ANALYZING THE FUTURE OF E-COMMERCE ADOPTION BY SMES AMID THE COVID-19 PANDEMIC

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Abstract

The COVID-19 pandemic has caused the use of technology to become increasingly massive and has an impact on increasing business trends through e-commerce. Failure to be proactive and adapt to change will cause business disruption in the near future. The adoption of e-commerce is the right solution for small and medium-sized enterprises (SMEs) to be ready to compete and survive in the crisis era. This study aims to analyze technological, organizational and environmental factors on e-commerce adoption and the impact of e-commerce adoption on the performance and competitive advantage of SMEs in the era of the COVID-19 pandemic. The object of this research is 100 SMEs in Jambi City, Indonesia. The sampling technique was non-random sampling with type purposive sampling. Data were collected by distributing questionnaires online to selected respondents. The findings of this study underscore the significant influence of technological, organizational, and environmental factors on the adoption of e-commerce among SMEs in Jambi City. Moreover, SMEs in Jambi City perceive that effectively embracing e-commerce can yield desired outcomes, enhancing their performance and competitive edge in the business landscape. Furthermore, the advantages of electronic commerce extend to the convenience of round-the-clock business operations from any geographical location, thus amplifying its appeal and utility for SMEs.

Keywords: COVID-19, Competitive Advantage, E-Commerce, Environment, Organization, Performance, SEM-PLS, Technology

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1. INTRODUCTION

The rapid growth and improvement of internet technology influence the expanding field of electronic commerce. Electronic commerce's potential benefits have been widely touted, including the convenience of being able to conduct business 24/7 from any location (Subagja, 2023). Small and medium-sized

enterprises (SMEs) have the same footing as multinational corporations because of online trade (Sutrisno et al., 2022). Furthermore, it can improve consumer-business interaction and boost productivity, sales, and service offerings. Scientists are optimistic that SMEs will be able to help boost the competitiveness of local products thanks to the advent of electronic commerce (Ausat et al., 2023). The research results of earlier scholars who still identified discrepancies in the adoption of electronic commerce by SMEs through technological, organizational, and environmental factors show that despite the benefits, there are impediments and problems for SMEs in adopting electronic commerce.

According to Al-Alawi and Al-Ali (2015), SMEs' adoption of e-commerce in Kuwait is favorably and considerably influenced by technological background. Research by Rahayu and Day (2015) indicated that technological considerations have a negligible impact on the adoption of electronic commerce by SMEs in Indonesia, hence their finding is at odds with that.

The degree to which an organization supports e-commerce is also a factor. The adoption of electronic commerce by SMEs in Kenya is influenced by organizational characteristics such as the age of the firm, business type, and firm size (Ochola, 2015). The results of this study suggest that the size of a company may play a role in determining whether or not to adopt e-commerce. Smaller businesses may struggle to purchase such a system due to a lack of funds, while larger ones can more easily do so (Ausat & Peirisal, 2021). Nonetheless, studies show that company size indicators, which represent organizational variables, have a negative and minor effect on SMEs' adoption of e-commerce (Rahayu & Day, 2015).

The setting is also important in determining the rate of e-commerce adoption. West Kalimantan's SMEs are heavily influenced by the surrounding environment, as measured by indications of government assistance (Kosasi, 2019). He argues that in order for SMEs to advance to a more advanced level of electronic commerce, the government must provide incentives including training, technical guidance, financing, and other types of support. These results run counter to previous studies that concluded that environmental variables including customer pressure, competition activity, and external support (from the government) all had a negative and minor effect on the likelihood of SMEs adopting e-commerce (Rahayu & Day, 2015).

Looking back at the study done so far, there are still mixed findings. Therefore, further research is required using new settings or materials. In addition, the current study will incorporate performance variables and competitive advantage to determine whether SMEs in the post-COVID-19 era are impacted by the adoption of e-commerce and, if so, how. Therefore, the novelty of this study lies in the fact that it employs a research model with six independent variables and five hypotheses, a combination that is still relatively uncommon in the academic literature.

Indonesia, ranking among the top 10 nations in e-commerce usage, presents an intriguing case for studying its impact on smaller businesses globally. With 88.1% of Indonesian internet users making online marketplace purchases, it boasts the world's highest percentage (Lidwina, 2021). With a population of 276,3 million, Indonesia has 212,35 million internet users, signaling a sizable and growing e-commerce market (Kusnandar, 2021). Despite a decline in the number of micro-, small and medium-sized enterprises (MSMEs) from 15,5 million (May 2020) to 14,5 million (August 2021), many have yet to leverage e-commerce, with half of the expected 30 million SMEs not participating by 2023 ("UMKM masuk e-commerce", 2021). In the post-COVID-19 era, technological infrastructure is essential for businesses, as in-person shopping habits shift online due to social restrictions. The anticipation is that 30 million MSMEs will engage in online trading by 2021.

The COVID-19 pandemic has severely impacted Indonesian MSMEs across six key aspects. Firstly, sales have plummeted, leading some MSMEs to shut down. Secondly, business profits have dwindled, particularly during strict enforcement of restrictions. The third aspect involves undercapitalization due to unbalanced income and operational expenses. Fourthly, many MSMEs have had to lay off employees. Fifthly, fulfilling bank obligations, such as loan installments, became challenging. Lastly, a notable aspect is the slow adoption of digital marketing, like e-commerce, with some still relying on traditional methods. The restriction on in-person shopping due to government regulations has worsened the plight of MSMEs during the pandemic. This aspect aligns with the focus of the research.

Many SMEs in Jambi City, particularly in the food and beverage sector, are likely still reliant on traditional methods, lacking reliable data on digital economy adoption (Umiyati & Achmad, 2021). Despite 3,506 SMEs in Jambi City in 2018, e-commerce studies are scarce. Research suggests 44% of processed food industry enterprises are more inclined to use digital apps than fashion and service industries (Umiyati & Achmad, 2021). Jambi City's provincial government promotes MSMEs' digital participation through extensive literacy and information technology (IT) training programs. Businesses with IT training are more likely to engage in the digital economy (Umiyati & Achmad, 2021). Government support in improving information and communications technology (ICT) knowledge, especially amid the pandemic, is crucial for success (Dhewanto et al., 2018). This study aims to analyze e-commerce adoption among Jambi City SMEs, encouraging those using traditional methods to transition. It adds to existing literature and serves as a reference for future research.

In order to make it easier for readers to understand the overall content of this study, the researcher formulates the structure of this paper as follows. Section 2 provides the literature review used in formulating the researcher's thoughts, and the hypotheses development which integrates the results of relevant previous studies. Section 3 describes the research methodology which explains that the current study adopts quantitative techniques. Section 4 presents the research results, Section 5 discusses the research findings in a structured manner, and Section 6 concludes the paper.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Diffusion of innovation theory and technology, organization, and environment framework

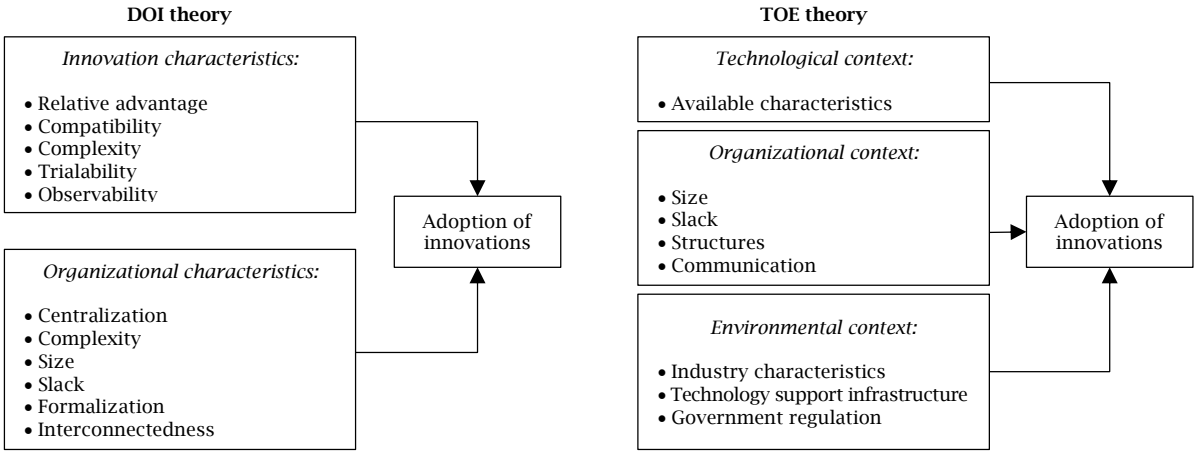
Research on the spread of e-commerce can draw from a variety of different theoretical frameworks by Davis (1989), Ajzen (1991), Rogers (1995), and Tornatzky et al. (1990). The most frequently applied theories are the technology acceptance model (TAM), the theory of planned behavior (TPB), the unified theory of acceptance and use of technology (UTAUT), the diffusion of innovation (DOI), and the technology, organization, and environment (TOE) framework (Davis, 1989; Ajzen, 1991; Venkatesh et al., 2003; Rogers, 1995; Tornatzky et al., 1990). However, there is a gap in the extant literature regarding the integration and comparison of these frameworks, particularly in the context of e-commerce adoption at organizational levels. This lack of synthesis impedes a comprehensive understanding of how different factors interact to influence e-commerce adoption, necessitating further research to address this gap.

The DOI and TOE frameworks have been used by researchers and scientists in the past to conduct a significant amount of research on the factors that can affect the adoption of e-commerce (Rogers, 1995; Tornatzky et al., 1990). However, existing studies often focus on explaining the relationship between individual factors and e-commerce adoption, neglecting the interactions and synergies between technological, organizational, and environmental factors (Rogers, 1995; Tornatzky et al., 1990). Therefore, there is a need for research that comprehensively examines the interplay of these factors within the DOI and TOE frameworks, providing insights into how organizations can effectively leverage e-commerce technologies to achieve strategic objectives.

In addition, while the DOI framework emphasizes the role of innovation characteristics and organizational factors in technology adoption (Rogers, 1995) and the TOE framework incorporates technological, organizational, and environmental factors (Tornatzky et al., 1990), there is limited understanding of how these frameworks overlap and complement each other in explaining e-commerce adoption (Ilin et al., 2017). Addressing this gap is crucial for developing a holistic understanding of the factors influencing e-commerce adoption and identifying strategic implications for organizations seeking to enhance their e-commerce capabilities.

Therefore, as factors that influence the adoption of e-commerce by SMEs, the researchers will employ TOE in the current study. Additionally, the current research will also interpolate the variables of SME performance and competitive advantage in order to see the influence of factors affecting e-commerce adoption in SMEs and their impact on SME performance and competitive advantage in order to contribute to interested parties both theoretically and practically. This is done in order to contribute to interested parties both theoretically and practically. Additionally, the indications that are incorporated inside each dimension that is constructed are complementary to the DOI and TOE framework. In light of this, the conceptual model depicted in Figure 2 (see Figure 2) may be understood to be an original contribution made by the research idea to the study of the adoption of IT by enterprises.

Figure 1. DOI theory and TOE framework



2.2. Technology

Both currently employed as well as market-available but not-yet-adopted technologies are part of the technical background since they are relevant to the business (Ausat & Suherlan, 2021). Therefore, the technological setting demonstrates how adoption is dependent on a range of technologies both within and beyond the organization. Dwivedi et al. (2012) argues that in-house tech is crucial because it serves as a benchmark for when and how an organization should incorporate new technologies, and so provides insight into the nature of the ensuing shifts. By analyzing the internal technological background, for instance, management can determine if a new technology will bring about progressive change or a rupture, rendering the previous method of work obsolete (Ausat et al., 2022). To measure the state of technology, this analysis makes use of relative advantage and compatibility.

2.3. Organization

The most studied aspect of businesses' e-commerce adoption has been their organizational setting. Attributes of an organization can either help or hinder its operations. Some studies have found that organizational environments are more reliable indicators of innovation uptake than others (Chatterjee et al., 2015). In order to meet customer expectations or take advantage of external opportunities, businesses regularly implement new strategies (Subagja et al., 2022). This research uses organizational size, technological readiness, support from top management, and organizational culture as indicators of the organizational setting.

2.4. Environment

The business environment consists of internal and external elements that work together to drive the company forward. Behavior, resources, strengths and weaknesses within or internal to the business, customers, competitors, government agencies, and suppliers' workforce are all mainly the outcome of decisions made during the management process (Ausat & Suherlan, 2022). Therefore, it's safe to say that external factors have a considerable impact on how well a company performs. To thrive in today's competitive and uncertain business climate, SMEs should take advantage of any chances to implement e-commerce that present themselves. In this investigation, indicators of the external environment include customer, competition, supplier, and support policies.

2.5. E-commerce adoption

"Adoption" denotes the acceptance of unused electronic commerce into regular use. In the academic realm, "e-commerce" encompasses various meanings, mainly involving the use of ICTs and apps to facilitate business activities in SMEs (Ahmad et al., 2015). This term refers to the exchange of goods and services among businesses and third parties using the internet, computers, and ICT (Abd Rahman et al., 2020). E-commerce enables the digital transformation of traditional business practices, allowing online buying, selling, and collaborative value chain activities. It involves using ICT to facilitate commercial transactions, both internally and externally. Online commerce primarily involves selling and buying through a company's website. Widespread and proper deployment of e-commerce is expected to empower SMEs in the global market and enhance competitive prospects. The study's indicators of e-commerce adoption is based on those used in earlier studies, including those of (Ausat et al., 2022):

1) internet usage during product sales;
2) availability of e-commerce support facilities;
3) readiness of human resources in e-commerce;
4) readiness of SMEs in responding to consumers online.

2.6. SMEs performance

Developmental SMEs in Indonesia, governed by Law No. 20 of 2008, face challenges amid the pandemic, impacting MSMEs. The government supports MSMEs with fiscal incentives through the National Economic Recovery (*Pemulihan Ekonomi Nasional* — PEN) program, allocating IDR171,17 trillion in 2021 to sustain growth (Kominfo, 2021). Recognizing MSMEs' vital role, the government launches the *Gerakan Nasional Bangga Buatan Indonesia* (Gernas BBI) program, promoting digitalization for offline MSMEs and enhancing the national branding of superior products, likely boosting exports (Kominfo, 2021). Organizational performance, measured by profitability, service quality, and efficiency, relies on effective resource utilization and adaptation to changing environmental conditions, ultimately determining success. This study borrows various performance indicators for SMEs from earlier studies, including increasing sales and profits and customer satisfaction (Ausat & Peirisal, 2021).

2.7. Competitive advantage

Each and every definition of competitive advantage must include value creation as a cornerstone (Pilinkiene et al., 2013). A company's competitive advantage is the consequence of strategic choices that have allowed it to build a strong position relative to its rivals (Hazen & Byrd, 2012). A business enjoys a competitive advantage when its operations in a given industry or market generate economic value and provide customers with greater value than that offered by competitors, either through selling at lower prices or by offering unique benefits that more than compensate for the higher prices charged by competitors for equivalent services (Marinagi et al., 2014). Given the rising levels of competition across most industries, SMEs have found one area of competitive advantage to be their use of IT (e-commerce) (Hu et al., 2019). This research uses indicators including cost reduction, growth, differentiation, and innovation to determine competitive advantage.

Now, we will look at the relationship between the variables used in this study. Regular funding for IT maintenance and upgrades is essential for expanding workers' IT expertise, maintaining systems, and hiring specialists (Ramadansyah & Taufik, 2017). Technology plays a pivotal role in e-commerce adoption, with successful online business transitions relying heavily on technological aspects (Dhewanto et al., 2018). Proper operation of IT is crucial for the success of the online retail industry (Ausat, 2023). Technology readiness is identified as the most critical factor in SMEs embracing e-commerce, influencing their ability to adopt the technology (Nurrohmah & Alfanur, 2016). Openness to new technologies correlates with a higher likelihood of utilizing online stores (Nurlinda & Fatimah, 2019). Technological elements significantly impact the spread of ICT (Setiowati et al., 2015), facilitating e-business adoption (García-Moreno et al., 2018). Perceived benefit is a crucial influence on SMEs' e-commerce decisions in Indonesia (Rahayu & Day, 2015). Additionally, technology compatibility indicators greatly influence people's willingness to use e-commerce (Kosasi, 2019). The first hypothesis can be formulated as follows:

H1: Technology has a positive and significant effect on e-commerce adoption.

Organizational variables, as measured by business size, positively affect e-commerce adoption (Ochola, 2015). Larger organizations have more resources, whereas tiny companies have fewer (Ausat & Peirisal, 2021). These results agree with (Dhewanto et al., 2018), who found that organization size influences e-commerce adoption. The second hypothesis can be formulated as follows:

H2: Organization has a positive and significant effect on e-commerce adoption.

Human resource (HR) competencies within businesses are crucial for maximizing e-commerce and IT benefits (Ausat & Suherlan, 2021). Age affects IT utilization, with older employees showing less interest (Widagdo, 2016). SMEs must monitor the business climate for risks and opportunities, utilizing national and international shows and the internet (Ramadansyah & Taufik, 2017). E-commerce adoption in SMEs is driven by external factors like customers and competition, and influenced by company culture (Dhewanto et al., 2018). Environmental factors, including government policies, significantly impact e-commerce adoption (Kosasi, 2019), with government support and regulations positively influencing adoption rates (Ilin et al., 2017). Competitive indicators in the external environment also favor e-commerce adoption (Lim et al., 2018), along with internal and external firm factors (Nurrohmah & Alfanur, 2016). These findings lead to the third hypothesis of this study:

H3: Environment has a positive and significant effect on e-commerce adoption.

E-commerce implementation enhances company performance by boosting online sales, impacting SME tactics (Alzahrani, 2019). With the rise of online shopping, companies adapt operations, improving service quality and speed, positively affecting sales and profitability (Nurlinda & Fatimah, 2019). Embracing e-commerce increases productivity and competitiveness (Ausat et al., 2022), aligning with findings by Ramadansyah & Taufik (2017) on SME productivity. Coordination and cost reduction in economic activities yield bottom-line growth (Hanum & Sinarasri, 2018). E-commerce automation minimizes coordination and transaction costs, enhancing efficiency (Hanum & Sinarasri, 2018). The second hypothesis can be formulated as follows:

H4: E-commerce adoption has a positive and significant effect on performance.

When it comes to e-commerce, businesses lose some of their edge. Competitive advantage is the skill that organizations have to win competition, with important management decisions, which distinguish themselves from their competitors. Greek small and medium-sized manufacturers saw an increase in their competitive edge as a result of investments in IT, particularly e-commerce (Marinagi et al., 2014). Another study, one of the Jordanian food industries, found that e-interactive commerce's marketing, commodities supply chain management, and electronic transactions all contribute to the sector's competitive advantage (Aldalayeen et al., 2013). Based on this explanation, it's safe to say that e-commerce modifies a company's edge in the market. Accordingly, the following might be stated as the study's fifth hypothesis:

H5: E-commerce adoption has a positive and significant effect on competitive advantage.

3. RESEARCH METHODOLOGY

This study employs a quantitative approach, collecting numerical and statistical data to meet scientific criteria. Exogenous variables include TOE, while e-commerce adoption, SME performance, and competitive advantage are endogenous. The use of TOE factors in exogenous variables aligns with the DOI theory and TOE framework, where these characteristics stimulate organizational innovative behavior. Jambi SMEs can adopt e-commerce by being adaptive to technological advances, enhancing performance, and gaining a competitive advantage. Research variables are illustrated in Figure 2, and purposive sampling criteria, including company scale, assets, revenue, number of employees, and at least 5 years of operation, were employed. This selection was based on the observation that adept e-commerce SMEs are usually older and engaged in the food and beverage sector, as discussed in the Introduction.

The author aims to demonstrate that SMEs, with increased age, tend to adopt more advanced thinking due to accumulated experience and knowledge. This adaptability is crucial in improvising digital business processes, particularly in utilizing e-commerce. Purposive sampling is employed to specifically select SMEs operating for over 5 years, as the authors believe the significant role of e-commerce in business has evolved in this timeframe. An online Likert scale questionnaire was distributed to SMEs in the food and beverage sector in Jambi City from June 2021 to August 2021, resulting in 100 valid responses after excluding 9 that did not meet the criteria. The demographics of the respondents are summarized in Table 2. The data and hypotheses were analyzed using structural equation model-partial least squares (SEM-PLS) with SmartPLS 3.2 software. The SEM-PLS analysis includes testing convergent validity, discriminant validity, and reliability in the outer model, and evaluating R-square (R^2), Q-square (Q^2), and hypotheses testing for the inner model.

In addition to the quantitative approach used in this research, an in-depth analysis of the research findings can provide profound insights into the experiences and perceptions of stakeholders regarding e-commerce adoption among SMEs in Jambi. By delving deeply into the data, researchers can explore detailed patterns, trends, and relationships emerging from the collected qualitative data. This analysis enables researchers to better understand the factors influencing e-commerce adoption, as well as their implications for the performance and competitive advantage of SMEs. Thus, an in-depth analysis of the research findings is crucial for gaining a more comprehensive understanding of the dynamics of e-commerce adoption among SMEs in Jambi.

Figure 2. Research framework

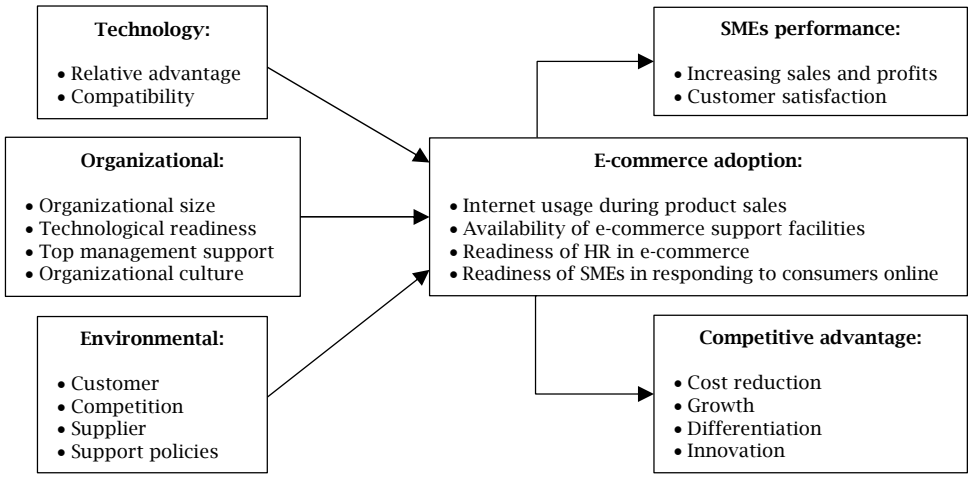


Table 1. SMEs criteria

Enterprises scale	*Asset*	*Revenue*	*Number of employees*
Small enterprises	> IDR50–IDR500 million	> IDR300 million–IDR2,5 billion	5–19 people
Medium enterprises	> IDR500 million–IDR10 billion	> IDR2,5 billion–IDR50 billion	20–99 people

Table 2. Demographic respondents

Demographic	*Frequency*	*Percentage*
Enterprises scale		
Small	57	57%
Medium	43	43%
Total	100	100%
Enterprises age		
6–10 years old	61	61%
11–15 years old	7	7%
16–20 years old	8	8%
> 20 years old	16	16%
Total	100	100%
Gender		
Male	64	64%
Female	36	36%
Total	100	100%
Age		
21–30 years old	27	27%
31–40 years old	22	22%
41–50 years old	29	29%
> 51 years old	22	22%
Total	100	100%
Adoption of e-commerce		
Yes	100	100%
No	0	0%
Total	100	100%

Table 2 shows that 57 out of 100 respondents in Jambi City are small businesses, while the remaining 43 respondents are medium-sized businesses. Meanwhile, there were 36 female respondents out of the total 100 respondents and 64 male respondents. As a result of these findings, it can be concluded that men have contributed the most to the success of this study. Also, based on the age of the business, it can be seen that 61 respondents are between 6 and 10 years old, and they are the main contributors to this study. Also, based on the adoption of e-commerce by SMEs during the pandemic, all respondents admitted to having utilized such electronic commerce.

4. RESULTS

4.1. Outer model

Testing the outer model is the first step in the SEM-PLS analysis, and it is demonstrated in this study through convergent validity, discriminant validity, and reliability testing.

4.1.1. Convergent validity

The principle is that a measure (indicator) of a construct must have a high correlation. Testing the convergent validity of reflexive indicators using the Smart-PLS 3.0 program is indicated through the loading factor value for each construct manifest variable which must be higher than 0.70 (Hair et al., 2011). From the acquisition of the analysis output, it can be seen in Table 3 that all construct indicators produce a loading factor value > 0.70 which means valid and have met convergent validity.

4.1.2. Discriminant validity

Comparing each square root of average variance extracted (AVE) to the correlation value between constructs. If the AVE-square value is higher than the correlation value between constructs, it is declared to meet the discriminant validity criteria (Hair et al., 2011). The output results are shown in Table 4 which shows that the model is valid.

4.1.3. Reliability test

Cronbach's alpha and composite reliability (CR) in reliability testing which if the value is above 0.60, the variable with reflexive indicators is declared to pass the test (Hair et al., 2011). The reliability test results can be seen in Table 3 below. Table 3 shows that all Cronbach's alpha and reliability values exceed 0.60, so all research constructs are declared reliable.

Table 3. Measurement model analysis

Variable	*Item*	*Factor loading*	*Cronbach's alpha*	*CR*	*AVE*
Technology (*X1*)	*X1.1*	0.951	0.862	0.935	0.878
	X1.2	0.922			
Organization (*X2*)	*X2.1*	0.813	0.776	0.855	0.696
	X2.2	0.751			
	X2.3	0.798			
	X2.4	0.722			
Environment (*X3*)	*X3.1*	0.937	0.956	0.968	0.883
	X3.2	0.938			
	X3.3	0.920			
	X3.4	0.963			
E-commerce adoption (*Y1*)	*Y1.1*	0.878	0.894	0.926	0.758
	Y1.2	0.858			
	Y1.3	0.900			
	Y1.4	0.846			
SMEs performance (*Y2*)	*Y2.1*	0.954	0.891	0.948	0.902
	Y2.2	0.945			
Competitive advantage (*Y3*)	*Y3.1*	0.911	0.948	0.962	0.865
	Y3.2	0.942			
	Y3.3	0.950			
	Y3.4	0.916			

Table 4. Discriminant validity

Variable/ Indicator	*X1*	*X2*	*X3*	*Y1*	*Y2*	*Y3*
X1.1	**0.951**	0.437	0.283	0.631	0.555	0.590
X1.2	**0.922**	0.478	0.185	0.506	0.477	0.530
X2.1	0.398	**0.813**	0.260	0.502	0.358	0.468
X2.2	0.626	**0.751**	0.187	0.642	0.461	0.545
X2.3	0.173	**0.798**	0.113	0.470	0.243	0.250
X2.4	0.196	**0.722**	0.184	0.451	0.282	0.339
X3.1	0.225	0.282	**0.937**	0.332	0.251	0.326
X3.2	0.268	0.197	**0.938**	0.371	0.265	0.332
X3.3	0.232	0.178	**0.920**	0.263	0.231	0.284
X3.4	0.230	0.250	**0.963**	0.340	0.221	0.309
Y1.1	0.595	0.616	0.276	**0.878**	0.479	0.504
Y1.2	0.545	0.560	0.276	**0.858**	0.491	0.537
Y1.3	0.536	0.617	0.344	**0.900**	0.463	0.501
Y1.4	0.452	0.593	0.336	**0.846**	0.362	0.470
Y2.1	0.531	0.454	0.240	0.510	**0.954**	0.864
Y2.2	0.522	0.401	0.251	0.472	**0.945**	0.811
Y3.1	0.556	0.474	0.337	0.538	0.833	**0.911**
Y3.2	0.563	0.485	0.255	0.504	0.851	**0.942**
Y3.3	0.558	0.549	0.311	0.554	0.802	**0.950**
Y3.4	0.555	0.490	0.337	0.552	0.800	**0.916**

4.2. Inner model

Testing the inner model is the next step in the SEM-PLS analysis, and it is demonstrated in this study using R^2, Q^2, and hypotheses testing.

4.2.1. R-square (R^2)

The R^2 value is used in order to find out the amount of contribution of exogenous constructs to endogenous constructs. The R^2 results are summarized in Table 5 below. The first R^2 value shows 0.592. This means that the TOE variables are able to explain the e-commerce adoption variable by 59.2%, while the remaining 40.8% is the contribution of other factors outside of this study that are not explained. The second value of the R^2 table of the SME performance variable is 0.268. This means that the variables of TOE and e-commerce adoption are able to explain the SME performance variable by 26.8%, while the remaining 73.2% is the contribution of other factors outside of this study that are not explained. The third value of the R^2 table of the competitive advantage variable is 0.335%. This means that the variables of TOE, e-commerce adoption and performance are able to explain the competitive advantage variable by 33.5%, while the remaining 66.5% is the contribution of other factors outside of this study that are not explained. The R^2 value has resulted in the SEM model simultaneously being said to be appropriate and strong (Hair et al., 2011).

Table 5. R-square

No	*Variable*	R^2
1	Y1	0.592
2	Y2	0.268
3	Y3	0.335

4.2.2. Q-square (Q^2) predictive relevance

Structural model testing is done by looking at the Q^2 (predictive relevance) value. The model is said to be good enough and has predictive relevance if the Q^2 value is greater than 0 (Hair et al., 2011). The formula for calculating Q^2 is as follows:

$$\begin{gathered} Q^2 = 1 - (1 - R_{12}) * (1 - R_{22}) * (1 - R_{32}) \\ Q^2 = 1 - (1 - 0.592) * (1 - 0.268) * (1 - 0.335) \\ Q^2 = 1 - 0.198606 \\ Q^2 = 0.801393 \end{gathered} \quad (1)$$

Calculation the value for Q^2 is 0.801. The value of Q^2 can be used to assess how successfully the model and estimating parameters created the observed values (Hair et al., 2011).

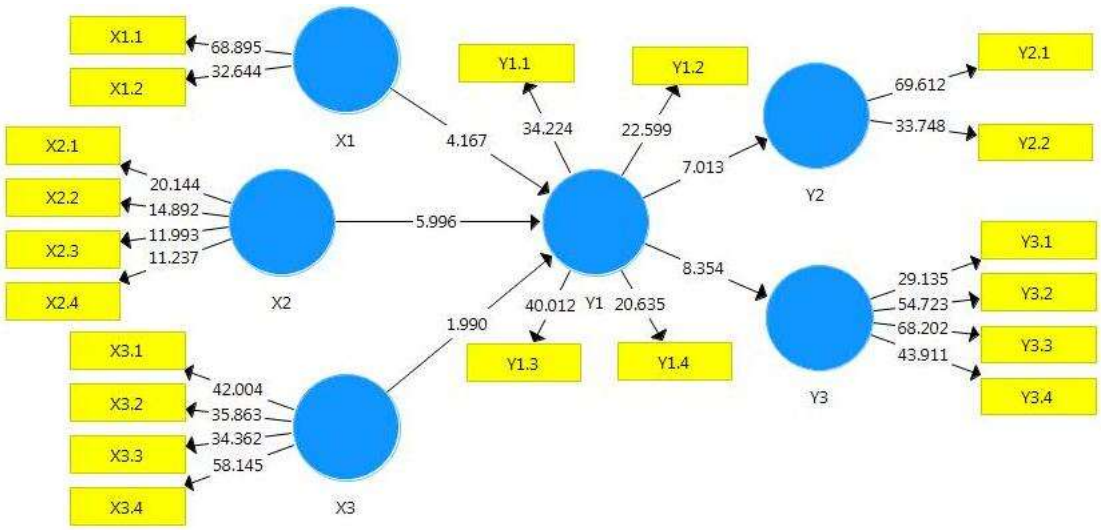
4.2.3. Hypotheses testing

The hypothesis is stated to have a positive correlation if the path coefficient value > 0.1 and is significant at a p-value < 0.05. Table 6 below shows the results of hypotheses testing and Figure 3 of the bootstrapping model which is used as an additional reference by looking at the t-statistic value to discuss the research hypotheses model to make it stronger.

Table 6. Hypotheses testing results

Hypothesis	*Variable*	*Path coefficient*	*p-values*	*Decision*
H1	*X1 → Y1*	0.342	0.000	Accepted
H2	*X2 → Y1*	0.483	0.000	Accepted
H3	*X3 → Y1*	0.148	0.047	Accepted
H4	*Y1 → Y2*	0.518	0.000	Accepted
H5	*Y1 → Y3*	0.578	0.000	Accepted

Figure 3. Bootstrapping model



5. DISCUSSION

5.1. The effect of technology on e-commerce adoption

Technology has a positive and significant effect on e-commerce adoption. This finding correlates with the results of research by García-Moreno et al. (2018) and Ausat et al. (2022), which obtained the same facts. The dynamic changes that occur in internet technology and e-commerce have made ICT a necessity in every business venture. Failure to be proactive and adapt to changes will cause businesses to be disrupted in the near future. E-commerce adoption is the right solution for SMEs to compete and survive in the era of the COVID-19 pandemic. The technology variable in this study has two indicators, namely relative advantage and compatibility. Both indicators have different t-statistic values (see Figure 3), the highest value is found in the relative advantage indicator (*X1.1*), then compatibility (*X1.2*). First, relative advantage (*X1.1*) is an important indicator that acts as a determinant of electronic commerce adoption in technology variables. This result shows that electronic commerce is adopted by SMEs when they feel that the innovative features and benefits match their needs. Relative advantage has a positive and significant correlation with the adoption of electronic commerce by SMEs in Indonesia (Rahayu & Day, 2015). Second compatibility (*X1.2*), is an important factor that influences SMEs to continue using e-commerce technology. Thus, the adoption of e-commerce must be compatible with the prevailing system otherwise the adoption rate is low and will have no effect. Compatibility is considered a significant factor in the adoption of e-commerce by SMEs.

5.2. The effect of organization on e-commerce adoption

Organization significantly influences e-commerce adoption, consistent with findings by Ochola (2015) and Dhewanto et al. (2018). SMEs must adapt their organizational systems to remain competitive in the face of evolving business landscapes. Swift adaptation ensures sustainability, while failure to seize opportunities from change can lead to elimination. E-commerce serves as a vital business solution, especially during the COVID-19 pandemic. The organizational variable in this study comprises organizational size, technology readiness, top management support, and organizational culture, each with varying t-statistic values. Organizational size (*X2.1*) exhibits the highest significance, followed by technology readiness (*X2.2*), top management support (*X2.3*), and organizational culture (*X2.4*).

Firstly, organizational size (*X2.1*) serves as a crucial determinant of e-commerce adoption within organizational variables. Contrary to the belief that only large-scale businesses possess adequate resources for technology investments, this study reveals that even SMEs can leverage e-commerce technology. SMEs have benefited from electronic business activities, particularly during the COVID-19 pandemic, indicating that e-commerce is not exclusive to large corporations. Organizational factors, as indicated by firm size, positively influence e-commerce adoption (Ausat & Peirisal, 2021), enabling SMEs to compete on par with larger counterparts. Secondly, technology readiness (*X2.2*) is another key indicator influencing e-commerce adoption within organizational variables. These finding highlights SMEs' possession of both technical knowledge and financial resources, facilitating e-commerce adoption.

With the significant increase in internet penetration, SMEs can access ICT innovations, further supporting their readiness for e-commerce adoption. Organizational technology readiness significantly impacts the adoption of business-to-business (B2B) e-commerce (Ocloo et al., 2020).

Thirdly, top management support (*X2.3*) significantly influences e-commerce adoption within organizational variables. Management's recognition of technology's potential benefits drives strategic intentions toward adoption, fostering positive perceptions among owners/managers. Clear visions of e-commerce development, coupled with government support for SME digitalization, mitigate investment risks associated with advanced technology adoption. Top management support positively affects e-commerce adoption (Mohtaramzadeh et al., 2018). Fourthly, organizational culture (*X2.4*) serves as a critical determinant of e-commerce adoption within organizational variables. The introduction of e-commerce transforms organizational problem-solving and processes, shaping new organizational cultures. Organizational culture plays a pivotal role in management decisions regarding new technology adoption, enabling adaptability to changing business environments and flexibility in leveraging IT. Organizational culture significantly impacts e-commerce adoption (Setiyani & Rostiani, 2021).

5.3. The effect of the environment on e-commerce adoption

The environment significantly impacts e-commerce adoption, consistent with findings by Lim et al. (2018) and Ilin et al. (2017). The dynamic business landscape, coupled with technological advancements, urges SMEs to seize opportunities amidst COVID-19 disruptions. Increasingly, invisible competitors challenge SMEs, emphasizing the need for technological innovation to bolster resilience. Various factors, including consumer, competitor, supplier pressures, and government support, influence SMEs' adoption of new technology. Environmental indicators — customers, competition, suppliers, and support policies — differ in their significance, with support policies (*X3.4*) showing the highest t-statistic value, followed by customer (*X3.1*), competition (*X3.2*), and supplier (*X3.3*).

Firstly, government support policies (*X3.4*) are crucial determinants of e-commerce adoption, indicating SMEs' recognition of governmental commitment, particularly during the COVID-19 pandemic. This support encompasses IT skills, financial incentives, and training programs, fostering SME enthusiasm for advanced e-commerce technology adoption. Moreover, e-commerce security laws provide SMEs with confidence in operating electronically. Government support significantly influences e-commerce adoption, supported by empirical evidence highlighting the importance of technological infrastructure, policies, and funding (Awiagah et al., 2016). It also impacts SME decisions to adopt e-commerce (Ahmad et al., 2015). Secondly, customer preferences (*X3.1*) are vital indicators driving e-commerce adoption, with SMEs adapting to changes in consumer purchasing behavior, especially amid COVID-19 restrictions. SMEs recognize the significance of meeting consumer needs through IT, acknowledging consumers as a key revenue source. Customer pressure plays a pivotal role in e-commerce adoption within the external environment (Nurrohmah & Alfanur, 2016).

Thirdly, competitive pressure (*X3.2*) significantly drives e-commerce adoption among SMEs, compelled by intense market competition. SMEs strategically adopt e-commerce to engage potential clients, maintain customer relationships, and expedite transactions, leveraging platforms like websites, email, and WhatsApp Business (Ocloo et al., 2020; Ausat & Suherlan, 2021). This adoption is driven by the substantial impact of competition on technology uptake, enhancing SMEs' competitive positioning and strengthening supplier partnerships (Ocloo et al., 2020). Fourthly, supplier pressure (*X3.3*) serves as a key determinant of e-commerce adoption, prompting SMEs to embrace technological change to compete effectively. SMEs recognize the increasing adoption of ICT by suppliers, which enhances business relationships, irrespective of geographical constraints (Abd Rahman et al., 2020). Pressures from suppliers and business partners significantly influence e-commerce adoption in SMEs.

5.4. The effect of e-commerce adoption on SME performance

As expected, e-commerce adoption has a positive and significant effect on SME performance. All research respondents have utilized electronic commerce as an effort to support their business activities in the COVID-19 pandemic era, and have had a direct impact on the performance of SMEs, especially on the performance indicators themselves, namely increasing sales and profits (*Y2.1*), and customer satisfaction (*Y2.2*). The e-commerce variable in this study has four indicators, namely the use of the internet during product sales (*Y1.1*), the availability of electronic commerce supporting facilities (*Y1.2*), the readiness of HR in electronic commerce (*Y1.3*), and the readiness of SMEs to respond to consumers online (*Y1.4*). The four indicators have different t-statistic values (see Figure 3), the highest value is found in the indicator of HR readiness/competence in electronic commerce (*Y1.3*). This means that the HR competency indicator in electronic commerce is a key factor that plays the most important role in the success of a business when it has adopted e-commerce which ultimately has an impact on increasing sales, profits, and even customer satisfaction. The results of this study have also become empirical evidence. E-commerce adoption has a positive and significant effect on the performance of MSMEs (Ausat et al., 2022).

HR competencies in e-commerce if correlated with the conditions of the COVID-19 pandemic are the same as personal innovativeness which reflects the desire to change and try new things related to technology for business success. This means that personal innovativeness is an important factor for agile surfing in electronic commerce as a means of attracting purchasing decisions on SME products, customer loyalty, customer satisfaction, and of course increasing sales and profits can be achieved. HR competencies have a positive and significant effect on organizational performance (Gadzali, 2023).

5.5. The effect of e-commerce adoption on competitive advantage

E-commerce adoption has a positive and significant effect on the competitive advantage of SMEs. IT is a key resource that SMEs can leverage to obtain an edge in the marketplace; as such, it can provide support to SMEs' plans for gaining that edge and maintaining domestic market competitiveness in the face of the H1N1 pandemic. Results from this research show that e-commerce technology is useful for more than only gaining an edge in the market; it also aids in preserving and spreading the benefits of the sector as a whole. Adopting IT increases efficiency and effectiveness, which leads to a competitive advantage, according to research by Hazen and Byrd (2012). Similar studies by Hamad et al. (2018) demonstrate that e-commerce helps SMEs achieve a competitive advantage by improving business efficiency, reducing expenses, and launching innovative new products and services. The competitive advantage variable in this study has four indicators, namely cost reduction, growth, differentiation and innovation. The four indicators have different t-statistic values (see Figure 3), the highest value is in the differentiation indicator (*Y3.3*), then growth (*Y3.2*), innovation (*Y3.4*), and cost reduction (*Y3.1*).

First differentiation (*Y3.3*), is an attribute achieved by SMEs after utilizing electronic commerce. Concerning differentiation, SMEs acquire a competitive advantage after adopting electronic commerce through a number of channels, including improved customer service, the introduction of novel products and services, and enhanced brand awareness and reputation. In addition, SMEs were able to distinguish themselves by raising brand recognition for their products and services. This finding is consistent with the results of previous research by Hamad et al. (2018) which found that adopting electronic commerce will achieve a form of differentiation. Second, growth (*Y3.2*), is an attribute achieved by SMEs after utilizing electronic commerce. Regarding growth, SMEs gain competitive advantages through growth such as market improvement, business efficiency, and access to new markets after using electronic commerce. This finding is consistent with the results of research by Hamad et al. (2018) which found that adopting electronic commerce helps SMEs to improve business efficiency. The results of this study imply that utilizing more sophisticated electronic commerce will achieve greater growth rates. Adopting a higher level of electronic commerce helps SMEs increase revenue and growth (Elbeltagi et al., 2016).

Third, innovation (*Y3.4*), is an attribute that SMEs achieve after utilizing electronic commerce. To stay ahead of the competition, SMEs must innovate by streamlining their operations, shifting the way they do business, and decreasing the time it takes to bring a product to market. This study's findings are consistent with those of others that have shown that e-commerce is not merely a cost-cutting measure but also a conduit for innovation in the way businesses operate (Hu et al., 2019). Fourth, cost reduction (*Y3.1*), is an attribute achieved by SMEs after utilizing electronic commerce. When it comes to saving money, SMEs get an edge over their competitors by cutting back on expenses associated with promotion, publicity, information dissemination, and supplier-customer interaction. These findings are consistent with prior studies which found that e-commerce led to some type of cost savings (Hamad et al., 2018). As a result, the greater the penetration of e-commerce, the greater the savings. The more widely used internet commerce becomes, the more of an edge it gives businesses (Elbeltagi et al., 2016).

6. CONCLUSION

The evolving landscape of internet technology and e-commerce has rendered ICT indispensable for businesses. Failing to proactively embrace these changes may lead to disruptions. E-commerce adoption emerges as a vital solution for SMEs to thrive in the COVID-19 era. This study focused on Jambi City SMEs and established that technological, organizational, and environmental factors significantly impact e-commerce adoption. Introducing a novel e-commerce technology adoption model, beyond DOI theory and TOE framework, the research illustrates its positive and significant impact on performance and competitive advantage. The government plays a crucial role in supporting SMEs during the pandemic through essential assistance. While not solely relying on the government, SMEs should actively reduce technological barriers and strategically capitalize on e-commerce opportunities for long-term sustainability.

This first-order PLS research employs a quantitative approach, measuring observable dimensions and indicators of latent variables. Generalizing findings may be biased, and the factor analysis model can be modified based on research needs. Despite potential biases in self-evaluations through questionnaires, the research's validity remains intact. PLS-SEM proves to be a powerful tool for testing weak theories, contributing valuable insights into the positive and negative impacts of e-commerce on SMEs. For future research, a qualitative approach emphasizing in-depth analysis is recommended to explore the impact of technological, organizational, and environmental factors on e-commerce adoption, performance, and competitive advantage. This study lays the groundwork for further research focusing on individual units in SMEs, utilizing models like TPB, TAM, and UTAUT with a larger sample size. Additionally, incorporating interviews can enhance data truth and stability. Importantly, the conceptual model can be applied in various contexts to examine consistent effects across different objects or locations.

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