

The Effect of The Technology Organization Environment (TOE) Framework and Diffusion of Innovation (DOI) Theory on The Business Performance of Micro Enterprises in Emerging Economies: Evidence from Indonesia

Rifqi Muhammad^{1*}, Ade Suherlan²

¹Faculty of Economics and Business, Universitas Islam Negeri Syarif Hidayatullah Jakarta, South Tangerang, Indonesia

²School of Social Sciences, Western Sydney University, Penrith, New South Wales, Australia

**Corresponding author*

ABSTRACT

This study aims to analyze how technological, organizational, environmental, and individual context effect Micro Enterprises' e-commerce adoption and its impact on business performance in Indonesia's emerging economy. This study employs a quantitative approach using the Structural Equation Model - Partial Least Squares (SEM-PLS), integrating the Technology-Organization-Environment (TOE) framework and the Diffusion of Innovation (DOI) theory. Data were obtained from 158 Micro Enterprises who use Shopee market place through questionnaires using a purposive sampling. The findings show that technological, organizational, and individual context directly affect e-commerce adoption, while environmental context does not. The findings also show that e-commerce adoption has a direct effect on the business performance of Micro Enterprises, and mediates the relationship between technological, organizational, and individual context on the business performance of Micro Enterprises. However, it does not mediate the relationship between environmental context and business performance. This study contributes to the development of digital marketing literature, particularly the determinants of technology adoption among Micro Enterprises, as well as to provide practical contribution for Micro Enterprises and policymakers in accelerating digital transformation in Indonesia's emerging economy.

Keywords:

Technology Organization Environment, Diffusion of Innovation, E-commerce Adoption, Business Performance, Micro Enterprises

JEL Classification: L81; M15; O33

Introduction

Micro, Small, and Medium Enterprises (MSMEs) are strategic sectors that make a great contribution to the Indonesia's emerging economy. Based on Omnibus Law (Law No. 11 of 2020 on Job Creation) and its implementing regulation, Government Regulation (PP) No. 7 of 2021, the specific criteria for Micro, Small, and Medium Enterprises (MSMEs) regarding business capital and annual turnover are defined in Table 1. Based on IMF Country Report 2024 data, the MSMEs sector in Indonesia contributes more than 60% to the national Gross Domestic Product (GDP) and absorbs up to 97% of the workforce. Data from the Ministry of Cooperatives and Small and Medium Enterprises notes that the number of MSMEs at the end of 2024 will reach around 64.2 million business units and continue to grow to 66 million business units in May 2025, with a contribution to GDP reaching 61.1–61.9% (detikfinance, 2025; Hidayat, 2025; Directorate General of Regional Development, 2024).

From the various factors driving the growth of MSMEs, e-commerce has emerged as a very decisive driver in the digital era. E-commerce allows MSMEs to expand market without investing in large physical outlets, lower marketing costs, and accelerate cross-regional transactions. The adoption of e-commerce leads to an increase in MSMEs' sales and revenue. It plays a role as one of the main pillars in encouraging MSMEs to upgrade. This growth is also reflected in the value of national e-commerce transactions which increased from IDR 42 trillion in 2017 to IDR 487 trillion in 2024, with Jakarta as the region with the highest percentage of online shopping in Indonesia, which is 32.32% (Abdullah, 2025; GoodStats, 2025; Databox, 2024).

Tabel 1. MSME Criteria

Business Scale	Criteria	
	Business Capital (Maximum)	Annual Sales / Turnover (Maximum)
Micro	Up to IDR 1 Billion	Up to IDR 2 Billion
Small	More than IDR 1 Billion up to IDR 5 Billion	More than IDR 2 Billion up to IDR 15 Billion
Medium	More than IDR 5 Billion up to IDR 10 Billion	More than IDR 15 Billion up to IDR 50 Billion

Source: Government Regulation (PP) No. 7 of 2021

However, in the midst of the rapid growth of e-commerce, the adoption rate by MSMEs in Indonesia is still relatively low. Government data shows that in 2023–2024, only around 25–27 million MSMEs (37.46%–41.51%) have adopted digital technology, and most of those connected come from Small and Medium Enterprises (SMEs), not Micro Enterprises. The low utilization of e-commerce by Micro Enterprises is triggered by the limited literacy and IT experience of business owners, the unpreparedness of technology and supporting infrastructure, the difficulty of accessing financing for digital investments, and concerns related to the security of online transactions (KEMENPANRB, 2024; Ausat & Peirisal, 2021).

To examine the factors influencing e-commerce adoption by Micro Enterprises in Indonesia's emerging economy, this study integrates the Technology–Organization–Environment (TOE) framework and Diffusion of Innovation (DOI) theory. In TOE framework, three factors may affect technological innovation in an organization, namely: technological, organizational, and environmental context. Meanwhile, the DOI theory explains that the adoption and the use of innovation by companies is influenced by innovation and organizational characteristics, including the characteristics of individual decision-makers. Thus, the combination of TOE framework and DOI theory complement each other, providing a more

comprehensive explanation of the innovation adoption process at both organizational and individual levels (Tornatzky & Fleischer, 1990; Rogers, 1995; Ilin et al., 2017).

Rahayu & Day's (2015) used the TOE framework and individual context as an influential factor in the adoption of e-commerce by Small and Medium Enterprises (SMEs) in Malang, East Java, Indonesia. Malang is the second-largest city in East Java after Surabaya, and the 12th-largest city in Indonesia by population. The study added the SMEs' business performance as a new variable and found that technology, organizational, and environmental factors significantly effect e-commerce adoption, which subsequently effect SMEs' business performance (Ausat & Peirisal, 2021). Different with Rahayu & Day's (2015) previous research, this study will analyze Micro Enterprises in Jakarta that use Shopee marketplace to sell their products. Shopee has the highest number of visitors in Indonesia, while Jakarta is the region with the highest online shopping transactions in Indonesia (Ausat & Peirisal, 2021; Scarlet Knight, 2025). This study will examine how technological, organizational, environmental, and individual contexts effect e-commerce adoption by Micro Enterprises, as well as its effects on the business performance, providing more relevant and contextual empirical evidence in Indonesia's emerging economy.

Theoretical Background and Hypotheses Development

Technology–Organization–Environment (TOE)

The TOE framework was first introduced by Tornatzky & Fleischer (1990) through his book, "The Processes of Technological Innovation". It explains that the process of adopting technological innovation at the organizational level is influenced by three main contexts, namely: the technological, organizational, and environmental context. The technological factor emphasizes the characteristics and perception of the technology to be used. The organizational factor focuses on the internal conditions of the organization, while the environmental factor refers to external pressure and support from competitors, consumers, and the government (Tornatzky & Fleischer, 1990).

Diffusion of Innovation (DOI)

The DOI theory was introduced by Rogers (1995) through his book, "The Diffusion of Innovations". It explains that the spread of new ideas and technologies follows certain predictable patterns, as well as being influenced by innovation characteristics and organizational characteristics, including individual decision-makers. The research of Ilin et al. (2017) found that the TOE framework and DOI theory related to each other, but overlaps where there are similarities in terms of innovation characteristics and technological contexts, as well as organizational characteristics and organizational contexts. However, the TOE framework does not include individual characteristics such as owner innovation, while the DOI does not take into account the effect of environmental factors. Thus, this study integrates combines the TOE framework and DOI theory, where the technological, organizational, and environmental context represent the TOE, while the individual context represents the DOI as an additional factor. This integration will comprehensively explain the e-commerce adoption by Micro Enterprises and its effect on business performance.

Business Performance

Business performance reflects the results of business achievements as a result of business strategies and decisions taken, including the decision to adopt digital technology. In this study, Micro Enterprises business performance was measured through increased sales, increased profits, and increased customer satisfaction. Previous research found that the adoption

of e-commerce has been proven to be able to improve the business performance of SMEs'. They confirmed that digital adoption has a significant effect on the operational performance and income of SMEs' (Ausat & Peirisal, 2021; Santos-Jaén et al., 2023; Effendi & Subroto, 2021).

Technological Context

The technological context reflects the perception of business actors towards the characteristics of the e-commerce technology to be adopted, which includes perceived benefits, compatibility, and cost. Perceived benefits are the perception of business actors regarding the extent to which e-commerce adoption is able to provide real benefits for businesses, such as increasing operational efficiency and expanding market reach, which has been proven to have a significant effect on adoption decisions. Compatibility refers to the extent to which e-commerce technology is able to align with infrastructure, organizational culture, and daily work practices. Cost includes all costs that must be borne by business actors in adopting e-commerce, which is often the main obstacle for business actors with limited financial resources (Al-Alawi & Al-Ali, 2015; Bening et al., 2023; Ghobakhloo et al., 2011; Setyowati et al., 2024). This previous research formulated the following hypotheses:

H1. Technological context effects e-commerce adoption.

H6. Technological context effects business performance through e-commerce adoption.

Organizational Context

The organizational context was measured through firm size and age of firm. Firm size refers to the scale of the business that reflects the availability of organizational resources, both in terms of finance, technology, and human resources. Thus, a business with a larger scale tend to has more adequate organizational capacity to support the adoption of digital technology. The age of firm describes the length of time a business has been operating, which reflects the level of maturity of the organization as well as the experience of business actors in dealing with changes in the business environment. Thus, a businesses that has been operating longer tend to has a more rational decision-making pattern in adopting new technologies (Al-Alawi & Al-Ali, 2015; Ausat & Peirisal, 2021; Bening et al., 2023). This previous research formulated the following hypotheses:

H2. Organizational context effects e-commerce adoption.

H7. Organizational context effects business performance through e-commerce adoption.

Environmental Context

The environmental context reflects external pressures and support from customers, suppliers, competitors, and government. Customer or supplier pressure refers to the level of pressure felt by the firm from customers or suppliers to adopt e-commerce as a means of transaction. Competitor pressure refers to the pressure that arises due to the intensity of competition between business actors, where the adoption of e-commerce by competitors encourages other firms to follow suit so as not to lose market share. Government support reflects support from government programs and policies in encouraging business digitalization (Al-Alawi & Al-Ali, 2015; Ausat & Peirisal, 2021; Bening et al., 2023). This previous research formulated the following hypotheses:

H3. Environmental context effects e-commerce adoption.

H8. Environmental context effects business performance through e-commerce adoption.

Individual Context

Individual context is an additional factor based on the DOI theory which is measured through owner innovativeness, IT skill and experience. Owner innovativeness refers to the level of tendency of business owners to accept, try, and implement new ideas of technologies in their business activities. It is a crucial factor in a business because a simple organizational structure makes technology adoption decisions depend heavily on the business owner's attitude toward innovation. Owner IT skills and experience describe the ability and experience of business owners in using and understanding information technology. It plays an important role in reducing uncertainty and risk in e-commerce adoption (Ausat & Peirisal, 2021; Bening et al., 2023; Gu, 2022; Rahayu & Day, 2015; Stuart & Day, 2015). This previous research formulated the following hypotheses:

H4. Individual context effects on e-commerce adoption.

H9. Individual context effects business performance through e-commerce adoption.

Ecommerce Adoption

E-commerce is a form of business where products and services are traded online through various digital channels, making it easier to transact between sellers and buyers without being limited by time and space. The use of e-commerce through marketplaces and commercial websites has been proven to be able to improve the performance of business. E-commerce adoption reflects the extent to which business actors have integrated digital platforms into their business processes, including the use of the internet for sales processes, the readiness of human resources in operating the platform, and the ability to respond to customers online in a timely manner (Ausat & Peirisal, 2021; Sahu & Singh, 2023). This previous research formulated the following hypotheses:

H5. E-commerce adoption effects business performance.

Thus, based on the theoretical background and hypothesis development above, the research framework is conceptualized in Figure 1.

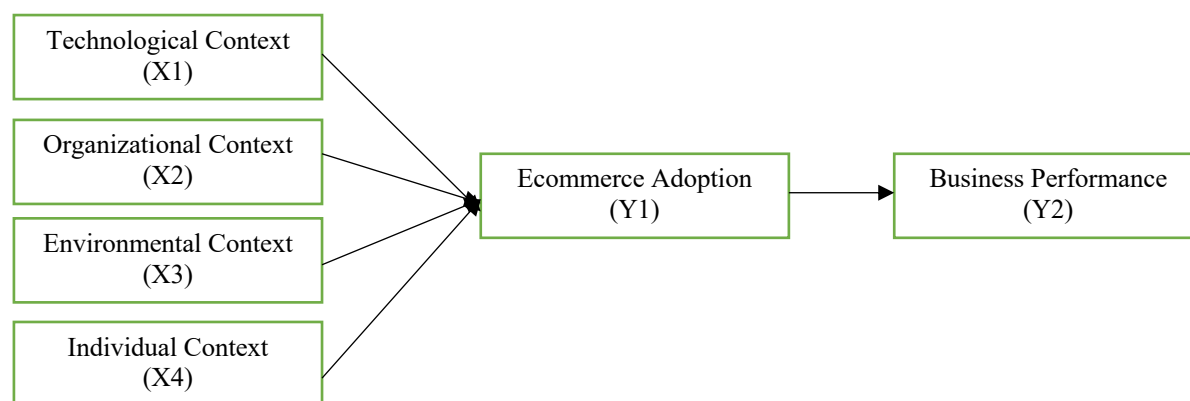


Figure 1. Conceptual Research Framework

Research Method

This study uses a quantitative approach with a positivistic paradigm that focuses on testing causal relationships between variables through statistical measurement. The design is explanatory research, which is to explain the effect of technological, organizational, environmental, and individual context on e-commerce adoption, as well as its effect on Micro

Enterprises' business performance, making e-commerce adoption as a mediating variable. All indicators of each variable are represented in Table 2.

Table 2. Operational Variables.

Variables	Dimensions	Indicators	References
Technological Context (X1)	Perceived Benefits	Online marketplace is beneficial for my business.	Ghobakhloo et al. (2011), Al-Alawi & Al-Ali (2015),
	Compatability	Online marketplace's service is consistent with the business process I run.	
	Cost	Online marketplace's service fees are affordable.	
Organizational Context (X2)	Firm Size	My business assets are sufficient to use online marketplace.	Al-Alawi & Al-Ali (2015), Ausat & Peirisal (2021)
	Age of Firm	My business is well established enough that I need to use online marketplace.	
Environmental Context (X3)	Customer and supplier Pressure	Buyers and Ssppliers encouraged me to sell on online marketplace.	Al-Alawi & Al-Ali (2015), Ausat & Peirisal (2021)
	Competitor Pressure	Market competition pushed me to sell on online marketplace.	
	External Support	Programs, training, policies, and funding from the government helped me transition to a digital business.	
Individual Context (x4)	Owner Innovativeness	Online marketplace makes me more creative and innovative.	Rahayu & Day (2015) and Ausat & Peirisal (2021)
	Owner IT Experience	My experience using technology has made it easier for me to use online marketplace.	
	Owner IT Ability	My ability to use technology makes it easier for me to use online marketplace.	
Ecommerce Adoption (Y1)	Internet use for product sales process	The internet facilities I have are quite adequate to transact at online marketplace.	Rahayu & Day (2015) and Ausat & Peirisal (2021)
	Readiness of human resources in ecommerce	The ability of the admin to operate in online marketplace helped my business development.	
	Responding to customers online in a timely manner	Online marketplace allows me to serve customers faster.	
Business Performance (Y2)	Increased Sales	Online marketplace can increase my sales.	Ausat & Peirisal (2021)
	Increased Profits	Online marketplace can increase my profits.	
	Increased Customer Satisfaction	Online marketplace can increase customer satisfaction.	

The sampling technique uses non-probability sampling with a purposive sampling approach. This study limites the Micro Enterprices in Jakarta who actively sell their products on Shopee marketplace, and have been operating for at least one year. The number of samples

refers to Hair et al. (2010), which is at least 5–10 times the number of indicators. Data collection was carried out through an online questionnaire and by visiting MSE actors directly. This study used 158 respondents as primary data. It was obtained through questionnaires based on the Likert scale of 1–5. This study also used secondary data which were obtained from scientific literature, official reports, and related publications (Scott, 2023).

The data was analyzed using the Structural Equation Modeling - Partial Least Squares (SEM-PLS) approach with SmartPLS 4.1 software. The SEM-PLS was chosen because it is suitable for predictive research, is able to test complex relationships between latent variables, and can be used in models involving mediation constructs (Hair et al., 2021). SEM-PLS also allows simultaneous evaluation of measurement models (outer model) and structural models (inner model).

Results

Respondent Characteristics

A total of 158 respondents met the research criteria, namely Micro Enterprises in Jakarta who are actively selling on Shopee marketplace, and have been operating for at least one year. The majority of respondents were in the age range of 30–45 years or the millennial group (48.7%), and dominated by the male gender (51.9%). In terms of education, the majority of respondents are high school graduates (41.8%). Most of the respondents operate the Shopee through mobile devices (49.4%) and have a turnover of less than IDR 300 million per year (60.1%). In terms of product categories, fashion is the most sold category (32.3%). In addition to Shopee, the majority of respondents are also actively selling their products through TikTok Shop as alternative platform.

Table 3. Respondent Characteristics

Characteristics		Quantity	%
Gender	Male	82	51.9
	Women	76	48.1
Age	17 – 30 years old	48	30.4
	>30 – 45 years old	77	48.7
	>45 – 60 years old	32	20.3
	>60 years old	1	0.6
Devices Used	PC	10	6.3
	Laptop	70	44.3
	Mobile	78	49.4
Turnover per year	<IDR 300 million	95	60.1
	IDR 300 million – IDR 2 billion	63	39.9
Product Categories on Shopee	Fashion	51	32.3
	FMCG	40	25.3
	Lifestyle	37	23.4
	Electronics	20	12.7
	Other Categories	10	6.3
E-commerce other than Shopee	Tokopedia	98	62
	Tiktok Shop	107	67.7
	Lazada	21	13.3
	Posted on Instagram	41	25.9
	Posted on Facebook	49	31.0
	Whatsapp	62	39.2

Measurement Model Evaluation (Outer Model)

All indicators in each variables showed an outer loading value above the required threshold (> 0.70) with values ranging from 0.915 to 0.966 (see Table 4). The Average Variance Extracted (AVE) value of the entire construct also exceeded the threshold of 0.50, with an average AVE of 0.899 (see Table 5). Thus, it meets the convergent validity criteria (Hair et al., 2021; Yamin, 2023). Construct reliability was evaluated through Cronbach's Alpha, Composite Reliability, and Composite Reliability (Table 6), all of which exceeded the minimum value of 0.70 (Yamin, 2023).

Table 4. Outer Loading

	Ecommerce adoption	Environmental context	Individual context	Business performance	Organizational context	Technological context
EA1	0.961					
EA2	0.951					
EA3	0.949					
EC1		0.946				
EC2		0.966				
EC3		0.952				
EC4		0.915				
EC5		0.957				
EC6		0.929				
EC7		0.953				
IC1			0.960			
IC2			0.959			
IC3			0.946			
KBU1				0.925		
KBU2				0.923		
KBU3				0.930		
OC1					0.956	
OC2					0.963	
TC1						0.933
TC2						0.953
TC3						0.964

Table 5. Average Variance Extracted

Variable	AVE
Technological Context	0.909
Organizational Context	0.894
Environmental Context	0.911
Individual Context	0.857
Ecommerce Adoption	0.921
Business Performance	0.903

Table 6. Construct Reliability

Variable	Cronbach's Alpha	Composite Reliability	Composite Reliability
Ecommerce Adoption	0.950	0.951	0.968
Environmental Context	0.982	1.039	0.983
Individual Context	0.951	0.952	0.969
Business Performance	0.917	0.917	0.947
Organizational Context	0.915	0.920	0.959
Technological Context	0.946	0.946	0.966

The discriminant validity was evaluated through three methods, namely: cross loading (Table 7), the Fornell-Larcker Criterion (Table 8), and the Heterotrait-Monotrait Ratio or HTMT (Table 9). The results showed that all indicators had the highest outer loading on their own constructs compared to other constructs. The Fornell-Larcker criterion compares the square root of the AVE of each construct with the correlation values between that construct and other constructs.

Table 7. Cross Loading

	Ecommerce adoption	Environmental context	Individual context	Business performance	Organizational context	Technological context
EA1	0.961	-0.110	0.756	0.790	0.660	0.733
EA2	0.951	-0.082	0.749	0.725	0.665	0.703
EA3	0.949	-0.054	0.757	0.741	0.682	0.690
EC1	-0.055	0.946	-0.098	-0.084	0.032	-0.091
EC2	-0.107	0.966	-0.128	-0.051	0.007	-0.129
EC3	-0.080	0.952	-0.123	-0.065	-0.044	-0.124
EC4	-0.002	0.915	-0.074	-0.005	0.053	-0.052
EC5	-0.061	0.957	-0.091	-0.053	0.000	-0.084
EC6	-0.026	0.929	-0.077	-0.018	0.006	-0.074
EC7	-0.101	0.953	-0.138	-0.098	-0.044	-0.142
IC1	0.771	-0.076	0.960	0.688	0.595	0.674
IC2	0.760	-0.109	0.959	0.675	0.556	0.671
IC3	0.731	-0.169	0.946	0.631	0.566	0.662
KBU1	0.750	-0.060	0.646	0.925	0.562	0.583
KBU2	0.723	-0.059	0.647	0.923	0.553	0.576
KBU3	0.718	-0.076	0.641	0.930	0.528	0.585
OC1	0.642	-0.008	0.520	0.520	0.956	0.490
OC2	0.702	-0.016	0.626	0.612	0.963	0.535
TC1	0.704	-0.134	0.654	0.589	0.484	0.933
TC2	0.710	-0.107	0.669	0.605	0.532	0.953
TC3	0.705	-0.107	0.675	0.596	0.507	0.964

Discriminant validity is established when the $\sqrt{\text{AVE}}$ of each construct exceeds all its correlation values with other constructs (Yamin, 2023). The $\sqrt{\text{AVE}}$ values are displayed on the main diagonal of the matrix. The results of the Fornell-Larcker criterion test are presented in Table 7. All HTMT values were below the threshold of 0.90 (Table 8), with the highest value in the Individual Context–MSE Business Performance pair of 0.845. Thus, all constructs in this study are declared to be discriminatory valid (Hair et al., 2021; Yamin, 2023).

Table 8. The Fornell-Larcker criterion.

	Ecommerce adoption	Environmental context	Individual context	Business performance	Organizational context	Technological context
EA	0.954					
EC	-0.086	0.946				
IC	0.790	-0.123	0.955			
KBU	0.789	-0.070	0.697	0.926		
OC	0.701	-0.013	0.599	0.592	0.960	
TC	0.743	-0.122	0.701	0.628	0.534	0.950

Table 9. The Heterotrait-Monotrait Ratio (HTMT).

	Ecommerce adoption	Environmental context	Individual context	Business performance	Organizational context	Technological context
EA						
EC	0.069					
IC	0.831	0.114				
KBU	0.845	0.063	0.745			
OC	0.751	0.032	0.640	0.644		
TC	0.783	0.109	0.739	0.674	0.573	

Structural Model Evaluation (Inner Model)

The Inner VIF testing was used to test for multicollinearity among the latent predictor constructs. The results show that all values are below the threshold of 5.00 (Table 10), so there are no serious multicollinearity problems between the predictor constructs. The determination coefficient (R^2) shows that (Table 11) E-commerce Adoption has an R^2 value of 0.751 as in strong category. Thus, 75.1% of the variation can be explained by the four exogenous variables together. Business Performance has an R^2 value of 0.623 as in medium category. Thus, 62.3% of the variation can be explained by the five exogenous variables together (Hair et al., 2021; Yamin, 2023).

Table 10. Inner VIF

	Ecommerce adoption	Environmental context	Individual context	Business performance	Organizational context	Technological context
EA				1.000		
EC	1.026					
IC	2.299					
KBU						
OC	1.639					
TC	2.057					

Table 11. Determination Coefficient (R^2)

Variable	R-square	R-square adjusted
Ecommerce adoption	0.751	0.744
Business performance	0.623	0.620

The results of the predictive relevance (Q^2) test showed a value of 0.738 for E-commerce Adoption and 0.542 for Business Performance, both in the strong category (> 0.50), which confirms that the model has excellent predictive relevance (Table 12). The fit model evaluation showed an SRMR value of 0.036 (< 0.08), NFI of 0.906 (≥ 0.90), and a Goodness of Fit (GoF) Index of 0.786, which far exceeded the threshold of the large category (> 0.36), so this research model was declared feasible for further hypothesis testing (Hair et al., 2021; Yamin, 2023).

Table 12. Predictive Relevance (Q^2)

Variable	Q^2 predict	RMSE	MAE
Ecommerce adoption	0.738	0.518	0.422
Business performance	0.542	0.686	0.558

Robustness Check

As an additional step to ensure the reliability of the analysis results, Hair et al. (2021) and Yamin (2023) recommend the implementation of robustness checks, which are an additional set of tests to detect potential bias or validity threats that are not captured by the standard evaluation. Some of the robustness check procedures relevant to this study include the linearity test with the ANOVA or Ramsey Reset test, the Endogeneity test with the Gaussian Copula Method, and the FIMIX-PLS test (Yamin, 2023).

Linearity Test

The assumption of SEM PLS is that the relationships between variables are linear. On the other hand, the potential for non-linear occurrence between variables is possible.

Table 13. Linearity Test

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	p-values
QE (EA)→KBU	-0.033	-0.036	0.043	0.764	0.445
QE (EC)→EA	0.020	0.021	0.031	0.651	0.515
QE (IC)→EA	0.007	0.011	0.029	0.236	0.813
QE (OC)→EA	-0.048	-0.048	0.031	1.526	0.127
QE (TC)→EA	-0.061	-0.066	0.036	1.690	0.091

All quadratic effect (QE) values on the structural path have a p-value > 0.05 , which means that *the non-linear effect* is declared insignificant. Therefore, it can be concluded that the effect of Technological, Organizational, Environmental, and Individual context on Ecommerce adoption and the effect of Ecommerce adoption on Business Performance are linear. Thus, the linear effect of the model is fulfilled or robust.

Endogeneity Test

Endogeneity occurs when there is a correlation between exogenous variables and errors or residual or the presence of other variables that are not included in the model but affect exogenous variables but these variables have nothing to do with endogenous variables. In PLS analysis, endogeneity examination is carried out if the research objective is to focus on exploratory studies rather than prediction objectives. The model is declared free of damaging endogeneity problems if the entire value of the Gaussian coefficient of Copula is insignificant (p-value > 0.05).

Table 14. Endogeneity Test

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	p-values
GC (EA→KBU)→KBU	-0.112	-0.107	0.043	2.564	0.010
GC (EC→EA)→EA	-0.033	-0.108	0.186	0.179	0.858
GC (IC→EA)→EA	0.138	0.153	0.179	0.771	0.441
GC (OC→EA) →EA	-0.216	-0.198	0.208	1.036	0.300
GC (TC→EA)→EA	-0.073	-0.040	0.185	0.393	0.694

The data shows that on the antecedent path of TOE towards Ecommerce adoption (EA), the entire p-value > 0.05, confirms the absence of endogeneity problems. However, in the EA →KBU of Business performance pathway, the p-value = 0.010 < 0.05 indicates a significant indication of endogeneity. This condition provides a study that the variation in Business performance is influenced by variables outside the model that interact with E-commerce Adoption (such as from the amount of business capital). Despite the presence of endogeneity in the final pathway, overall the coefficient of the main pathway remains robust and can be interpreted scientifically as the bias has been isolated through copulation control parameters.

Fimix-PLS

Based on the data above, because the AIC, BIC, AND CAIC values are shrinking and the entropy values are very strong, it was decided that the sample in this study is divided into 2 different segments. This means that business actors cannot be considered equal. In the field, they are divided into two clusters: for example, the first group is business actors that have physical stores and online stores, and the second group is business actors that only have online stores.

Table 15. FIMIX Standardized Latent Score

Fit Index	1 Segment	2 Segment
AIC (Akaike's information criterion)	541.731	435.690
AIC3 (modified AIC with Factor 3)	558.731	470.690
AIC4 (modified AIC with Factor 4)	575.731	505.690
BIC (Bayesian information criterion)	593.795	542.881
CAIC (consistent AIC)	610.795	577.881
HQ (Hannan-Quinn criterion)	562.875	479.221
MDL5 (minimum description length with factor 5)	938.052	1251.644
LnL (Log Likelihood)	-253.866	-182.845
EN (normed entropy statistic)	0.000	0.874
NFI (non-fuzzy index)	0.000	0.896
NEC (normalized entropy criterion)	0.000	19.915

Table 16. FIMIX Unstandardized Latent Score

Fit Index	1 Segment	2 Segment
AIC (Akaike's information criterion)	271.915	95.950
AIC3 (modified AIC with Factor 3)	288.915	130.950
AIC4 (modified AIC with Factor 4)	305.915	165.950

Fit Index	1 Segment	2 Segment
BIC (Bayesian information criterion)	323.979	203.141
CAIC (consistent AIC)	340.979	238.141
HQ (Hannan-Quinn criterion)	293.059	139.482
MDL5 (minimum description length with factor 5)	668.236	911.904
LnL (Log Likelihood)	-118.958	-12.975
EN (normed entropy statistic)	0.000	0.889
NFI (non-fuzzy index)	0.000	0.918
NEC (normalized entropy criterion)	0.000	17.593

Hypothesis Testing

Hypothesis testing in PLS-SEM was performed through a bootstrapping procedure with 5,000 subsamples, a two-tailed testing method at a significance level of $\alpha=5\%$ (Hair et al., 2021; Yamin, 2023). Table 17 shows that four of the five direct effect proved to be significant at a p-value < 0.05 (t-statistic > 1.96). Technological context ($\beta = 0.305$; t-value = 5.642), Organizational context ($\beta = 0.301$; t-value = 5.729), and Individual context ($\beta = 0.397$; t-value = 7.339) proved to have a significant direct effect on Ecommerce adoption, with Individual context being the variable with the largest path coefficient. Thus, H1, H2, and H4 were accepted. On the other hand, Environmental context had no significant direct effect on Ecommerce adoption ($\beta = 0.040$; t-value = 0.770; p-value = 0.539). Thus, H3 was rejected. Furthermore, E-commerce adoption has proven to have a significant direct effect on Business Performance with the largest channel coefficient in the overall model ($\beta = 0.789$; t-value = 25.839). Thus, H5 was accepted.

Table 17. Path Coefficient

Hypothesis	Direct Effect	Original Sample	t-value	Verdict
H1	Technological context→Ecommerce adoption	0.305	5.642	Accepted
H2	Organizational context→Ecommerce adoption	0.301	5.729	Accepted
H3	Environmental context→Ecommerce adoption	0.040	0.770	Rejected
H4	Individual context→Ecommerce adoption	0.397	7.339	Accepted
H5	Ecommerce adoption→Business performance	0.789	25.839	Accepted

Table 18. Specific Indirect Effect

Hypothesis	Mediation Effect	Original Sample	t-value	Verdict
H6	Technological context→Ecommerce adoption→Business performance	0.241	5.433	Accepted
H7	Organizational context→Ecommerce adoption→Business performance	0.237	5.598	Accepted
H8	Environmental context→Ecommerce adoption→Business performance	0.003	0.077	Rejected
H9	Individual context→Ecommerce adoption→Business performance	0.313	7.121	Accepted

This study also examines the mediating effect of Ecommerce adoption in the relationship between the four factors and Business performance. The bootstrapping results in Table 18 show that Ecommerce adoption significantly mediate the indirect effect of Technological context ($\beta = 0.241$; t-value = 5.433; p-value = 0.000), Organizational context (β

= 0.237; t-value = 5.598; p-value = 0.000), and Individual context ($\beta = 0.313$; t-value = 7.121; p-value = 0.000) on Business performance. Individual context has the largest indirect effect among the three mediation effect, which confirms that the competence and individual characteristics of business actors are the most strategic factors in the chain of causality towards improving business performance. Thus, H6, H7, and H9 were accepted. On the other hand, the mediation of Ecommerce adoption on the indirect effect of Environmental context on Business performance was insignificant ($\beta = 0.003$; t-value = 0.077; p-value = 0.939). Thus, H8 was rejected which is consistent with the insignificant direct effect of Environmental context on Ecommerce adoption.

Discussion

This study aims to analyze the effect of technological, organizational, environmental, and individual context on ecommerce adoption of Micro Enterprises in Jakarta, as well as its impact on their business performance. In general, the results showed that all direct effect are significant, except for environmental context effects on ecommerce adoption. The integration model of TOE framework and DOI theory, where internal factors (technological, organizational, and individual context) are proven to be more dominant than the external factor (environmental context) in encouraging technology adoption among Micro enterprises in Indonesia's emerging economies.

The Effect of Technological Context on Ecommerce Adoption

The findings show that Technological context significantly effects Ecommerce adoption (H1 is accepted). The perceived benefits indicator is the most dominant one, which implicates that Micro Enterprises in Jakarta value Shopee marketplace as a strategic investment for transaction efficiency. This research is strengthened the fact that Jakarta is the region with the highest internet penetration in Indonesia, where online shopping is the main activity (databoks, 2024). It also in lines with previous research, which found that the perceived benefits is the main determinant of technology adoption, as well as that the perceived benefits can strengthen the confidence of Micro Enterprises to adopt ecommerce. Moreover, this study also found that the perception of usability is a strong driver for Micro Enterprises owner to use digital platforms sustainably (Ausat & Peirisal, 2021; Putri et al., 2023; Setyowati et al., 2024).

The Effect of Organizational Context on Ecommerce Adoption

Organizational context has been proven to have a significant effect on Ecommerce adoption (H2 is Accepted). The majority of Micro Enterprises in Jakarta are individual or micro businesses with flexible structures, so that decision-making to use Shopee can be done quickly without complicated bureaucratic obstacles. These results are in line with research by Bening et al. (2023) which found that organizational commitment and the availability of internal facilities are the main keys to innovation adoption, as well as other previous research, which found that management support and IT readiness are determinants in e-commerce adoption (Bening et al., 2023; Sujatha & Karthikeyan, 2021).

The Effect of Environmental Context on Ecommerce Adoption

This study found that environmental context insignificantly effect Ecommerce adoption (H3 is rejected). This indicates that external pressures, such as market competition or government pressure, have not yet been the main driver for Micro Enterprises in Jakarta to switch to digital platforms. The owners tend to adopt Shopee based on their own internal awareness and business needs. This is in line with the fact that most consumers in Indonesia are

known as conventional online shoppers, where the products offered are only seen through online sites but orders are still made conventionally. Different with previous research, this study identified certain environmental barriers can prevent adoption from occurring, suggesting that the role of environmental context in ecommerce adoption is contextual and not always consistent between study areas (Ausat & Peirisal, 2021; Madhavan et al., (2025).

The Effect of Individual Context on Ecommerce Adoption

Individual context significantly effects Ecommerce adoption, even being an exogenous variable with the largest path coefficient (H4 is accepted). Because the majority of respondents are owners or managers, their personal characteristics of innovativeness and having a good IT skills and practices are the main keys. This study is supported by the fact that individual contexts such as owner innovation, IT skills and experience significantly effect Ecommerce adoption by Micro Enterprises. This is reinforced by the fact that the absorptive capacity and information ability of owners or managers have a great effect on the level of the new technology adoption, as well as those that affirm that the personal characteristics of decision-makers are crucial factors in the adoption of digital technology (Ausat & Peirisal, 2021; Gu, 2022; Salah & Ayyash, 2024).

The Effect of Ecommerce Adoption on Business Performance

E-commerce adoption is empirically proven to significantly improve Business performance (H5 is accepted), with the largest path coefficient in the entire model. Micro Enterprises acknowledged that digital adoption helps them analyze consumer tastes through sales data, which has an effect on increased profits and sales volumes. This study on Micro Enterprises in line with previous research which prove that digital adoption has a significant effect on the operational performance and revenue of Small and Medium-scale Enterprises (Effendi & Subroto, 2021; Santos-Jaén et al., 2023).

The Mediation Effect of Ecommerce Adoption

This study found that Ecommerce adoption mediates the indirect effects of technological, organizational, and individual contexts on the business performance of Micro Enterprises (H6, H7, and H9 are accepted). This aligns with the direct effects of these contexts on business performance. The findings are further supported by the observation that information technology capacity can independently enhance the capabilities of Micro Enterprises and that Ecommerce plays a mediating role in linking internal organizational factors to improved performance outcomes. In contrast, Ecommerce adoption does not mediate the indirect effect of environmental context on business performance (H8 is rejected). This indicates that external pressures do not significantly influence the business performance of Micro Enterprises through the mechanism of e-commerce adoption. This finding is consistent with previous research, which suggests that environmental context can have a more complex and not always linear impact on technology adoption (Gu, 2022; Hussain et al., 2020).

Theoretical Contributions

This research provides several relevant theoretical contributions to the development of the literature on technology adoption and Micro Enterprises' business performance. First, this study strengthens the validity of the integration of TOE framework and DOI theory in the context of e-commerce adoption by Micro Enterprises in Indonesia's emerging economy. Although each theory has been widely used separately, the integration of the two in this study was shown to explain the 75.1% variance in e-commerce adoption ($R^2 = 0.751$), which confirms

the integration complement each other significantly, which aligns with the study of Ilin et al. (2017).

Second, this study confirms the central role of individual context which in DOI theory, as the strongest predictor of ecommerce adoption among the four contexts tested ($\beta = 0.397$; $t\text{-value} = 7.339$). This study expands the model for the Micro-scale business, where the business actors plays the role of the sole decision-maker, personal characteristics of innovativeness, IT skill and practices which is more determinant as internal factor than the external factor of environmental pressures. This aligns with previous study by Ausat & Peirisal (2021).

Third, this study contributes to clarifying the boundary condition of the role of Ecommerce adoption, proving its functions as a mediator that comes from internal factors (technological, organizational, and individual context), not in external factors (environmental context). This study enriches the understanding of the causality mechanism of technology adoption in Micro Enterprises and opens up space for the development of more comprehensive models in subsequent studies.

Practical Implications

From a practical perspective, this study has important implications for three main stakeholders. First, for Micro Enterprises, this study confirms that investment in improving the digital competence of business actors, ranging from basic technology literacy to mastering online marketplace's advanced features such as Shopee Ads, Shopee Live, and store analytics, is the most effective strategic step to encourage Ecommerce adoption while improving business performance. Micro-scale business actors are advised not to wait for pressure from competitors or government policies as the main motivator, but to proactively build digital capacity independently and sustainably.

Second, for Ecommerce providers, this study emphasizes the importance of user-friendly onboarding design and a sustainable mentoring program for novice new sellers. Given that perceived benefits and compatibility are the most influential technology sub-indicators, the provider can strengthen in-app educational features (such as Shopee Academy) and simplify the store management interface to make it more intuitive for sellers with limited digital experiences.

Third, for the government and policy makers, this study of the insignificance of the environmental context, which includes the external support dimension of government programs, is an important signal that the current MSMEs' digitalization program held by central or local government has not been significantly effected by Micro Enterprise actors, especially in Jakarta region. Thus, the government needs to redesign the digital mentoring program to be more oriented towards improving the competencies of business actors directly, not just providing infrastructure or subsidizing platform costs, and ensuring that the program can be accessed and the benefits are real-world by the micro-scale business segment.

Limitations and Future Research

Limitations

This study has several limitations that need to be considered. First, the sampling is limited to Micro Enterprises in Jakarta that are actively use Shopee marketplace, so the results of the study cannot be generalized for entire MSMEs in Indonesia that uses other ecommerce platforms or those operating outside Jakarta. Second, this study is cross-sectional. Data collection is carried out at a certain point in time, so that it cannot capture dynamic changes in the Ecommerce adoption behavior of business actors over time. Third, the measurement of

organizational context variables only uses two indicators (firm size and age of firm), without including broader organizational readiness indicators such as the availability of IT human resources and top management support, which has the potential to limit the depth of explanation of the organizational context.

Future Studies

Based on these limitations, several future research directions can be proposed. First, further research is suggested to expand the scope of the area to other major cities outside Jakarta, such as Surabaya, Bandung, or Medan, as well as to areas with lower internet penetration rates, in order to obtain a more representative picture and allow comparisons between regional contexts. Second, longitudinal research is suggested to explore how Ecommerce adoption patterns and their effect on MSMEs' business performance evolve over time, especially amid the changing dynamic digital ecosystem. Third, future research can consider expanding the model by including other relevant variables to the current digital landscape, such as the integration of artificial intelligence (AI) in online store management, cybersecurity readiness, and social commerce platforms such as TikTok Shop which are increasingly dominant in Indonesia. Fourth, the use of mixed methods by adding in-depth interviews can enrich understanding of the obstacles and motivations for e-commerce adoption from the perspective of MSE actors in a more nuanced manner.

Conclusion

This study concludes that the integration of the TOE framework and DOI theory has a significant effect on Ecommerce adoption among micro-scale business. Within Indonesia's landscape as a rapidly growing emerging market economy, the Individual context emerges as the absolute strongest predictor of technology adoption. In contrast, the Environmental context does not have a significant effect, indicating that the decision to adopt Ecommerce is driven primarily by internal readiness rather than external market pressures or systemic environmental factors. Furthermore, Ecommerce adoption has a significant effect on Micro Enterprises' business performance, serving as a mediator for paths originating from internal factors. However, Ecommerce adoption does not mediate the relationship between the environmental context and business performance. Ultimately, individual business actors' competencies, technology readiness, and internal organizational capacity are the definitive keys driving digital transformation and subsequent business performance improvements within this critical emerging economic sector.

References

- Abdullah, A. S. A. (2025). *The Impact of E-Commerce on the Growth of MSMEs in Indonesia* (pp. 3126–3130). https://doi.org/10.2991/978-94-6463-758-8_260
- Al-Alawi, A. I., & Al-Ali, F. M. (2015). Factors affecting e-commerce adoption in SMEs in the GCC: An empirical study of Kuwait. *Research Journal of Information Technology*, 7(1), 1–21. <https://doi.org/10.3923/rjit.2015.1.21>
- Ausat, A. M. A., & Peirisal, T. (2021). Determinants of E-commerce Adoption on Business Performance: A Study of MSMEs in Malang City, Indonesia. *Journal of Industrial Systems Optimization*, 20(2), 104–114. <https://doi.org/10.25077/josi.v20.n2.p104-114.2021>

- Bening, S. A., Dachyar, M., Pratama, N. R., Park, J., & Chang, Y. (2023). E-Commerce Technologies Adoption Strategy Selection in Indonesian SMEs Using the Decision-Makers, Technological, Organizational and Environmental (DTOE) Framework. *Sustainability (Switzerland)*, 15(12). <https://doi.org/10.3390/su15129361>
- Databox. (2024). *The Proportion of Online Shopping Consumers from Jakarta to Papua*. Databox. <https://databoks.katadata.co.id/teknologi-telekomunikasi/statistik/66d97824d0703/proporsi-konsumen-belanja-online-dari-jakarta-sampai-papua>
- detikfinance. (2025). *MSMEs Contribute 61% of GDP, Now Driven to Be More Inclusive & Competitive*. <https://finance.detik.com/berita-ekonomi-bisnis/d-8021508/umkm-sumbang-61-pdb-kini-didorong-lebih-inklusif-kompetitif>
- Directorate General of Regional Development. (2024, September 24). *The Ministry of Home Affairs Encourages Local Governments to Utilize SIDT Cooperatives and MSMEs in Empowering Business Actors*.
- Effendi, A. P., & Subroto, B. (2021). Analysis of E-Commerce Adoption Factors by Micro, Small, and Medium Enterprise, and Its Effect on Operating Revenue. *Journal of Accounting and Finance Review*, 11(2), 250–265. <https://doi.org/10.22219/jrak.v11i2.16667>
- Ghobakhloo, M., Hong Tang, S., Zulkifli, N., Branch, G., Sadegh Sabouri, M., & Sai Hong, T. (2011). Information Technology Adoption in Small and Medium-sized Enterprises; An Appraisal of Two Decades Literature Information Technology Adoption in Small and Medium-sized Enterprises; An Appraisal of Two Decades Literature Morteza Ghobakhloo (Corresponding author). In *Interdisciplinary Journal of Research in Business* (Vol. 1, Number 7). <https://www.researchgate.net/publication/228448004>
- GoodStats. (2025). *Indonesia's E-Commerce Transaction Value Reaches IDR 487 Trillion in 2024*. <https://goodstats.id/article/nilai-transaksi-e-commerce-indonesia-capai-rp487-triliun-pada-2024-vqv7l>
- Gu, J. (2022). CEO Information Ability, Absorptive Capacity, and E-Commerce Adoption among Small, Medium, and Micro Enterprises in China. *Sustainability (Switzerland)*, 14(2). <https://doi.org/10.3390/su14020839>
- Hair et al. (2010). *Multivariate Data Analysis*
- Hair, J. F., Ringle, C. M., & Danks, N. P. (2021). *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R*. <http://www>
- Hussain, A., Shahzad, A., & Hassan, R. (2020). Organizational and environmental factors with the mediating role of e-commerce and SME performance. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(4), 1–21. <https://doi.org/10.3390/joitmc6040196>
- Ilin, V., Ivetić, J., & Simić, D. (2017). Understanding the determinants of e-business adoption in ERP-enabled firms and non-ERP-enabled firms: A case study of the Western Balkan Peninsula. *Technological Forecasting and Social Change*, 125, 206–223. <https://doi.org/10.1016/j.techfore.2017.07.025>
- KEMENPANRB. (2024). *Kominfo Targets 30 Million MSMEs to Adopt Digital Technology by 2024*. <https://www.menpan.go.id/site/berita-terkini/berita-daerah/kominfo-targetkan-30-juta-umkm-adopsi-teknologi-digital-pada-2024>
- Madhavan, M., Sharafuddin, M. A., & Wangtueai, S. (2025). Factors Influencing Cross-Border E-Commerce Adoption of Thai MSMEs: A Fuzzy DEMATEL Approach. *Sustainability (Switzerland)*, 17(8). <https://doi.org/10.3390/su17083632>

- A Taste of the Past. (2025). *15 Best and Most Popular Online Marketplaces in Indonesia*. Databox. <https://qontak.com/blog/marketplace-online-di-indonesia/>
- Hidayat, N. (2025, June 14). *By May 2025, the number of MSMEs will reach 66 million business units*. <https://foto.bisnis.com/view/20250614/1884915/jumlah-umkm-di-indonesia>
- Putri, L., Aini, A., Solekah, N., & Istiqomah, D. (2023). Exploring E-Commerce Adoption in Small and Medium Enterprises (SMEs) using the Technology Acceptance Model. *International Journal of Business Economics (IJBE)*, 5(1). <https://doi.org/10.30596/ijbe.v5i1.16262>
- Rahayu, R., & Day, J. (2015). Determinant Factors of E-commerce Adoption by SMEs in Developing Country: Evidence from Indonesia. *Social and Behavioral Sciences*, 195, 142–150. <https://doi.org/10.1016/j.sbspro.2015.06.423>
- Rogers, E. M. . (1995). *Diffusion of innovations*. Free Press.
- Sahu, G., & Singh, S. (2023). *eCommerce: An Emerging Platform to Boost Global Economy*. www.ijfmr.com
- Salah, O. H., & Ayyash, M. M. (2024). E-commerce adoption by SMEs and its effect on marketing performance: An extended of TOE framework with ai integration, innovation culture, and customer tech-savviness. *Journal of Open Innovation: Technology, Market, and Complexity*, 10(1). <https://doi.org/10.1016/j.joitmc.2023.100183>
- Santos-Jaén, J. M., Gimeno-Arias, F., León-Gómez, A., & Palacios-Manzano, M. (2023). The Business Digitalization Process in SMEs from the Implementation of e-Commerce: An Empirical Analysis. *Journal of Theoretical and Applied Electronic Commerce Research*, 18(4), 1700–1720. <https://doi.org/10.3390/jtaer18040086>
- Setyowati, N., Masyhuri, Mulyo, J. H., & Irham. (2024). Motivational factors and the impact of e-commerce adoption on business performance: Evidence from traditional drink SMEs in Indonesia. *International Journal of Data and Network Science*, 8(3), 1689–1700. <https://doi.org/10.5267/j.ijdns.2024.2.018>
- Sugiyono. (2023). *QUANTITATIVE, QUALITATIVE, AND R&D research methods*. www.cvalfabeta.com
- Sujatha, R., & Karthikeyan, M. S. (2021). Determinants of e-commerce adoption: Evidence from small and medium-sized enterprises in india. *International Journal of Business and Society*, 22(2), 574–590. <https://doi.org/10.33736/ijbs.3740.2021>
- Tornatzky, L. G., & Fleischer, M. (1990). *The Processes of Technological Innovation*. <https://archive.org/details/processesoftechn0000torn/page/n23/mode/2up>
- Yamin, S. (2023). *SMARTPLS 3 SMARTPLS 4 AMOS & STATA Statistical Data Processing: [Simple & Practical]*. www.dewanggapublishing.com