

Connecting the dots: Linking technological, individual, organizational and environmental factors towards SMEs performance with the mediation role of e-commerce adoption

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ABSTRACT

Despite the proven potential of e-commerce in generating business competitiveness and performance, small and medium enterprises (SMEs) adopting that particular technology in developing countries such as Indonesia remains relatively low. It is critical to evaluate the obstacles, expose them, and find a way to overcome the issue, especially as the recent global pandemic of COVID-19 has impacted this sector to a great extent. The impact of COVID-19 on Indonesian SMEs and how they are dealing with it are highlighted in this paper, which is quite scarce and insufficient to cover the gap. Using a survey of 278 SME owners and/or managers in Indonesia, our study aims to explore the influence of technological, individual, organizational, and environmental factors on SMEs' adoption of e-commerce and business performance. We use PLS to explore the relationships proposed in our framework model. The results of this study revealed that technological, individual, organizational, and environmental factors positively affect the adoption of e-commerce. The findings also confirmed that technological, organizational, and environmental factors are the determinant factors that affect Indonesian SMEs' performance. Interestingly, the study did not prove the direct effect of individual characteristics on performance. It indicates that the performances and innovativeness of SMEs within our study are more rooted in their organizational setting rather than individual.

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Introduction

The COVID-19 pandemic has significantly impacted both national and global economies, as noted by Piccialli *et al.* (2021) and Elakkiya *et al.* (2021). According to Brodeur *et al.* (2020), COVID-19 represents the most severe epidemic since the 1918 Spanish Influenza pandemic. This unforeseen global phenomenon has disrupted the economy and brought commerce to a standstill (Ćosić *et al.*, 2020; McKibbin & Fernando, 2020; Qamruzzaman, 2020). Small and medium-sized enterprises (SMEs) have emerged as some of the hardest-hit victims of the COVID-19 crisis as they have struggled to navigate the prolonged and unexpected disruption (Prasad *et al.*, 2015; Bartik *et al.*, 2020). In China, many firms, especially those engaged in exports, were operating at reduced capacity primarily due to diminished demand. Distressingly, the pandemic led to the permanent closure of approximately 19% of incorporated enterprises and 25% of self-employed businesses (Dai *et al.*, 2021). When considering the pandemic's impact across various industry sectors, the study by Lu *et al.* (2021) revealed some interesting dynamics. Despite the severe setbacks faced by the hospitality industry, including accommodation and catering services, which experienced substantial cash flow pressures, their supply chain management and product delivery mechanisms remained relatively resilient.

Conversely, the manufacturing sector, which encountered fewer financial difficulties, grappled with supply chain disruptions. Meanwhile, the pandemic temporarily closed 43% of small firms in the USA, with most having limited cash reserves (Bartik *et al.*, 2020). Estimates suggest that 1.4 million to 2.1 million small and medium-sized firms in the USA may face permanent closure due to the pandemic (Dua *et al.*, 2020). Similar indices were observed in India, as Rathore and Khanna (2020) noted. Their study revealed that firms faced dual shocks regarding raw material shortages and a collapse in the market for final output. The highest impact was on the decrease in demand (55%), driven by an employment loss, production falling from an average of 75% of capacity to just 11%, and the closure of businesses.

The COVID-19 pandemic has posed unprecedented challenges for SMEs, making digital transformation imperative for survival (Papadopoulos *et al.*, 2020). Prolonged lockdowns, movement restrictions, social distancing measures, and consumer behavior toward online services have reshaped the global market landscape (Cowling *et al.*, 2020; Cai & Luo, 2020). In response to this emerging crisis, SMEs must adapt their business strategies. While traditional businesses reliant on physical outlets face adversity, SMEs embracing digital

platforms for product and service delivery thrive and reap significant rewards (Juergensen *et al.*, 2020). Ato Sarsah *et al.* (2020) argue that digital transformation represents the highest level of digital proficiency achieved through integrated innovation and creativity. In times like the COVID-19 crisis, adopting technology, digital marketing, a digital presence, and innovation in digital skills are indispensable for the long-term survival of SMEs. Digital technologies also play a pivotal role in enhancing internal efficiency and productivity, opening new avenues, and enabling SMEs to access broader markets without physical expansion (Cirillo & Molero Zayas, 2019; Kurnia, 2015).

One of the critical digital technologies that can empower SMEs in overcoming these challenges is E-Commerce (EC). EC technologies have emerged as a cornerstone of resilience during the COVID-19 pandemic. However, SMEs in developing countries have been relatively hesitant to adopt these technologies. They encounter various obstacles when considering its integration into their operations (Abdullah *et al.*, 2013). These challenges include environmental factors, such as pressure from consumers and suppliers (Thabit *et al.*, 2016; Nogueira *et al.*, 2022); organizational factors (Wang *et al.*, 2016; Janssen *et al.*, 2020), financial resources (Tarhini *et al.*, 2019); individual characteristics, such as a lack of digital literacy and skills among SME owners and employees (Yu *et al.*, 2017; Antee, 2021), and the issue of data security and privacy (Stewart & Jürjens, 2018). A substantial portion of the existing literature delves into SMEs' adoption of EC technologies aims to elucidate this behavior through the lens of technology adoption. It draws upon established theoretical frameworks such as the Theory of Reasoned Action, the Theory of Planned Behavior, the Technology Acceptance Mode, and the Diffusion of Innovation. The rationale behind this approach is rooted in the recognition that EC technologies represent innovative domains that play a pivotal role in fostering SME growth (Grandón *et al.*, 2011). However, few studies have been dedicated to exploring the adoption of EC technologies within specific industry sectors, such as the food and beverage retail sector, especially when pandemics arise in developing nations like Indonesia. Notably, this sector, renowned for its extensive product range and minimal profit margins, has a history of pioneering innovative technologies to bolster operational efficiency (Pranata, 2022). Consequently, the food and beverage retail sector offer an ideal and valuable context for investigating the adoption of EC technologies. Furthermore, many prior studies primarily focus on assessing the impact of various factors related to technology or organizational aspects individually on the adoption process (Shah Alam *et al.*, 2011; Hussain, 2022), but few studies have undertaken a simultaneous examination of technological and organizational factors. Motivated by the knowledge gaps,

this study investigates how different factors, including those related to individuals, organizations, technology, and environmental pressures, influence the adoption of EC technologies in small and medium-sized food and beverage sectors in Indonesia, especially during the pandemic.

Literature Review

Understanding The Technology Adoption

Numerous theoretical frameworks have been developed to empirically investigate technology adoption, addressing organizational or individual perspectives depending on the unit of analysis. In the context of e-commerce adoption, this paper delves into six prominent theories of technology adoption, selected for their widespread prevalence and acceptance within technology adoption research. Among these widely discussed models are the Theory of Planned Behavior (TPB), the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), the Technology-Environment-Organization (TEO) model, the Diffusion of Innovation (DOI) theory, and the Institutional Theory. This study primarily focuses on the TAM as the central framework for investigating e-commerce adoption.

TAM serves as a predictive framework aimed at understanding users' acceptance and utilization of technology, drawing upon the behavioral aspects of TPB. TAM posits that technology usage is influenced by one's attitude toward using the technology subsequently impacting their intention to use it. The model asserts that an individual's attitude toward technology usage is shaped by their perception of the technology's ease of use (Perceived Ease of Use, PEOU) and perceived usefulness (PU). Furthermore, TAM recognizes that external variables can influence and moderate the relationship between PU and PEOU (Davis, 1985). Critiques of TAM's limited predictive power have led to the development of TAM II, which incorporates social influence and cognitive instrumental processes (Venkatesh & Davis, 2000). While PEOU and PU dimensions in understanding the acceptance or rejection of e-commerce are valuable, they fall short in explaining actual adoption, often referred to as the intention-behavior gap, highlighting that intention alone is an insufficient precursor to successful action (Sheeran & Webb, 2016). Like TPB, TAM I and II primarily focus on analyzing the adoption intentions of individual members of society rather than organizations. TAM does not consider environmental and organizational drivers, such as market dynamics or human resources. Consequently, contemporary research on

organizational e-commerce adoption often combines TAM with the DOI theory (Rogers & Williams, 1983) to compensate for the lack of contextual factors (Wang *et al.*, 2016; Oettmeier & Hofmann, 2017; Marak *et al.*, 2019).

Technological Factors

Technological characteristics are crucial aspects of e-commerce, and the evaluation and measurement of these factors play a pivotal role in enhancing the overall quality (information and system quality) of the e-commerce platform. Delone and McLean (2003) highlight the significance of information quality in improving customer satisfaction and user acceptance. Information quality is characterized by accuracy, completeness, timely access, availability, readability, and the capacity to manage large volumes of data, essential for managing crucial information like patient records, as defined by Nguyen *et al.* (2014). Similarly, as defined by Venkatesh *et al.* (2003), system quality pertains to the excellence of the software or system itself. It encompasses aspects such as user interface consistency, ease of use, system response times, quality of system documentation, ease of code maintenance, and the absence of bugs. Mohamadali and Garibaldi (2010) emphasize that system quality can be gauged based on overall performance. For instance, a system riddled with bugs discourages user engagement, rendering it incapable of fulfilling users' needs effectively. In conclusion, the quality of information and system functionalities significantly influences the adoption of technology and ultimately impacts the performance of SMEs. High-quality information and user-friendly systems contribute to enhanced technology adoption, which, in turn, augments the overall efficiency and effectiveness of SME operations.

H₁: Technological factors significantly influence SMEs' e-commerce adoption.

H₂: Technological factors significantly affect the performance of SMEs.

Individual Factors

Individual factors determine SMEs' ability to adopt e-commerce (Rita & Day, 2015). According to the Theory of Planned Behavior (TPB), individual factors influence e-commerce adoption behavior. In e-commerce, the intention to use e-commerce is influenced by individual factors, such as attitudes, subjective norms, and perceived behavioral control. A positive attitude towards e-commerce will increase the intention to use e-commerce. A highly subjective norm, which is the belief that important people around a person will approve of using e-commerce, will also increase the intention to use e-commerce. High perceived behavioral control, which is the belief that a person can use e-commerce, will also increase

the intention to use e-commerce. TPB theory can also explain that intention to re-use relates to actual use behavior in TRA theory. Therefore, understanding individual factors and how they affect user perceptions is key in driving wider adoption of e-commerce.

Individual characteristics in the context of technology adoption are pivotal in influencing SMEs' performance. As users increasingly recognize the importance of security and the need for IS/IT knowledge, their compatibility with work processes determines their willingness to embrace technology. Compatibility, aligned with existing values and experiences, as demonstrated by Chen and Hsiao (2012) and Hsiao *et al.* (2011), significantly impacts technology adoption. Additionally, users' self-efficacy in dealing with e-commerce, driven by their comprehension and knowledge of computers, enhances their confidence and comfort in using technology, affecting perceived benefits and ease of use. Studies by Hsieh *et al.* (2013) and Sezgin and Yildirim (2014) affirm the importance of self-efficacy in shaping user acceptance. Moreover, social influence, reflecting individuals' perceptions of the encouragement from those significant to them, exerts a considerable impact on technology adoption, as evident in studies by Hsieh *et al.* (2013) and Kummer *et al.* (2013). In conclusion, fostering compatibility, self-efficacy, and social influence among SMEs is integral to promoting technology adoption, ultimately enhancing their performance and competitiveness.

H₃: Individual factors significantly influence SMEs' e-commerce adoption

H₄: Individual factors significantly influence SMEs' performance

Organizational Factors

The relationship between organizational factors and the adoption of e-commerce can be elucidated through Everett Rogers' Diffusion of Innovation (DOI) Theory. In the realm of e-commerce adoption, organizational factors can significantly influence SMEs' attitudes and their ability to control their behavior when it comes to utilizing e-commerce for innovation. Various organizational factors, including structural support, corporate culture, systems, and policies shape the willingness of companies to embrace e-commerce. Organizations characterized by flexible structures, change-friendly cultures, and systems and policies that facilitate the integration of e-commerce technology are more likely to effectively adopt e-commerce. Essentially, the higher an organization's readiness to adapt and change, the greater the likelihood of successful e-commerce adoption.

The Resource-Based View (RBV) Theory also highlights the substantial connection between organizational factors and SME performance. Within SMEs, organizations boasting effective structures, processes, cultures, and systems tend to enhance SME performance. An efficient organizational structure aids SMEs in clarifying task divisions and responsibilities, thereby boosting productivity. Streamlined business processes enable SMEs to provide high-quality products and services, fostering innovation. A culture that encourages innovation and adaptability is also crucial.

Furthermore, effective information systems assist SMEs in efficiently managing data and information, contributing to greater resilience. Thus, comprehending organizational factors through the RBV framework plays a pivotal role in enhancing SME performance by maximizing the use of internal resources. Essentially, the more effective the structures, processes, and systems within SMEs, the better their overall performance.

Organizational characteristics include factors related to internal organizational aspects, such as managerial support and the facilitation of conditions for the implementation of new technology. Research by Lo and Fu (2016) and Ahmad *et al.* (2019) emphasizes the pivotal role of managerial support in adopting new technology and its subsequent impact on organizational performance. Ahani *et al.* (2017) further underscore that the acceptance of IT-based technologies in SMEs is primarily influenced by upper management, as they are responsible for making decisions ranging from day-to-day efforts to investment choices. Additionally, top management is crucial in coordinating and ensuring the availability of resources, including human talents, time, and financial resources, necessary for IS/IT adoption. Facilitating conditions refer to objective environmental factors that, according to consensus among observers, simplify the execution of an action. This includes the provision of computer support (Mohamadali & Garibaldi, 2010; Tahar *et al.*, 2021).

H₅: Organizational factors significantly influence the adoption of e-commerce by SMEs.

H₆: Organizational factors significantly influence SME performance.

Environmental Factors

According to the DOI framework, the decision to adopt an innovation is shaped by internal and external factors. In e-commerce, external environmental factors are pivotal in influencing adoption decisions. These factors encompass the extent of internet penetration, robust technological infrastructure, and governmental support. A higher internet penetration rate simplifies businesses' access to and utilization of e-commerce platforms. Adequate technological infrastructure availability facilitates the integration of e-commerce into

business operations. Governmental support, manifesting in favorable policies and training initiatives, is encouraging for businesses considering e-commerce adoption. E-commerce adoption behavior, as delineated by the Technology Readiness Assessment (TRA), is significantly shaped by these environmental factors, which foster a conducive atmosphere for e-commerce implementation. Moreover, the competitive landscape within an industry compels SMEs to embrace e-commerce as a means of survival and growth (Zhu & Kraemer, 2005). Essentially, the more supportive the environment for e-commerce adoption, the higher the likelihood that businesses will adopt it. Empirical research conducted by Fitriyah *et al.* (2015) substantiates the positive impact of the corporate environment on e-commerce adoption.

Within the SME context, a favorable environment contributes to enhanced SME performance. The Resource-Based View (RBV) theory elucidates that various factors are essential resources crucial for SMEs to attain a competitive edge in their business endeavors (Duan, 2012). These include infrastructure availability, supportive governmental regulations, consistent economic growth, a healthy competitive landscape, and social backing. SMEs' ability to adapt and make decisions by their environmental context is instrumental in achieving optimal performance, particularly in dynamically changing conditions. A more robust environmental support system is anticipated to facilitate performance improvements among many SMEs. Research conducted by Handayani (2016) corroborates that SME business performance experiences enhancements when influenced by environmental factors. The growth of companies is propelled by shifts in internal and external business environments, which mutually influence each other (Crijns & Ooghe, 2000).

H7: Environmental factors significantly influence the e-commerce adoption of SMEs.

H8: Environmental factors significantly influence SME performance.

E-commerce Adoption and SME Performance

The evolving landscape of e-commerce is reshaping the dynamics of business interactions, revolutionizing how enterprises and individuals engage with each other. E-commerce, when effectively implemented, offers a myriad of advantages, spanning international business operations, transactional efficiency, customer loyalty, satisfaction, global network connections (del C. Alarcon *et al.*, 2015), information dissemination, communication management, partnerships, and streamlining logistics throughout the supply chain (Cao *et al.*, 2018). Contemporary research endeavors primarily draw from the Diffusion

of Innovation (DOI) theory and the Technology Acceptance Model (TAM) to explore the adoption of technology. Both models center on elucidating why and how swiftly innovative concepts, technologies, and ideas are embraced by diverse entities, encompassing considerations of environmental factors and industry characteristics. Empirical insights derived from studies applying the TAM framework reveal that various factors, including perceived benefits, technology readiness, owners' innovativeness, owners' IT proficiency, and owners' IT experience, play pivotal roles in influencing the adoption of e-commerce among Indonesian SMEs (Rahayu & Day, 2015). Moreover, a study conducted by Charoensukmongkol (2017) involving 217 small shops in Thailand provided compelling evidence of a significant association between technology usage, including social media, and firm performance. In addition, Chege and Wang (2020), in their study of 204 small businesses situated in Kenya, also revealed the significant impact of technology innovation on firm performance.

The performance of SMEs stands as a pivotal gauge of organizational effectiveness. SME performance encompasses crucial metrics such as market share, firm profitability, and overall firm growth, with profitability and growth serving as indispensable constituents used to evaluate effectiveness (Soininen *et al.*, 2012). Furthermore, SME performance holds immense significance for for-profit entities (Abu-Jarad *et al.*, 2010) and is a fundamental indicator of a firm's accomplishments. Previous research endeavors have commonly assessed SME performance by considering factors such as profit, survival, value, growth, and public image (Prasanna, 2019).

H₉: The adoption of e-commerce significantly influences SMEs' performance.

H₁₀: The adoption of e-commerce mediates the relationship between the TAM constructs (a) technological, (b) individual, (c) organizational, (d) environmental, and SME performance.

Methods

The study employed a purposive sampling technique to collect essential data for analysis, a non-probability method in which the researcher selects units based on their knowledge and professional judgment. This approach was chosen as it proved most effective in identifying respondents who had either adopted, used, or intended to adopt e-commerce and were, therefore, well-informed on the subject. The study sample consisted of food and beverages SMEs located in East Java, Indonesia, selected from the province government database of registered SMEs. From this list, SMEs that met the criteria for e-commerce adoption or intent

became the focus of our survey, utilizing the purposive sampling method mentioned earlier. A total of 278 self-administered online questionnaires were sent to these SMEs via email and WhatsApp, with 251 questionnaires received and analyzed, yielding a response rate of 90%. The use of online or web-based surveys is regarded as a significant and validated tool for new research, offering a rapid, straightforward, and cost-effective means of data collection (Vincent & François, 2016). It's worth noting that ethical considerations were paramount, and respondents were assured that their participation would remain voluntary, confidential, and anonymous throughout the research process. Table 5 presents a demographic overview of a sample population across various profile characteristics. Gender distribution shows a nearly equal split, with 51% males and 49% females. In terms of education, the majority possess a Bachelor's Degree (60%), while other categories include High School (31%) and Master's Degree.

Table 1. Demographic Profile

Profile	Classification	Amount	Percentage (%)
Gender	Male	128	51
	Female	123	49
Age	20-29	71	28
	30-39	92	37
	39 and above	88	35
Education	High-School	79	31
	Bachelor Degree	151	60
	Master Degree	14	6
	PhD	7	3
Job Position	Owner	43	17
	Managing Director	27	11
	Department Head	132	53
	Others	49	20
Number of Employees	Less than 5	72	29
	5-20	82	33
	20 and above	97	39

Table 2. Item, Factor loadings, AVE, Cronbach Alpha, and Composite Reliability.

Constructs	Measurements	Loading	CA	CR	AVE
Technological (TEC)	The information covered meets my work needs.	0.767	0.944	0.951	0.733
	Provides all the useful functions for my work.	0.770			
Individual (IND)	E-commerce adoption is compatible with our business processes and operations.	0.778	0.888	0.871	0.731
	I can easily use e-commerce even though I have not used it before.	0.740			
	People who are important suggested that I use it.	0.737			
Organizational (ORG)	Management provides adequate training.	0.881	0.849	0.892	0.625
	I was involved in implementing e-commerce in my company.	0.877			
Environmental (ENV)	E-commerce would allow the firm to generate higher profits.	0.740	0.832	0.900	0.750
	We adopt e-commerce because many other firms are already using it.	0.754			
Intent to Adopt (ADO)	I use e-commerce to conduct sales activities.	0.815	0.944	0.964	0.899
	I advertise and promote products in e-commerce.	0.737			
Performances (PEF)	E-commerce helps firms enhance awareness.	0.862	0.891	0.917	0.716
	E-commerce helps firms enhance sales.	0.877			

Figure 1. Research Framework

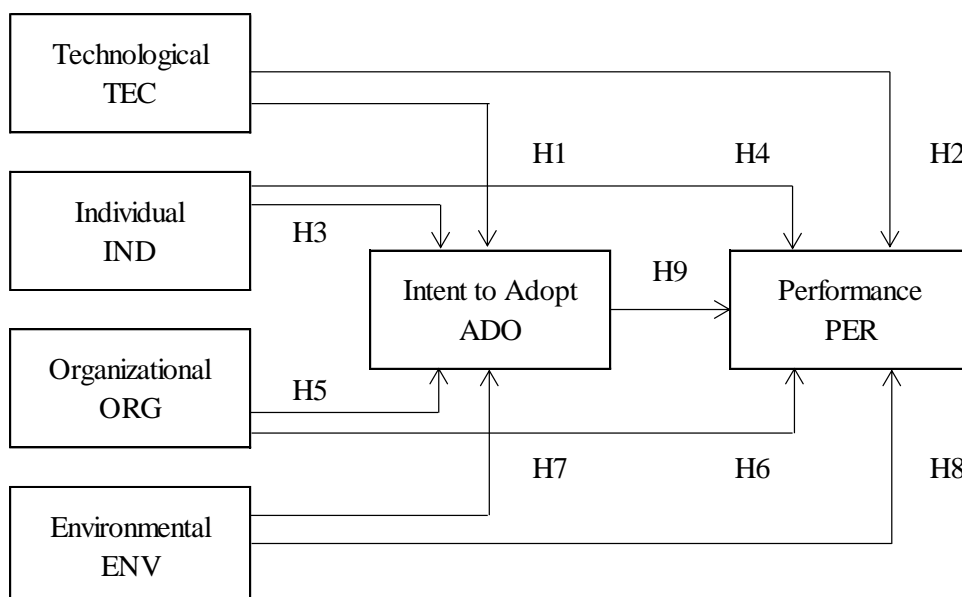


Table 3. Discriminant Validity

	TEC	IND	ORG	ENV	ADO	PER
TEC	0.856					
IND	0.562	0.854				
ORG	0.210	0.342	0.790			
ENV	0.355	0.400	0.677	0.866		
ADO	0.379	0.330	0.525	0.727	0.948	
PER	0.288	0.322	0.534	0.733	0.808	0.846

(6%), and PhD (3%). The majority of the respondents, comprising 37% of the total sample, fall within the age group of 30-39 years. Following closely behind is the age group of 39 years and above, representing 35% of the participants. Meanwhile, the age group of 20-29 years constitutes 28% of the respondents. Additionally, Job positions vary, with Department Heads constituting the largest group at 53%, followed by Owners (17%), Managing Directors (11%), and Others (20%). Concerning the size of the companies or organizations, the sample is distributed across three categories: Less than five employees (29%), 5 to 20 employees (33%), and 20 or more employees (39%).

In this study, responses from respondents were recorded using a five-point Likert scale, where one denoted "strongly disagree," and five represented "strongly agree." The assessment of the technological construct drew upon items from Venkatesh *et al.* (2003), focusing on system and information quality. Meanwhile, the organizational construct was evaluated using two items sourced from Mohamadali and Garibaldi (2010), specifically addressing management support and facilitating conditions within the organization. For individual characteristics, three items measuring compatibility, self-efficacy, and social influence were adapted from Handayani *et al.* (2016). Additionally, two items related to environmental factors and behavioral intentions to adopt e-commerce technology were adapted from Awiagah *et al.* (2015). Finally, the assessment of SMEs' performance encompassed seven items adapted from Cao *et al.* (2018). Table 2 provides the item measurement for each construct and the result of the measurement model, including loading factor, composite reliability (CR), Cronbach alpha (CA), and Average Variance Extracted (AVE). Figure 1 shows the comprehensive research framework of the study.

Furthermore, the validation of the measurement model involved a rigorous assessment of various quality criteria and construct-related factors to ensure the reliability and validity of

observed constructs in relation to their respective latent constructs. These criteria encompassed evaluating the goodness of fit to determine how well the model aligns with the observed data, examining factor loadings to ensure their values surpass a designated threshold (e.g., 0.7), signifying robust relationships between items and their latent constructs (Hair *et al.*, 2019). Additionally, they guided the Average Variance Extracted (AVE) was used to gauge the proportion of variance captured by the constructs, with values above 0.5 considered acceptable, while Composite Reliability (CR) and Cronbach's Alpha assessed the internal consistency of items within constructs, with values exceeding 0.7 indicative of good reliability. Collectively, these criteria provided a comprehensive evaluation of the measurement model's quality and rigor, ensuring that it accurately represents the relationships between observed and latent variables. This robust validation process contributes to our confidence in understanding how self-efficacy, compatibility, social influence, and other factors can enhance technology adoption and subsequently improve SMEs' overall performance. Table 2 above shows that all values of loading factor, AVE, CR, and CA meet the threshold. Table 3 confirms satisfactory discriminant validity, as the square root of the Average Variance Extracted (AVE) for each construct exceeds the inter-correlations of the construct with other model constructs. Additionally, the study's results indicate that the R-squared (R^2) values exceed 0.1, signifying a strong predictive capability. Furthermore, the predictive relevance of endogenous variables was assessed using the Q^2 statistic, where a Q^2 value above 0 confirms predictive relevance. The results demonstrate that the Q^2 values for all endogenous constructs are above 0, further confirming their predictive relevance.

Result and Discussion

Based on the results of hypothesis testing presented in Table 4, the probability values in the regression weight table are all below 0.05, with a probability value of 0.000, indicating statistical significance. Consequently, hypotheses H_1 , H_2 , H_3 , H_5 , H_6 , H_7 , H_8 , and H_9 are accepted. This implies that technological, individual, organizational, and environmental factors significantly influence e-commerce adoption by SMEs. Moreover, technological, organizational, and environmental factors and e-commerce adoption significantly impact SME performance, except for individual factors, which do not significantly affect SME performance, as indicated by a regression weight exceeding 0.05. Additionally, the study explored the indirect effect of e-commerce adoption on the relationship between technological, individual, organizational, and environmental factors and SME performance. The results of hypothesis testing show that H_{10} is partially accepted, signifying a partially

significant indirect effect, demonstrated by the coefficient of the indirect effect being greater than the coefficient of the direct effect. This suggests that e-commerce adoption enhances the relationship between technological, organizational, and environmental factors and SME performance.

The study sheds light on various factors influencing SMEs' adoption of e-commerce. Primarily, technological factors play a pivotal role in shaping the readiness of business actors to incorporate e-commerce into their operations. E-commerce adoption is influenced by the availability of technological resources that support the system, including hardware and software. SMEs benefit from e-commerce by efficiently managing their operations, reducing operational costs, expanding their market reach, and enhancing competitiveness. Additionally, SMEs consider the utility of e-commerce in their operations, as it automates various business processes, saving both time and costs. Consequently, increased technological factors are associated with higher e-commerce adoption rates among SMEs. This finding aligns with previous research by Venkatesh *et al.* (2003) and Mohamadali and Garibaldi (2010), highlighting the positive impact of technological factors on e-commerce adoption.

Table 4. Hypothesis Testing

Hypothesis	<i>t</i> -value	<i>p</i> -value	Decision
H ₁ : TEC -> ADO	3.740	0.000	Accepted
H ₂ : TEC -> PER	4.493	0.000	Accepted
H ₃ : IND -> ADO	3.112	0.000	Accepted
H ₄ : IND -> PER	1.300	0.076	Rejected
H ₅ : ORG -> ADO	2.992	0.000	Accepted
H ₆ : ORG -> PER	6,143	0.000	Accepted
H ₇ : ENV -> ADO	2.501	0.006	Accepted
H ₈ : ENV -> PER	2.925	0.000	Accepted
H ₉ : ADO -> PER	3.433	0.000	Accepted
H _{10a} : TEC -> ADO -> PER	2.766	0.000	Accepted
H _{10b} : IND -> ADO -> PER	1.222	0.068	Rejected
H _{10c} : ORG -> ADO -> PER	2.282	0.012	Accepted
H _{10d} : ENV -> ADO -> PER	2.132	0.001	Accepted

E-commerce adoption decisions are significantly influenced by individual factors, particularly the technological knowledge and skills possessed by SME actors. Those with a strong grasp of technology find it easier to embrace e-commerce, and individual characteristics play a pivotal role in fostering business innovation. Such individuals tend to adopt e-commerce to leverage their competencies effectively, and the presence of skilled human resources capable of operating e-commerce systems facilitates its implementation. This finding is consistent with prior research by Handayani *et al.* (2016).

Organizational factors also exert a substantial influence on the decision to adopt e-commerce. These factors encompass the availability of financial resources, willingness to accept the associated risks, leadership commitment, change readiness, and the development of information technology. E-commerce adoption is facilitated when a company supports transitioning from conventional sales to online channels. Companies' willingness to adopt e-commerce often stems from changing consumer behavior as more consumers shift from in-person shopping to online transactions. Sufficient financial resources motivate companies to adopt e-commerce, anticipating the benefits outweigh the costs incurred. Thus, environmental factors are pivotal in SMEs' decisions to adopt e-commerce. These factors encompass customer pressures, demands and encouragement from suppliers, support for business development, and government initiatives to promote digitalization. The evolution of the business landscape itself influences changes in consumer behavior from traditional shopping to online purchases. Modern consumers prefer the convenience and practicality offered by e-commerce transactions. Higher pressures from business partners encourage companies to adopt e-commerce to maintain their competitive edge. Companies that wish to retain customers and compete effectively must keep pace with evolving business trends, including adopting e-commerce. This finding aligns with research by Ahani *et al.* (2017) and Lo & Fu (2016).

Superior SME performance is integral to the growth and development of SMEs. This study underscores the impact of various factors on SME performance, including technological, organizational, environmental factors, and e-commerce adoption. Technological factors contribute to improved SME performance, leading to an increase in market share. Social media enhances customer service and marketing performance, boosting sales turnover. Technology is not merely a source of information; it also serves as a cost-efficient operational strategy. Companies with a technology-oriented approach can compete effectively as consumers increasingly shift to online shopping. This finding is supported by research conducted by Soininen *et al.* (2012), Abu-Jarad *et al.* (2010), and Prasanna (2019).

Organizational factors significantly influence SME performance, with technological readiness and larger company sizes leading to better performance. The competitive strategy adopted by an organization aligns with its size, and larger companies possess the resources required to establish the necessary infrastructure for performance improvement. The ability to allocate financial and human resources enhances the development of a competitive business system. An adaptive organizational culture fosters flexibility in responding to competitive strategies. Therefore, effective organizational management is crucial for achieving strong SME performance. This observation is consistent with research by Tiago and Maria (2010).

Environmental factors are key drivers supporting SME performance. Each stage of a company's growth is shaped by its business environment, encompassing internal and external factors that influence each other. Dynamic capability is an internal factor that enhances a company's potential to systematically solve problems, ultimately contributing to improved performance. External factors, such as industry, market conditions, competitors, and economic climate, introduce environmental uncertainty. Competitors' activities in the market prompt SMEs to continually adapt to environmental uncertainties. SMEs capable of meeting customer demands, preferences, and tastes have the potential to achieve strong performance and outcompete rivals. This observation aligns with Oentaroel's (2017) and Duan (2012) research.

An increasing number of SMEs are registering their businesses and leveraging e-commerce to support their operations. The primary driver influencing e-commerce adoption is the belief among companies that it will yield greater benefits than conventional trading methods. SMEs perceive that going online provides advantages such as improved access to essential information for buyers seeking products and sellers marketing their offerings. E-commerce adoption increases sales by enhancing service quality and marketing performance, increasing sales turnover. E-commerce adoption has a direct and positive impact on SME performance.

While most of the hypotheses have been accepted, one intriguing finding is that individual factors do not significantly affect SME performance. This suggests that demographic aspects such as business management capabilities, SME age, and SME experience do not substantially enhance SME performance. While individual capabilities contribute valuable skills and decision-making, external factors often substantially influence SME success. Therefore, SME performance frequently hinges on their capacity to manage and adapt to changes in the external business environment, which they may not fully control.

This indicates that the performances and innovativeness of SMEs within our study are more rooted in their organizational setting rather than individual attributes.

Conclusion and Suggestion

The purpose of this study was to investigate the relationship between technological factors, individual factors, organizational factors, environmental factors, and e-commerce adoption in the context of SME performance. The results demonstrated that technological, individual, organizational, and environmental factors all exerted significant effects on the adoption of e-commerce. Furthermore, these factors, along with e-commerce adoption itself, significantly influenced SME performance. However, the study revealed that individual factors did not significantly impact SME performance. Additionally, e-commerce adoption was found to mediate the relationships between technological factors, organizational factors, and environmental factors on SME performance. Notably, e-commerce adoption did not mediate the relationship between individual factors and SME performance. This outcome suggests that SMEs must adaptively leverage digital technology to maximize performance.

In a broader context, these findings have meaningful implications for academia, practitioners, and regulators. Academics now recognize the mediating role of e-commerce adoption in explaining why technological, individual, organizational, and environmental factors impact SME performance. By incorporating mediation effects into analytical models, researchers can enhance the accuracy and relevance of SME performance prediction models, shedding light on the underlying mechanisms of these relationships and providing a more effective framework for enhancing SME performance. Practitioners in the business world now appreciate the crucial role of digital technology adoption in their operations. To boost their performance, SMEs must proactively respond to the shift from traditional to digital business paradigms by integrating technology adoption with internal and external factors.

However, this study has limitations, which could serve as avenues for future study. The use of cross-sectional data in this study precludes the establishment of causal relationships between the variables. Future studies could employ longitudinal data to elucidate causal links and combine survey and interview methods for a comprehensive understanding. Additionally, the study's sample was limited to SMEs in the Greater Malang area, potentially limiting the generalizability of the results. Similar studies should be conducted in diverse contexts to enhance external validity to ascertain the findings' generalizability. Furthermore, this study focused solely on financial performance and did not consider non-financial performance

indicators. Future research should incorporate non-financial performance metrics to provide a more holistic assessment of SME performance.

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