov & Yildirim, 2016). E-commerce refers to the process of purchasing, promoting for sale, exchanging or trading goods, services, and data through computer networks, including the World Wide Web (www), internet, and intranet, among other things (Turban et al., 2010). E-commerce, as defined by Kinder (2002), is a system involving the search, evaluation, and transaction processes, as well as post-purchase engagement that is made possible and facilitated by information and communication technology.

Technological Context

The technological context of the organization includes both internal and external technologies that are important to an organization (Oliveira & Martins, 2011). It comprises existing tools and equipment within the organization, as well as a variety of externally accessible technology (Tornatzky et al., 1990). For this study, technology context refers to relative advantage and compatibility.

Firstly, relative advantage refers to the direct and indirect benefits that a business may derive from e-commerce. Some researchers (Gangwar et al., 2015; Mahakittikun et al., 2021; Nguyen et al., 2022) found that entrepreneurs will be more likely to adopt e-commerce if they feel they perceive a greater relative advantage. This indicates that anticipated e-commerce

benefits boost e-commerce adoption. When managers believe that adopting e-commerce would benefit the company strategically and operationally, they are more inclined to advocate for the shift to e-commerce.

Compatibility refers to the level of compatibility between e-commerce and the company's existing technological infrastructure, culture, values, and working procedures (Morteza et al., 2011). If an innovation is in keeping with the organization's core principles, can address the needs of the organization, and is consistent with the organization's culture, it will be easily accepted by the organization. If organizational policy and technological innovation are compatible, it will be simpler to express innovation in a more familiar setting (Rahayu & Day, 2015). Therefore, compatibility for this study can be referred to as the degree to which e-commerce interacts with current firms' operations, as well as suppliers, customers, and competitors. Many studies (Eze et al., 2021; Gangwar et al., 2015; Nguyen et al., 2022; Rahman et al., 2022; Saffu et al., 2008) found that compatibility has a significant relationship with e-commerce adoption. Some other studies (Mahakittikun et al., 2021; Rahayu & Day, 2015), however, found that compatibility has a positive correlation with e-commerce adoption, but the correlation is not statistically significant.

Organizational Context

The organizational context refers to the characteristics of the firm that might influence the adoption of e-commerce technology (Rahayu & Day, 2015). The organizational context in this study refers to top management support and organizational readiness. Nguyen et al (2022) discovered that top management support has a role in determining the adoption of e-commerce. Managers who support the use of e-commerce in commercial activities within their firm tend to take the initiative and have a positive management attitude towards e-commerce. Top management is more likely to play a significant role in persuading their staff to adopt e-commerce when they acknowledge the value of technology. Additionally, they are more willing to invest resources in technology utilisation. In other words, it acts as a catalyst to quicken the business transformation process, which in turn speeds up the adoption of e-commerce.

Next, organizational readiness is an assessment of whether a company's resources and capabilities (such as its technological infrastructure, related systems, and technical skills) are sufficient to deploy e-commerce. All accessible and pertinent resources in business operations must be prepared to successfully adopt e-commerce. The likelihood that a company will adopt e-commerce increases if it has these pertinent resources and technical strengths (Gangwar et al., 2015). In other words, the greater the organizational readiness, the more likely the organization will adopt e-commerce, and vice versa. According to a study done by Rahayu and Day (2015), the use of e-commerce and organizational readiness are positively and significantly correlated.

Environmental Context

In this study, the environmental context refers to competition intensity and government support. Competition intensity is the degree to which firms are driven to adopt new technology to compete in the market. Firms may feel pressured to adopt e-commerce to remain competitive if they realize that their rivals are doing so (Rahayu & Day, 2015). Firms are compelled to diversify strategies to keep up with the competition as a result of competitive pressure. In other words, the likelihood that e-commerce adoption will occur increases with the intensity of industry competitiveness. Some researchers (Mahakittikun et

al., 2021) found that competitive pressure may influence e-commerce adoption. However, some studies (Nguyen et al., 2022; Rahayu & Day, 2015) found that there is no evidence to indicate a relationship between e-commerce adoption and competitive pressure.

Next, government support refers to government involvement in supporting e-commerce for business operations, marketing, payment systems, finance, and infrastructure. A country's economic activity may be considerably boosted when its government helps businesses adopt e-commerce into their operations through financial aid and infrastructure. Nguyen et al. (2022) emphasized a close relationship between government support and innovation adoption. This suggests that firms' adoption of e-commerce is greatly influenced by government support. Their findings demonstrate that governments must provide both financial and non-financial support to create policies, which in turn improves firms' decisions about e-commerce adoption. Their findings are also supported by other studies (Mahakittikun et al., 2021; Mujahed et al., 2022) which found that government support is the most important factor in influencing e-commerce adoption.

Methodology

A cross-sectional study was carried out in Selangor state. It was conducted over a two-month period from May to June 2022. This study was conducted on women entrepreneurs who run businesses in urban areas. The sample was selected using a simple random sampling method. A total of 110 urban women entrepreneurs completed and returned the questionnaire with a response rate of 80%.

The questionnaire was developed and modified from previous studies (Ahmad et al., 2015; Ali et al., 2019; Cruz-Jesus, 2019; Gangwar et al., 2015; Gutierrez et al., 2015; Hamed et al., 2015; Yeh et al., 2015; Zhu et al., 2006). The instrument used for this study was a self-administered questionnaire with five components. Part A consisted of socio-demographic data that includes age, ethnicity, education level, and type of business, while parts B, C and D contained questions about technology context, organization context, and environment context. Finally, Section E contained questions related to e-commerce adoption.

This study employed Statistical Package for Social Sciences version 27.0 for data analyses. Before the measurement could be utilized on urban women entrepreneurs, the reliability of the modified instrument needed to be examined. The current study describes the Exploratory Factor Analysis (EFA) process for validity, reliability, and for getting truly feasible items to measure e-commerce adoption and TOE constructs for urban women entrepreneurs. This study suggests that the core dimensions to quantify e-commerce adoption among urban women entrepreneurs are technology, organization, and environment.

Results and Discussion

In this study, there were six dimensions and 31 items for the TOE constructs, which were adapted from previous studies (Ahmad et al., 2015; Ali et al., 2019; Cruz-Jesus, 2019; Gangwar et al., 2015; Gutierrez et al., 2015; Hamed et al., 2015; Yeh et al., 2015; Zhu et al., 2006). Among 31 adapted items of e-commerce adoption and TOE constructs, three items belong to e-commerce adoption dimension, four items belong to the relative advantage dimension, five items belong to the compatibility dimension, four items belong to top management support, four items belong to the organizational readiness dimension, six items belong to the competition intensity dimension, and five items belong to the government support dimension.

Table 1

Kaiser–Meyer–Olkin (KMO)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.848
Bartlett's Test of Sphericity	Approx. Chi-Square	3060.858
	df	465
	Sig.	.000

As shown in Table 1, the Kaiser-Meyer-Olkin (KMO) value of 0.848 is excellent and is higher than the KMO's 0.60 general acceptance index. Additionally, Table 1 shows that the significance value of Bartlett's Test of Sphericity is 0.00, which satisfies the requirement to have a significance value of less than 0.005. (Bahkia et al., 2019). The value shows that these factors are adequate for intercorrelation. Furthermore, it implies that the sample size and data were appropriate and sufficient to continue with the reduction process.

Table 2

Total Variance Explained (Rotation Sums of Squared Loadings)

Factor	Total	% of Variance	Cumulative %
1	6.534	21.076	21.076
2	5.083	16.396	37.472
3	3.972	12.813	50.285
4	2.590	8.356	58.641
5	2.482	8.006	66.647
6	1.088	3.031	69.678

Extraction Method: Principal Axis Factoring.

The primary axis factorization method with Varimax Rotation and Kaiser Normalization criteria of eigenvalues 1 or greater was used to extract the factors. To make sure that the factor grouping is not correlated, Varimax rotation was chosen. The five components of the TOE construct that were retrieved by the EFA procedures are shown in Table 2 and will be taken into consideration for future investigation. The eigenvalues were in the range of 1.088 to 6.534. With an eigenvalue of 6.534, the first component accounts for 21.076% of the variance. Component 2 contributed 16.396% (eigenvalue = 5.083), component 3 contributed 12.813% (eigenvalue = 3.972), component 4 contributed 8.356% (eigenvalue = 2.590), component 5 contributed 8.006% (eigenvalue = 2.482), and component 6 contributed 3.031% (eigenvalue = 1.088). The sum of six components explained 69.678% of the variance, which is acceptable because it is higher than 60% of the variance (Bahkia et al., 2019).

Table 3

Rotated Factor Matrix

	Factor					
	1	2	3	4	5	6
ECA1	.757					
ECA2	.760					
ECA3	.730					
RA1		.697				
RA2		.747				
RA3*		.588				

RA4		.745			
CA1			.656		
CA2			.686		
CA3			.642		
CA4			.798		
CA5			.830		
MS1*				.408	
MS2				.813	
MS3				.685	
MS4*				.484	
OE1*				.582	
OE2				.787	
OE3				.739	
OE4*				.497	
CI1					.797
CI2					.831
CI3					.712
CI4					.719
CI5					.737
CI6					.728
GS1					.775
GS2					.750
GS3					.658
GS4					.676
GS5					.734
Extraction Method: Principal Axis Factoring.					
Rotation Method: Varimax with Kaiser Normalization.					
* Deleted items					

The results in Table 3 further demonstrate that the EFA procedure extracted six components. Eight items contained in component 4, which are four items from Top Management Support (MS1, MS2, MS3, and MS4) and four items from Organizational Readiness (OE1, OE2, OE3 and OE4) are seen to measure the same construct. Therefore, this study renamed this component with a new name, Management Readiness.

A specific number of items with the appropriate factor loading are present in each component. Since factor loading shows the usefulness of the items in measuring the specific construct, only items with a factor loading above 0.60 will be preserved (Bahkia et al., 2019). The rotated component matrix shows that 26 items have factor loadings greater than 0.60. One item from component 2 (RA3) and four items from component 4 (MS1, MS4, OE1, and OE4) indicate that the factor loading of the items is less than 0.60. As a result, all five items must be deleted.

The final instrument consists of six components, comprising three items belonging to the e-commerce adoption dimension, three items belonging to the relative advantage dimension, five items belonging to the compatibility dimension, four items belonging to the management readiness dimension, six items belonging to the competition intensity dimension, and five items belonging to government support dimension.

Reliability

Reliability refers to the consistency, equivalence, and stability of the instrument by quantifying the measurement error. It means that the respondent will get the same score from the instrument if the trait to be measured does not change even after being measured numerous times with the same instrument. To assess the internal consistency of the retained items' reliability in assessing the constructs, the researchers need to compute Cronbach's alpha. To indicate that the element achieves internal reliability, Cronbach's alpha value must be greater than 0.70 (Bahkia et al., 2019). The six components that measure the e-commerce adoption and TOE construct, with their respective Cronbach's alpha values, are shown in Table 4.

Table 4

The table shows the internal reliability coefficient for assumed factors.

Component	Name	Number of items	Cronbach's Alpha
1	E-commerce adoption	3	.902
2	Relative advantage	3	.773
3	Compatibility	5	.916
4	Management Readiness	4	.776
5	Competition intensity	6	.934
6	Government support	5	.897

The Cronbach's alpha for each component indicates a high-reliability level that is higher than the cutoff point of 0.70. The Cronbach's alpha values for the six components are as follows: 0.902 for component 1 (e-commerce adoption), 0.773 for component 2 (relative advantage), 0.916 for component 3 (compatibility), 0.776 for component 4 (management readiness), 0.934 for component 5 (competition intensity) and 0.897 for component 6 (government support). It suggests that the extracted components with their associated items can be used to measure e-commerce adoption and TOE constructs. Hence, future researchers are recommended to use those items to measure e-commerce adoption and TOE constructs, especially in the context of women entrepreneurs.

Conclusion

Recent research has added to the existing knowledge regarding the measurement of e-commerce adoption and TOE constructs, particularly among urban women entrepreneurs. The EFA results extracted six components, including e-commerce adoption, relative advantage, compatibility, management readiness, competitive intensity, and government assistance, as determined by the 23 elements. The instrument tested also achieved Bartlett's Test of Sphericity significance value of less than 0.005, exceeding the general acceptance index of KMO value of 0.60, and factors loading above the minimum threshold of 0.60 (Bahkia et al., 2019).

The findings of this study demonstrated that e-commerce adoption and TOE instruments have completed measurement characteristics and satisfy various requirements. The Cronbach's alpha values for this instrument ranged from 0.773 to 0.934, which indicates a high-reliability value. The outcome is consistent with prior research, which discovered that similar instruments used by other researchers have a Cronbach's alpha value above 0.70 (Gómez et al., 2022; Mahakittikun et al., 2021; Nguyen et al., 2022). Thus, the e-commerce

adoption and TOE instrument developed by the current study is precise, understandable, and equivalent to the original version.

Therefore, this study suggests that e-commerce adoption and TOE measurements are reliable, and this validated instrument is consistent and robust across samples. As a better alternative to using existing instruments used on entrepreneurs from a general context, this instrument might be taken into consideration for future research to measure e-commerce adoption and TOE in the context of urban women entrepreneurs. However, further research needs to be done on a sample of women entrepreneurs from the other states in Malaysia to validate the instrument.

Some study limitations may affect outcomes and generalizations. The survey was conducted in Selangor, which produces results limited to the context of entrepreneurs in Malaysia. While the data was collected, Malaysia had just entered the endemic era of Covid-19, where many entrepreneurs were just beginning to recover from the effects of the Movement Control Order (MCO). Therefore, the current situation of entrepreneurs may influence their responses when participating in the survey conducted. Thus, to assess the actual e-commerce adoption situation, interviews and focus groups with entrepreneurs are greatly recommended.

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