

TOE Framework for E-Commerce Adoption by MSMEs during The COVID-19 Pandemic: Can Trust Moderate?

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Abstract—Currently, there are still many MSMEs in the regions that have not been connected to the digital ecosystem. This results in limited market reach, a lack of visibility, a lack of operational efficiency, and difficulty competing in the digital market. The purpose of this study is to review the adoption of e-commerce among MSMEs during the COVID-19 pandemic within the scope of the organization. Integrating the TOE framework (technology, organization, environment) with trust is carried out to explain the key parameters behind the adoption of e-commerce by MSMEs. This study collected samples using a saturated sample technique from 181 people who were members of the population. There were 153 questionnaires that were returned in full for further analysis using SEM-PLS modeling. The test results showed that technology did not have a significant influence on the adoption of e-commerce. Organizations, the environment during the pandemic, and trust have had a significant influence on the adoption of e-commerce. In addition, organizations that are moderated by trust have no significant effect on e-commerce adoption. The role of trust is as a moderation predictor. This research shows that the TOE framework is still strong enough to be used in explaining the adoption of e-commerce by MSMEs. This research also expands the TOE framework, where trust can also influence MSMEs to adopt e-commerce. Researchers and managers can use the set of variables that have been identified to strategize the adoption of e-commerce by MSMEs. This study presents a series of variables that can be used to study the adoption of e-commerce by MSMEs in the future.

Index Terms—Technology, organization, environment during the pandemic, e-commerce adoption, MSMEs.

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I. INTRODUCTION

The majority of Indonesians currently work in the MSME sector. MSMEs in Indonesia are equivalent to 99.99% of the total existing business units [1]. This shows how big the role of MSMEs is in building the Indonesian economy. Currently, the COVID-19 pandemic has changed all aspects of people's lives because people are required to keep their distance from each other [2]. People have to start adapting to a new life; even in terms of shopping, they have begun to switch to online shopping [3]. Some experts believe that e-commerce is the only future for retail sales by MSMEs [4, 5]. According to them, currently, MSMEs are still constrained in terms of product marketing through digital media.

The Minister of Cooperatives and SMEs of Indonesia, Teten Masduki said that there are still many MSMEs in areas that have not been connected to the digital ecosystem. This makes it difficult for MSMEs to compete with competitors who have utilized digital marketing, limited market reach, lack of visibility, and lack of operational efficiency, so it needs encouragement so that MSMEs are able to use digital systems in marketing their products [7]. Some studies mention that research related to the adoption of e-commerce in developing countries is still very rare [8, 9]. This requires research to identify the determinants of e-commerce adoption by MSMEs in Indonesia. There are several theories that can be used to identify the determinants of e-commerce adoption by MSMEs, one of which is the TOE framework [10, 11]. The TOE framework describes the adoption of technology within the organizational sphere based on technology-organization-environment [12, 13]. The TOE framework is considered suitable to explain the adoption of e-commerce by MSMEs because it can be used within the scope of MSMEs as an organization [14].

According to several studies, technology has a significant influence on the adoption of e-commerce [15-17]. If e-commerce technology is considered useful, profitable, and in accordance with the values adopted by MSMEs, then the adoption of e-commerce will be more likely to occur [18]. Another study states that organizations are the most widely used context for identifying decision-making to adopt innovations by MSMEs [19]. Previous research findings

suggest that organizations have a significant influence on e-commerce adoption [15-17]. Other studies cite the opposite result, where organizations do not have a significant influence on e-commerce adoption [20, 21]. Religia et al. [22] stated that MSMEs are organizations in a too small scope, so organizational decisions are not always in the hands of top management, and not necessarily MSMEs have enough human resources to operate e-commerce. According to some studies, it is also mentioned that the environment has a significant impact on the adoption of e-commerce [15, 17, 23]. There is pressure felt by MSMEs from their environment, especially during the COVID-19 pandemic, which has made MSMEs start to look at e-commerce as an alternative to marketing their products [24, 25]. The environment referred to in this study is the MSME environment during the pandemic, because this research was conducted during the COVID-19 pandemic and wants to see how far the COVID-19 pandemic affects MSMEs adoption of e-commerce.

According to Pavlou [26], trust plays an important role in the acceptance of technology. Higher dependence on technology in recent years has led to trust in technology also getting more attention [27]. Some studies state that trust has a significant influence on the use of e-commerce [28, 29]. The existence of organizational trust in the technology to be used is essential for the acceptance of new technologies [30, 31]. Users who believe that e-commerce can be reliable and have good quality will be more interested in using it [32].

Based on the discussion in the previous paragraph, it is known that there are two research gaps in this article, namely:

- 1) There is still very limited research discussing the adoption of e-commerce by MSMEs during the COVID-19 pandemic, especially in Indonesia;
- 2) The results of previous research differ on the influence of organizations on the adoption of e-commerce. There are studies that say that organizations have a significant influence on the adoption of e-commerce, while other studies state the opposite.

This research gap requires further research to be able to answer it, so that theoretically it is expected to contribute to the TOE framework literature, and practically it is expected to be used as a model in preparing e-commerce adoption strategies among MSMEs. This study will try to answer two research questions, namely: (1) how to analyze and explain the role of technology, organization, environment, and trust in influencing e-commerce adoption intentions among MSMEs; and (2) how trust moderates the organization in influencing e-commerce adoption intentions among MSMEs.

II. RELATED WORK AND HYPOTHESIS

A. E-Commerce Adoption

Saridakis et al. [33] define e-commerce as the process of transactions through internet platforms in order to conduct trade (e.g., price, product availability, order processing, and product delivery) among participants in marketing channels. E-Commerce uses electronic means for the sale, marketing, and distribution of products and services over the Internet [34]. Lian et al. [35] said it's not only about the use of new technologies for marketing, but e-commerce also provides a wide range of services and prospects for electronic commerce.

E-commerce adoption can help MSMEs grow by exploring new markets and accessing previously untapped client segments. The existence of e-commerce changes the primary rule of expansion into foreign markets for MSMEs with more automated digital commercial transactions. MSMEs are said to adopt e-commerce when they actually use e-commerce applications to help market their products [18, 22]. According to Amofah and Chai [36], MSMEs that adopt e-commerce can also be seen through the continuous use of e-commerce.

B. TOE Framework

The TOE framework is a model that classifies technology, organization, and environment as factors influencing the adoption of innovation [18]. Some studies use the TOE framework to look at the adoption of innovations in the form of information technology (e.g., e-commerce, cloud computing, etc.) [10, 12]. This study uses the TOE framework because the TOE framework is suitable for explaining the adoption of innovation within the organizational sphere [14]. The TOE framework will be used as a theoretical basis for making research models and hypotheses.

1) Technology

The first factor of the TOE framework is technology, where technology refers to the characteristics of the technology that are relevant to the company. According to Abed [37], the technological characteristics of an organization usually explain the adoption of innovations in the IT field of the organization. Some studies suggest that technology consists of indicators of perceived usability, relative advantages, and compatibility [37, 38]. According to Davis [39], perception of use refers to the extent to which the user considers that using a particular technology will improve its performance. The relative advantage can be seen in the extent to which an innovation is considered better than the idea it replaces [18]. Compatibility refers to the extent to which an innovation is considered in accordance with the values that exist in the organization [40]. Several previous studies have mentioned that technology has a significant influence on e-commerce adoption [15-17]. When e-commerce technology is considered easy to use, MSMEs will be more likely to adopt e-commerce [18]. Based on previous studies, it will be hypothesized:

H1 : *Technology has a significant influence on the adoption of e-commerce by MSMEs*

2) Organization

The second factor of the TOE framework is organization. Organization refers to the characteristics and resources of an organization in the adoption of technology. According to Yeng et al. [19], organizational characteristics are the most widely used factor to explain the adoption of innovation by MSMEs. Organizations can be explained through indicators of organizational readiness and top management support [37, 38]. Organizational readiness refers to the level of technical and financial resources available in the organization to adopt new innovative technologies [41]. Explains that top management support refers to the degree to which managers understand and treat the technological capabilities of the new technologies to

be adopted [42]. Previous research has found that organizations have a significant influence on e-commerce adoption [15-17]. Based on previous research, it will be hypothesized:

H2 : *Organizations have a significant influence on the adoption of e-commerce by MSMEs*

3) Environment during pandemic

The third factor of the TOE framework is the environment. Larch refers to external pressures and supports those that affect the adoption of technology. Several studies state that the environment can be seen through indicators of competitive pressure and consumer pressure during the pandemic [24, 37, 38]. Competitive pressure refers to the pressure experienced by MSMEs from similar business competitors who have adopted e-commerce to obtain a competitive advantage [22]. Consumer pressure during the pandemic refers to the desire of MSMEs to provide valid product/service information and ease of product purchase transactions during the pandemic [25, 43]. Previous research stated that MSMEs are under pressure from the pandemic, where people are required to keep their distance from each other, including in terms of shopping [24, 25]. Several studies have found that environments are significant to e-commerce adoption [15, 17, 23]. Based on previous research, the environment referred to in this study is the environment of MSMEs during the pandemic, so it is hypothesized:

H3 : *The environment during the pandemic had a significant influence on the adoption of e-commerce by MSMEs*

C. Trust

Trust is at the heart of social exchange, and its influence on determining organizational outcomes in empirical matters has been quite consistent and positive [44]. According to Aparicio et al. [32], "believing user" refers to the reliability and quality of e-commerce, which will make users more interested in using such e-commerce [32]. Some studies state that trust can be seen in indicators of service reliability and service quality [32, 45]. E-commerce that can be relied on refers to the availability of services that facilitate the processes of transaction and product marketing [46]. Quality e-commerce refers to the minimal risk that will be caused by the use of e-commerce [26]. Previous studies have found that trust has a significant influence on the use of e-commerce [28, 29]. An organization's trust in the technology to be adopted is essential to adopting new technologies [30, 31]. Based on previous research, it will be hypothesized:

H4 : *Trust has a significant influence on the adoption of e-commerce by MSMEs*

H5 : *Organizations moderated by trust have a significant effect on the adoption of e-commerce by MSMEs*

This study tested five hypotheses that have been presented. The conceptual model formed from this research hypothesis

can be seen in Figure 1.

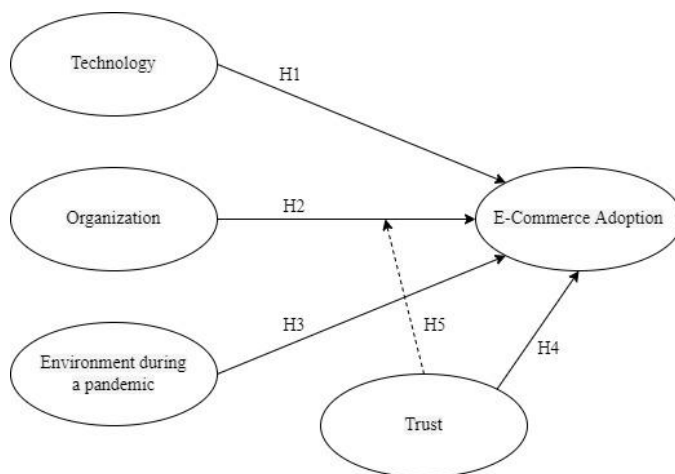


Fig. 1. Conceptual Model of Research

III. RESEARCH METHOD

There are several stages carried out in this study, starting from identifying the problem of the research object, identifying research gaps, formulating hypotheses, distributing questionnaires, analyzing using SEM-PLS, discussing research results, and making research conclusions. This research took data from e-commerce site belanjaukm.com. There were 525 MSMEs that had joined belanjaukm.com when this study was conducted, but only 181 MSMEs were used as potential respondents. The selection of 181 MSMEs is based on population criteria, namely: (1) respondents have a minimum of one employee, this is due to the assumption that the object under study is an MSME within the scope of the organization; (2) the respondent is a manager of MSMEs, this is because the manager has the authority to decide whether to adopt e-commerce or not. This study used non-probability sampling as a withdrawal process for one. Sample collection was carried out using a census of 181 populations conducted for 1 month (August 2022). The distribution of questionnaires was carried out using an online survey through the www.googledocs.com site, which was shared using the MSME WhatsApp Application contact. Based on the questionnaires distributed, there were 161 questionnaires returned, but only 153 were returned completely, so these 153 questionnaires were used as research data. Curran and Blackburn [47] argue that the number of respondents returning is at least 60%, so the 153 questionnaires collected can be considered to have met the 60% threshold because they reached 84.53% of the returned data. Following what was conveyed by Malhotra [48], the size of the research data was carried out using a Likert scale from a scale of 1 (strongly disagree) to a scale of 5 (strongly agree). This research uses an SEM model that utilizes analysts' partial least square (PLS) using the Smart PLS application version 3.0. The use of PLS is not only to test the relationship between the research variability of the constructed model but also to test the external

relationship (outer model) and the internal relationship/inner model [49]. This study also conducted interviews to explain the results of tests conducted to sharpen the results of the study. The interview was conducted after distributing the questionnaire to 10 randomly selected respondents. The stages of this research can be seen in Fig. 2.

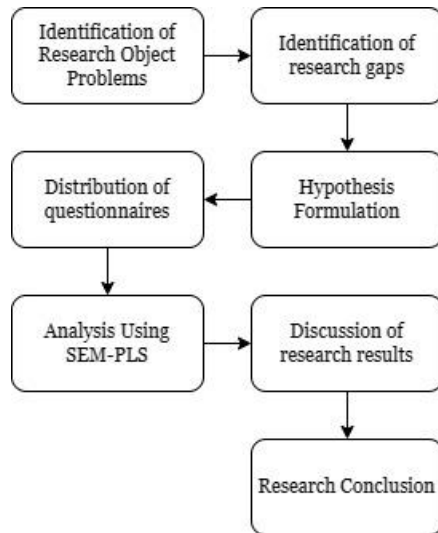


Fig. 2. Research Stages

IV. RESULT AND DISCUSSION

A. Characteristics of Respondents

Based on the questionnaires that have been collected, the demographic characteristics of respondents were obtained in the form of the number of employees owned by MSMEs, the types of products marketed by MSMEs, and the latest education from top management holders in MSMEs. The majority of MSMEs have 1-3 employees, or a percentage of more than 50%. This shows that most MSMEs in Indonesia are indeed dominated by microbusiness units. Many MSMEs do not market their own products but instead take locally made products to be marketed. This points to the fact that the majority of MSMEs focus more on business processes and product marketing alone without having to be charged for the production process. This result is in accordance with an interview that reveals that MSMEs are more interested in making finished products than their own products because they don't want to be bothered with the production process.

Table 1.
Characteristics Demography Responden

Characteristic	Criterion	N	Percentage
Number of Employees	1-3 employees	95	62.1
	3-5 employees	34	22.2
	6-8 employees	24	15.7
Product Type	Locally Made	76	49.7
	Homemade	57	37.3
	Service Services	20	13.1
Final Education	Junior High School	34	22.2
	Senior High School	87	56.9
	Bachelor's degree	32	20.9

Note: N = Number of respondents

The production process is considered to require a lot of resources and permits, which are still difficult to obtain because of the limited resources owned by MSMEs. Top management in MSMEs is dominated by leaders with the equivalent of senior high school. According to Suryono and Pitoyo [50], the Indonesian population, especially on the island of Java, with a last high school education or equivalent, mostly works in the fields of sales business personnel and service personnel. The complete demography characteristics of respondents can be seen in Table 1.

B. Validity and Reliability Test Results

This study used SmartPLS 3.0 as a modeling technique for structural equations. SmartPLS was chosen because it has no restrictions regarding sample size and relative distribution normality [51]. The stage begins with evaluating the quality of the measurement model, followed by assessing the structural model. Table 2 shows the value of loading between 0.709 and 0.798; the result is higher than the threshold of 0.7 and statistically significant ($p < 0.05$) to be said to be convergently valid.

Table 2.

Average, Loadings, Average Variance Extracted, and Composite Reliability					
Variable	Indicators	Items	Loading	AVE	CR
Technology (TEC)	usability	TEC_1	0.750	0.782	0.785
		TEC_2	0.709		
	relative profit	TEC_3	0.742		
		TEC_4	0.797		
	Compatibility	TEC_5	0.764		
		TEC_6	0.713		
Organization (ORG)	Organizational readiness	ORG_1	0.731	0.734	0.800
		ORG_2	0.788		
		ORG_3	0.752		
	Top management support	ORG_4	0.786		
		ORG_5	0.795		
Environment during a pandemic (EDP)	Competitive pressure	EDP_1	0.725	0.774	0.817
		EDP_2	0.792		
	Consumer pressure during the pandemic	EDP_3	0.798		
		EDP_4	0.761		
		EDP_5	0.750		
Trust (TRU)	Service reliability	TRU_1	0.776	0.786	0.850
		TRU_2	0.783		
	Quality of service	TRU_3	0.730		
		TRU_4	0.770		
E-commerce adoption (ECA)	Actual usage	ECA_1	0.711	0.767	0.802
		ECA_2	0.776		
	Continuous use	ECA_3	0.748		
		ECA_4	0.758		

Note: $p < 0.05$; AVE = Average Variance Extracted; CR = Composite Reliability.

In addition, the average variance extracted (AVE) on all variables is valued greater than the threshold of 0.5, which indicates convergent validity for all variables used [52]. The

composite reliability value obtained ranges from 0.785 to 0.850, the results show that all research instruments used have been reliable and reflect the reliability of internal consistency because they are worth more than 0.7 [53].

Table 3 shows that the square root of the AVE in each variable is greater than the correlation between constructs, thus proving that the instrument used has discriminant validity [54].

Table 3.
Discriminant Validity

	TEC	ORG	EDP	ECA	TRU
TEC	0.753				
ORG	0.529	0.709			
EDP	0.586	0.637	0.788		
ECA	0.536	0.579	0.579	0.758	
TRU	0.458	0.303	0.364	0.463	0.766

Note: TEC = Technology; ORG = Organization; EDP = Environment During a Pandemic; ECA = E-Commerce Adoption; TRU = Trust.

C. Inter-Variable Relationship Test Results

Table 4 shows the results of testing relationships between variables. The research model built has an R-Square value of 0.483, so it can explain 48.3% of the variations in the adoption of e-commerce by MSMEs. The test results showed that technology had no significant effect on e-commerce adoption ($Original\ Sample_{TEC} = 0.108; p > 0.05$), so H1 was rejected. Organizations have a significant effect on e-commerce adoption ($Original\ Sample_{ORG} = 0.000; p < 0.001$), thus H2 is accepted. The original sample value obtained from the organization was 0.297. This shows the direction of the positive relationship of the organization in influencing the adoption of e-commerce. The environment during the pandemic had a significant influence on the adoption of e-commerce ($Original\ Sample_{EDP} = 0.010; p < 0.01$), so H3 is accepted. The original sample value obtained from the environment during the pandemic was 0.231.

Table 4.
Intervariable Relationship Test Results

Relations	OS	SM	SD	T-Stat	P-Values	Sig
TEC -> ECA	0.143	0.145	0.089	1.611	0.108	NS
ORG -> ECA	0.297	0.298	0.075	3.958	0.000	S
EDP -> ECA	0.231	0.236	0.091	2.541	0.010**	S
TRU -> ECA	0.212	0.211	0.086	2.464	0.014*	S
ORG*TRU -> ECA	-0.040	-0.040	0.079	0.511	0.610	NS

Note: R-Square = 0.483; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; OS = Original Sample; SM = Sample Mean; SD = Standard Deviation; T-Stat = T Statistics; Sig. = Significance; NS = Not Significant; S = Significant; TEC = Technology; ORG = Organization; EDP = Environment During a Pandemic; ECA = E-Commerce Adoption; TRU = Trust.

It also shows the direction of the positive relationship between the environment and the pandemic in influencing the

adoption of e-commerce. Trust significantly undermines e-commerce adoption ($Original\ Sample_{TRU} = 0.014; p < 0.05$), so H4 is accepted. Trust obtained an original sample value of 0.212. This shows the direction of the positive relationship of trust in influencing the adoption of e-commerce. The study also showed that trust had no significant effect in moderating organizations towards e-commerce adoption ($Original\ Sample_{ORG*TRU} = 0.610; p > 0.05$), thus H5 was rejected.

D. Discussion

This research was conducted because it considers the importance of using e-commerce for MSMEs. E-commerce can help MSMEs in achieving their business goals. This is as stated by Ramadhan et al. [57] which states that e-commerce can be used to facilitate the flow of communication along the company's supply chain in order to achieve a business goal through electronic channels (internet). The business objectives that can be achieved through e-commerce can be in the form of convenience for sellers (MSMEs) to be able to interact with buyers and can make it easier for buyers to get their needs without having to travel [58]. These needs must be considered by MSME players in order to survive in the current "new normal" market.

Technology is known to have no significant impact on e-commerce adoption. These results are in accordance with several studies that state that technology has no significant effect on the adoption of information [55, 56]. The interview results show that MSMEs adopt e-commerce not only because they see it as a platform that is useful, profitable, and in accordance with their needs, but also because they need the means, infrastructure, and technical capabilities to be able to use e-commerce applications [55, 56]. This finding contradicts several studies that mention that technology has a significant effect on e-commerce adoption [15-17]. This is a new research gap to be studied further in future studies.

Organizations are known to significantly influence e-commerce adoption. The results of this study are in accordance with the findings of several studies that mention similar results [15-17]. This shows that the greater the resources that MSMEs have for the adoption of e-commerce, the more likely it will be for these MSMEs to adopt e-commerce in their business activities. Based on the loading value, it is known that top management support has a greater value than other indicators in the organizational variable. The more top management feels the need to market their products through e-commerce, the more likely MSMEs will be to adopt e-commerce.

The results showed that the environment during the pandemic had a significant positive influence on the adoption of e-commerce. These findings support previous findings that suggest that the environment has a significant effect on e-commerce adoption [15, 17, 23]. The more internal and external pressures obtained by MSMEs to start adopting e-commerce during the pandemic, the more MSMEs are encouraged to adopt e-commerce. Consumer indicators during

the pandemic obtained the highest loading value compared to other indicators in the context variables. This shows that the more MSMEs are aware that their customers have begun to switch to using e-commerce during the pandemic, the more MSMEs are aware of starting to adopt e-commerce.

Trust is known to have a significant positive effect on e-commerce adoption. These results are in line with previous findings that trust has a significant effect on e-commerce adoption [28, 29]. The more reliable and quality e-commerce services there are for product marketing, the more likely it is for MSMEs to adopt e-commerce. Service reliability is the indicator with the highest loading value compared to other indicators in the trust variable. MSMEs will increasingly consider adopting e-commerce when they believe that it can simplify the process of marketing their products.

The results of this study show that trust has not been able to moderate organizations towards the adoption of e-commerce. The results of this study contradict some studies that state that organizational trust in the technology to be adopted is very important for adopting new technologies [30, 31]. The role of trust in moderating the organization adoption of e-commerce is limited to predictor moderation. Trust as a predictor of moderation means that trust only acts as an explanatory role in the model of relationships formed and does not moderate the organization towards e-commerce adoption. Based on the results of the interview, it was found that although MSMEs have the readiness and desire to adopt e-commerce, accompanied by trust in the e-commerce platform to be adopted, it still turns out that it will not be easy to adopt e-commerce without the ability to operate e-commerce.

This research provides several implications, both theoretically and practically. Theoretically, this study shows that the TOE framework is still strong enough to be used in explaining the adoption of e-commerce by MSMEs. This research also expands the TOE framework, where trust can also influence MSMEs to adopt e-commerce. In practical terms, this research can be used as a reference for MSMEs or e-commerce service providers in preparing strategies for implementing e-commerce among MSMEs. This research also shows that the demographics of MSMEs are dominated by MSMEs with micro-business units that market locally made products (not homemade products), with the top management being high school graduates.

V. CONCLUSION

The COVID-19 pandemic has encouraged people to change their behavior due to the new policy of keeping their distance from each other. The policy changes the normal to the new normal, including shopping to make ends meet. People who used to make transactions directly, are now starting to switch to online shopping through e-commerce. MSMEs, as the largest business unit in Indonesia, need to be encouraged to immediately adopt e-commerce to survive in this new marketing era. This research leverages the TOE framework and trust to explain the factors that influence the adoption of e-commerce by MSMEs.

This research found that technology has not been able to influence MSMEs adoption of e-commerce. MSMEs adopt e-commerce not only because they see it as a platform that is

useful, profitable, and suitable for their needs alone, but because they also need facilities (advice and infrastructure) and technical capabilities to be able to use operating e-commerce applications. Organizations, the environment during the pandemic, and trust can actually encourage MSMEs to adopt e-commerce. This research also found that organizations that are accompanied by trust have not been able to make MSMEs interested in adopting e-commerce. The role of trust is simply an explanation of the relationship model that is formed and has not been able to moderate the organizations adoption of e-commerce. Despite the preparation and desire that MSMEs have to adopt e-commerce, accompanied by trust in the e-commerce platform that will be adopted, it turns out that it will still not be easy to adopt e-commerce without the ability to operate e-commerce.

Theoretically, this research adds to the study of how e-commerce is used in developing countries, and it proves that the TOE framework is good enough to explain how MSMEs use e-commerce. Although the role of trust has not been able to moderate the organization adoption of e-commerce, this study found that trust can be used as a latent variable in explaining e-commerce adoption among MSMEs. This research practically contributes to stakeholders in the field of MSMEs in the preparation of e-commerce adoption strategies among MSMEs. Organizational factors of MSMEs, the environment of MSMEs during the pandemic, and MSMEs' trust in the e-commerce application to be adopted can be considered the main considerations in encouraging MSMEs to adopt e-commerce. Further research is expected to identify factors that can influence the role of technology in e-commerce adoption by MSMEs. Future research is also expected to consider facilities and technical capabilities in influencing MSMEs adoption of e-commerce.

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