

E-Commerce Implementation on MSME Sales Performance: Customer Satisfaction Mediation and Technology Adaptation Moderation

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ABSTRACT

This study examines the impact of e-commerce implementation on the sales performance of MSMEs across Indonesia. It specifically investigates the mediating role of customer satisfaction and the moderating effect of technology adaptation in this relationship. This study employed a correlational research design using a quantitative approach. Data were collected through random sampling from 366 Indonesian MSMEs engaged in e-commerce transactions. The data were analysed using structural equation modelling with the partial least squares (PLS-SEM) approach. The results indicate that e-commerce implementation has a significant positive effect on MSME sales performance. Customer satisfaction also plays a significant mediating role in this relationship. One limitation of this study is its reliance on cross-sectional data collected from a single source at one point in time, which may not capture longer-term patterns. In addition, the findings may not be generalisable to all MSMEs, as the sample may not fully represent the diversity of businesses across different regions of Indonesia.

KEYWORDS

Customer satisfaction
E-commerce
MSMEs
Sales performance
Technology adaptation

INTRODUCTION

Business transformation at the global level is increasingly driven by the rapid growth of online shopping transactions, including among MSMEs. Research by Kim et al. (2024) and Wijaya et al. (2025) showed that e-commerce can improve individual and organizational performance by enhancing the quality of systems, information, and services. Furthermore, Salah & Ayyash (2024) and Behera et al. (2025) found that e-commerce is a significant catalyst for increasing MSME sales and helps these businesses remain resilient during challenging economic conditions. Studies also show that the adoption of e-commerce can significantly improve MSME sales performance, with

customer satisfaction serving as a fundamental determinant of this positive outcome. However, how technology adaptation influences this relationship remains poorly understood.

For a considerable time, customer satisfaction has been considered a pivotal driver of business success. Research by Ashiq & Hussain (2024), Dinesh et al. (2021), and Li et al. (2023) stated that technological adaptability can help improve service quality, which ultimately enhances customer satisfaction in e-commerce. Ali & Alfayez (2024), Ashiq & Hussain (2024), Nursalim et al. (2025), and Rita et al. (2019) revealed that service quality within the digital marketplace is closely associated with customers' perceived value, satisfaction, and loyalty. Furthermore, Anitha & Kumar (2023) and Magatef et al. (2023) showed that online e-CRM activities positively influence customer satisfaction, which subsequently mediates the relationship between e-CRM and customer loyalty. Naibaho et al. (2025) demonstrated that customer satisfaction serves as a critical mechanism through which e-commerce adoption affects the marketing performance of MSMEs. Additionally, Purnamasari & Suryandari (2023) and Gao et al. (2023) underscored that both customer satisfaction and electronic trust function as pivotal determinants of consumers' repurchase intentions in the B2C e-commerce sector.

The capacity to integrate new technologies is essential for improving operational efficiency and enhancing overall organizational performance. Magatef et al. (2023) and Kumar & Mokha (2022) showed that online e-CRM activities improve customer satisfaction, which mediates the relationship between e-CRM and customer loyalty. Research by Ruiz-Herrera et al. (2023), Gimeno-Arias et al. (2024), Suryani (2025), Wang et al. (2023), and Yang et al. (2025) confirmed that business digitalization and operational efficiency through e-commerce improve overall organizational performance. Lantana & Digdowiseiso (2023) suggested that machine learning can help smaller-scale enterprises enhance their sales effectiveness through e-commerce. Herzallah & Mukhtar (2015) asserted that Organizational Information Ecology (OIE) also significantly influences e-commerce adoption and organizational performance. Moreover, Suparjo et al. (2020) showed that sales force integrity improves customer satisfaction by optimizing service delivery coordination.

Customer loyalty in online shopping is often influenced by customers' perceptions of service quality. Nursalim et al. (2025) indicated that high-quality service can enhance customers' perceived value, reduce their perceived risk, and improve their satisfaction and loyalty. According to Purnamasari & Suryandari (2023) and Gao et al. (2023), customer satisfaction and digital trust function as vital determinants of repurchase intention in the B2C e-commerce sector. Studies by Gimeno-Arias et al. (2024) and German Ruiz-Herrera et al. (2023) showed that different technology adoption models and theories influence the extent to which individuals accept and use e-commerce, which subsequently affects customer loyalty. Individual, environmental, and organizational factors also serve as critical drivers influencing the extent of e-commerce adoption and customer satisfaction (Hadian & Rizaludin, 2024; Hendricks & Mwapwele, 2024; Maslichah & Nur Diana, 2022). Moreover, Suwanamas et al. (2015) asserted that both service quality and customers' emotional states simultaneously influence customer satisfaction, which, in turn, positively affects customer loyalty.

Although previous literature has amply demonstrated that e-commerce implementation positively impacts the sales growth of MSMEs, the dynamic nature of digital market mechanisms often yields inconsistent results. Several studies have found that the adoption of digital technology does not necessarily boost sales without a positive market response. This gap arises because most previous research tends to assume a linear relationship, overlooking customer retention processes and organizations' internal capacity to respond to technological change. The use of digital platforms merely serves as an operational tool, whereas the key to sustainable sales lies in how the technology creates high customer satisfaction. Therefore, a mediating variable, specifically customer

satisfaction, is required to more accurately explain the causal pathway through which e-commerce implementation influences sales performance.

Conversely, the effectiveness of e-commerce in generating customer satisfaction and improving sales performance is highly dependent on the readiness of smaller-scale enterprises. This is where another theoretical gap lies: many smaller business units fail to maximize the benefits of digital platforms because of their limited ability to adapt to continuously evolving technologies and platform features. This research seeks to address this gap by incorporating technology adaptation as a moderating variable. This variable serves as a contextual factor that explains why the impact of e-commerce varies across businesses. By integrating customer satisfaction as a mediator and technology adaptation as a moderator into a single empirical model, this study provides a more comprehensive understanding of the challenges and factors involved in the digital transformation of MSMEs. This issue remains underexplored in the existing literature, particularly regarding the simultaneous examination of these relationships.

LITERATURE REVIEW

Information Systems Success Model (DeLone & McLean)

This model provides a comprehensive framework for evaluating the effectiveness and success of information system implementation. It is conceptually grounded in the causal relationships among six key dimensions: quality dimensions (system quality, information quality, and service quality), behavioural dimensions (system use and user satisfaction), and net benefits (DeLone & McLean, 2016). The implementation of e-commerce by MSMEs represents the adoption of information technology that reflects these quality dimensions. The quality of interactions and the reliability of the e-commerce system directly influence the customer transaction experience, which, in turn, contributes to customer satisfaction. Furthermore, customer satisfaction with the use of the system encourages repeat purchase behaviour and customer loyalty, ultimately generating net benefits for the organization. In this study, these net benefits are reflected in the sales growth of MSMEs.

The Predictive Power of Customer Satisfaction Regarding MSME Sales Performance

Previous scholarly work underscores the fundamental role of customer satisfaction in improving MSME sales performance. According to Singh et al. (2023), optimizing service quality enhances customer satisfaction, which, in turn, leads to higher sales. Ashiq & Hussain (2024) also emphasized that high customer satisfaction contributes to customer loyalty and retention, which are important indicators of sales growth. Furthermore, Rita et al. (2019) discovered that online e-CRM initiatives exert a positive and simultaneous influence on both customer satisfaction and sales performance. Balinado et al. (2021) pointed out that customer satisfaction and electronic trust are crucial determinants of repurchase intention in the business-to-consumer (B2C) e-commerce sector. Research by Kilay et al. (2022) also confirmed that technology and organizational factors significantly influence MSME performance through e-commerce adoption.

H1: Customer satisfaction positively influences MSME sales performance.

The Impact of E-commerce Adoption on Customer Satisfaction

Research by Nuralam et al. (2024), Wattoo et al. (2025), and Iqbal et al. (2023) revealed that e-commerce adoption enhances the customer experience by improving product accessibility and service efficiency. The integration of digital technology also positively influences customer satisfaction (Suryani, 2025). Similarly, Ashiq & Hussain (2024), G et al. (2021), and Li et al. (2023) discovered that the adoption of information technology significantly influences customer satisfaction. Providing further operational context, Nursalim et al. (2025) verified that business digitalization improves service quality, thereby increasing customer satisfaction.

H2: E-commerce adoption positively and significantly influences customer satisfaction.

The Effect of E-commerce Adoption on MSME Sales Performance

E-commerce adoption has become an important strategy for MSMEs to improve operational efficiency, expand market reach, and enhance sales performance. Investigations conducted by Paranti et al. (2024) and Sharma (2024) demonstrated that e-commerce implementation significantly enhances resource optimization and sales growth. Similarly, Malki et al. (2024) showed that the use of information technology improves business performance by supporting more effective business processes. Furthermore, Akin (2024), Julius (2025), and Liu et al. (2013) discovered that e-commerce adoption enhances company competitiveness and productivity. In addition, Salah & Ayyash (2024) revealed that e-commerce enables MSMEs to expand their markets and increase sales.

H3: E-commerce adoption positively and significantly influences MSME sales performance.

Customer Satisfaction as a Mediator between E-Commerce Adoption and MSME Sales Performance

Customer satisfaction plays a central role in explaining how e-commerce adoption can translate into improved business outcomes. Alisa & Agus (2025) highlighted that customer satisfaction is an important factor in building loyalty within e-commerce environments, as satisfied customers are more likely to develop stronger loyalty. Similarly, Wibowo et al. (2024) demonstrated that customer satisfaction functions as a mediating mechanism through which e-commerce innovation and e-service quality influence customer loyalty. Furthermore, Nuralam et al. (2024) found that the effect of perceived usefulness on repurchase intention occurs through the full mediation of consumer satisfaction. These findings suggest that e-commerce adoption alone may not directly generate improved sales performance; rather, customer satisfaction represents an essential pathway through which digital capabilities can create value and encourage favourable customer behaviours that contribute to MSME sales growth.

H4: Customer satisfaction significantly mediates the relationship between e-commerce adoption and MSME sales performance.

Technology Adaptation as a Moderator

Previous studies have highlighted the important role of technology adaptation in enhancing business processes and improving performance outcomes. Ashiq & Hussain (2024), Rane et al. (2023), and

Rita et al. (2019) suggested that when technology is effectively utilized, it can improve service quality and customer interactions, thereby increasing customer satisfaction and generating better sales outcomes. In the context of e-commerce, Paranti et al., (2024) In the context of e-commerce, Paranti et al. (2024) found that technology adaptation improves operational efficiency and customer satisfaction, which subsequently contributes to improved sales performance. Similarly, Malki et al. (2024) confirmed that business digitalization enhances overall company performance. Furthermore, Suparjo et al. (2020) demonstrated that sales forces capable of adapting to new technologies can improve service coordination and customer satisfaction, ultimately supporting sales growth. Ghobakhloo & Ching (2019) further indicated that technology adaptation becomes increasingly important in dynamic business environments, strengthening the relationship between customer satisfaction and sales performance.

H5: Technology adaptation significantly moderates the relationship between customer satisfaction and MSME sales performance.

Technology adaptation plays an important role in determining the extent to which e-commerce adoption can generate improved business performance. Ghobakhloo & Ching (2019) indicated that technology adaptation enhances the effect of technology adoption on business performance. They further found that trust and technology adaptation together strengthen the positive influence of e-commerce adoption on sales growth. Similarly, Faiz et al. (2024) and Nurdin et al. (2012) confirmed that technology adaptation significantly moderates the implementation of organizational technologies. According to Anabila et al. (2024), Nyarko et al. (2022), and Zhao-hui et al. (2020), trust and technology adaptation strengthen the positive impact of e-commerce adoption on sales value. Furthermore, Kumar & Mokha (2022) emphasized that technology adaptation is a key factor in enhancing the effectiveness of e-commerce adoption in improving sales growth. Malki et al. (2024) also demonstrated that technology adaptation increases the effectiveness of e-commerce implementation in accelerating organizational sales performance.

H6: Technology adaptation significantly moderates the relationship between e-commerce adoption and MSME sales performance.

Figure 1 illustrates the conceptual framework developed for this study based on a comprehensive review of the existing literature.

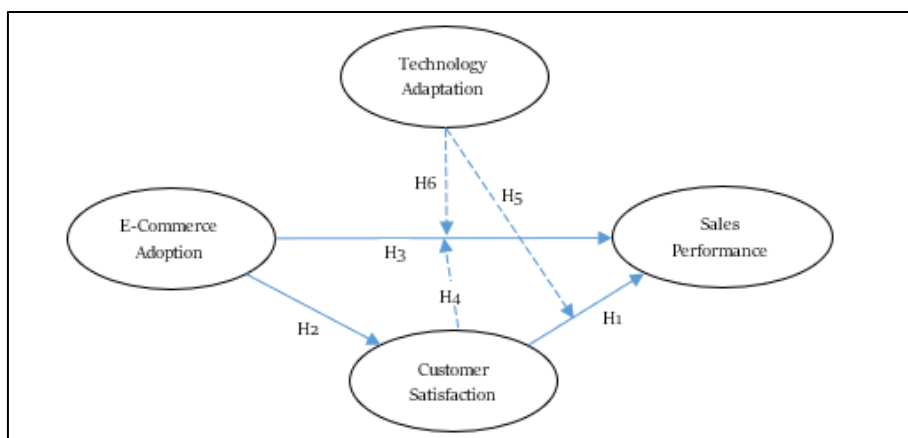


Figure 1. Hypothetical Model

RESEARCH METHOD

This research employed a correlational research design using a quantitative approach to examine the relationships among independent, mediating, moderating, and dependent variables simultaneously. Data were collected through an online survey of MSMEs that had adopted e-commerce. The research model consisted of four constructs: e-commerce adoption (ADOP) as an exogenous construct, customer satisfaction (CUST) as a mediating construct, technology adaptation (TECH) as a moderating construct, and sales performance (SALES) as an endogenous construct. Data were collected from 366 small and medium-sized enterprises through an online questionnaire. The questionnaire consisted of measurement items representing the research constructs, including e-commerce adoption, customer satisfaction, technology adaptation, and sales performance. It was distributed via WhatsApp to reach MSMEs that met the research criteria and ensure that the collected data aligned with the research objectives.

E-commerce adoption was measured through indicators related to digital platform utilization, the frequency of online transactions, and the range of products or services available through online channels (Halim et al., 2024; Mofokeng, 2021). Customer satisfaction was assessed based on service quality, digital shopping experience, and customer support effectiveness (Prakoso et al., 2023; Rita et al., 2019; Wattoo et al., 2025). Technology adaptation was measured through the ability to operate new technological developments, the speed of adopting new technologies, and the resources allocated to technological advancement. Meanwhile, sales performance was evaluated through annual sales growth, customer growth, and customer retention rate (Agag et al., 2023).

The questionnaire employed a 6-point Likert scale ranging from 1 (Strongly Disagree) to 6 (Strongly Agree). The collected data were analysed using the Partial Least Squares Structural Equation Modelling (PLS-SEM) approach with SmartPLS software. The analysis was conducted in two stages. The first stage involved evaluating the measurement model by assessing convergent validity, discriminant validity, and reliability. Convergent validity was evaluated using the Average Variance Extracted (AVE), with values above 0.50 indicating adequate validity, as presented in Table 1. Measurement reliability was assessed using Cronbach's Alpha and Composite Reliability, as shown in Table 2 (Hair et al., 2022). The second stage involved evaluating the structural model to examine the relationships among the constructs.

Table 1. Average Variance Extracted

	AVE
Customer Satisfaction	0.836
E-commerce Adoption	0.745
Sales Performance	0.819
Technology Adaptation	0.805

Table 2. Measurement Reliability and Internal Consistency Testing

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
Customer Satisfaction	0.967	0.967	0.973
E-commerce Adoption	0.942	0.944	0.953
Sales Performance	0.963	0.964	0.969
Technology Adaptation	0.960	0.960	0.967

The structural model was evaluated by examining the R-squared values (Table 3) of the endogenous constructs and assessing the significance of relationships among exogenous, mediating, moderating,

and endogenous constructs. The analysis also examined the moderating effect of technology adaptation on the relationship between e-commerce adoption and sales performance, as well as the mediating role of customer satisfaction in explaining the effect of e-commerce adoption on sales performance.

Table 3. Coefficient of Determination

	R-square	R-square adjusted
Customer Satisfaction	0.834	0.833
Sales Performance	0.885	0.883

RESULTS

The proposed theoretical framework was analyzed using Structural Equation Modelling (SEM) and is presented through the path diagram in Figure 2. The path diagram illustrates the relationships among the research constructs, including the relationship between e-commerce adoption and customer satisfaction, as well as the influence of technology adaptation on MSME sales performance. The questionnaire items demonstrated factor loadings above 0.70, indicating that the measurement model achieved adequate convergent validity and reliability.

The measurement model was developed using the questionnaire items to assess the latent constructs, including e-commerce adoption, customer satisfaction, technology adaptation, and sales performance. Both the measurement and structural models were analysed using SmartPLS software and are presented in Figure 2.

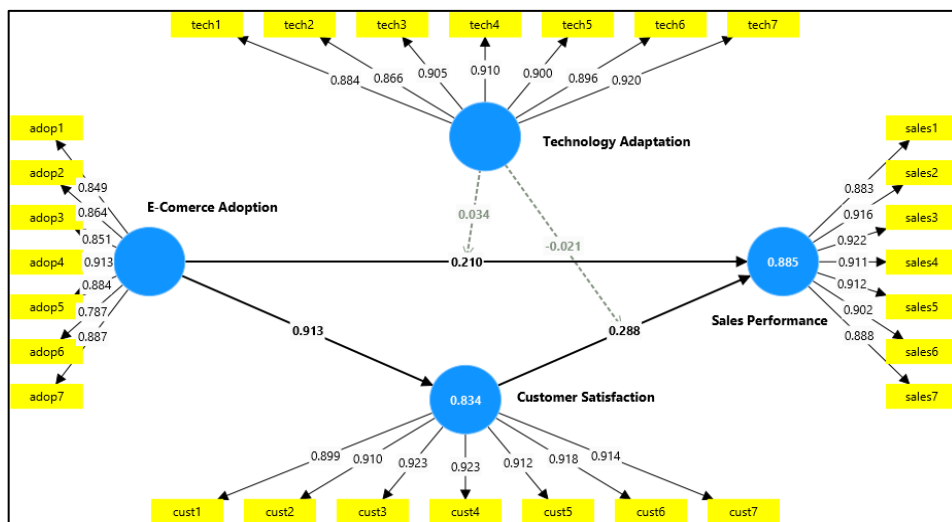


Figure 2. Path Diagram

The results of the factor loading analysis reveal that all indicators within the examined constructs meet the recommended threshold, with loading factor values exceeding 0.70. This indicates that the indicators demonstrate adequate convergent validity and are suitable for measuring the respective constructs. Furthermore, all indicators show statistically significant loadings, confirming the robustness of the measurement model.

The reliability analysis also confirms the consistency of all measurement scales, as both Cronbach's Alpha and Composite Reliability values exceed the recommended threshold of 0.70. These results indicate strong internal consistency among the items of each construct, providing a reliable foundation for further structural model analysis.

The structural model demonstrates strong predictive capability in explaining the variance of the endogenous constructs, particularly customer satisfaction and sales performance. Higher R-squared (R^2) values indicate that the exogenous constructs contribute substantially to explaining variations in the endogenous constructs, supporting the proposed research model. The model therefore provides an appropriate framework for examining the relationships among e-commerce adoption, customer satisfaction, technology adaptation, and MSME sales performance.

The proposed model also demonstrates satisfactory fit with the empirical data. The fit indices, including SRMR, Chi-square, and NFI, indicate that the model achieves an acceptable level of validity and is appropriate for further structural analysis. These results support the examination of the hypothesized relationships, including the mediating role of customer satisfaction and the moderating role of technology adaptation in the relationship between e-commerce adoption and MSME sales performance.

This study further assessed the effect sizes of the relationships among constructs using the f-square (f^2) value. Based on Cohen (2013), effect sizes are categorized as small (0.02), medium (0.15), and large (0.35). The analysis evaluates the practical importance of the exogenous constructs in explaining the endogenous constructs within the model.

The results indicate that e-commerce adoption significantly influences customer satisfaction, while both customer satisfaction and technology adaptation contribute significantly to MSME sales performance. However, the interaction effect involving technology adaptation does not demonstrate a significant influence. These findings highlight the importance of customer satisfaction and effective technology utilization in improving MSME sales performance.

Direct Effect Hypothesis Testing

Table 4. Direct Influence Hypothesis Test

				Parameter	t statistics	P values	Description
Customer Satisfaction	->	Sales Performance		0.288	3.920	0.000	H1: Accepted
E-commerce Adoption	->	Customer Satisfaction		0.913	77.311	0.000	H2: Accepted
E-commerce Adoption	->	Sales Performance		0.210	3.530	0.000	H3: Accepted
Technology Adaptation	x	Customer Satisfaction -> Sales Performance		-0.021	0.409	0.683	H5: Rejected
Technology Adaptation	x	E-commerce Adoption -> Sales Performance		0.034	0.622	0.534	H6: Rejected

The direct relationships among the research constructs were examined using the PLS-SEM approach. Table 4 summarizes the hypothesis testing results, including the estimated path coefficients (β), t-statistics, p-values, and the empirical status of each hypothesis. Following the recommendation of Hair et al. (2022), a hypothesis is considered statistically significant when the t-statistic exceeds 1.96, and the corresponding p-value is below 0.05.

The results indicate that customer satisfaction has a significant positive effect on MSME sales performance ($\beta = 0.288$, $t = 3.920$, $p < 0.001$), supporting H1. Likewise, e-commerce adoption has

a significant positive effect on customer satisfaction ($\beta = 0.913$, $t = 77.311$, $p < 0.001$), providing strong support for H2. The findings also confirm that e-commerce adoption significantly and positively influences MSME sales performance ($\beta = 0.210$, $t = 3.530$, $p < 0.001$), thereby supporting H3.

In contrast, the moderating effect of technology adaptation on the relationship between customer satisfaction and sales performance is not statistically significant ($\beta = -0.210$, $t = 0.409$, $p = 0.683$), leading to the rejection of H5. Similarly, technology adaptation does not significantly moderate the relationship between e-commerce adoption and MSME sales performance ($\beta = 0.034$, $t = 0.622$, $p = 0.534$); therefore, H6 is also not supported.

Overall, the findings demonstrate that e-commerce adoption significantly improves both customer satisfaction and MSME sales performance, while customer satisfaction also contributes positively to sales performance. However, technology adaptation does not significantly strengthen the relationships between customer satisfaction and sales performance or between e-commerce adoption and sales performance. These findings suggest that although technology adaptation is important for supporting digital business operations, its moderating role in the proposed model is not empirically supported.

Indirect Effect Hypothesis Testing

The indirect effect of e-commerce adoption on MSME sales performance through customer satisfaction was examined using the PLS-SEM approach. Table 5 presents the results of the mediation analysis.

Table 5. Indirect Effect Hypothesis Testing

	Parameter Coefficient	T statistics	P values
E-commerce Adoption -> Sales Performance	0.263	3.911	0.000

The results indicate that the indirect effect is positive and statistically significant ($\beta = 0.263$, $t = 3.911$, $p < 0.001$), demonstrating that customer satisfaction significantly mediates the relationship between e-commerce adoption and MSME sales performance. Accordingly, H4 is supported. These findings suggest that the positive effect of e-commerce adoption on MSME sales performance operates, in part, through increased customer satisfaction. In other words, greater adoption of e-commerce enhances customer satisfaction, which subsequently contributes to improved sales performance.

DISCUSSION

This study examines the direct effects of e-commerce adoption on MSME sales performance and customer satisfaction, as well as the mediating role of customer satisfaction and the moderating role of technology adaptation. The findings provide empirical evidence that e-commerce adoption and customer satisfaction play important roles in improving MSME sales performance, whereas the moderating effect of technology adaptation is not empirically supported.

The findings support the first hypothesis (H1), demonstrating that customer satisfaction has a significant positive effect on MSME sales performance. This result is consistent with the findings of Singh et al. (2023), who reported that service quality and customer emotions jointly enhance customer satisfaction, ultimately contributing to improved sales performance. Similarly, Rane et al.

(2023) emphasized that customer satisfaction is a key driver of customer loyalty, which subsequently leads to increased sales and higher profitability. Collectively, these findings reinforce the importance of customer satisfaction as a strategic asset that enables MSMEs to improve their sales performance in increasingly competitive digital markets.

The findings also support the second hypothesis (H2), indicating that e-commerce adoption has a significant positive effect on customer satisfaction. This finding is consistent with previous studies by Iqbal et al. (2023), Nuralam et al. (2024), and Wattoo et al. (2025), which demonstrated that e-commerce enhances the customer experience by improving accessibility, convenience, and service efficiency. Similarly, Suryani (2025) reported that digital technology contributes positively to customer satisfaction by facilitating more efficient and responsive customer interactions. These findings are further supported by Ashiq & Hussain (2024) and Rita et al. (2019), who argued that technological capabilities and organizational support play important roles in enhancing customer satisfaction. Taken together, these results suggest that effective e-commerce adoption enables MSMEs to deliver better customer experiences, thereby increasing customer satisfaction and strengthening their competitive position in the digital marketplace.

The findings further support the third hypothesis (H3), indicating that e-commerce adoption has a significant positive effect on MSME sales performance. This result is consistent with the findings of Paranti et al. (2024), who reported that e-commerce implementation improves operational efficiency and contributes to sales growth. Likewise, Malki et al. (2024) demonstrated that information technology adoption enhances overall business performance by enabling more efficient business operations. Similar evidence was reported by Suparjo et al. (2020), who found that e-commerce adoption strengthens company competitiveness and productivity. Collectively, these findings suggest that e-commerce adoption enables MSMEs to streamline business processes, expand market reach, and improve operational efficiency, all of which contribute to enhanced sales performance.

The findings also support the fourth hypothesis (H4), demonstrating that customer satisfaction significantly mediates the relationship between e-commerce adoption and MSME sales performance. This finding reinforces the Information Systems Success Model proposed by DeLone & McLean (2016), which identifies user satisfaction as a key mechanism through which information systems generate organizational benefits. In the context of this study, the results suggest that e-commerce adoption contributes to improved sales performance not only through its direct effect but also by enhancing customer satisfaction. This finding is further supported by Kumar & Mokha (2022), who argued that user satisfaction is a primary determinant of the successful implementation of new technologies within organizations.

In contrast, the statistical analysis does not support the fifth hypothesis (H5), indicating that technology adaptation does not significantly moderate the relationship between customer satisfaction and MSME sales performance. This finding differs from that of Taruté & Gatautis (2014), who reported that technology adaptation strengthens the relationship between customer satisfaction and sales outcomes. The discrepancy may reflect differences in the characteristics of the MSMEs examined, where customer satisfaction appears to exert a direct influence on sales performance regardless of the level of technology adaptation.

The absence of a significant moderating effect is further reflected in the results for the sixth hypothesis (H6). The findings indicate that technology adaptation does not significantly moderate the relationship between e-commerce adoption and MSME sales performance. This result contrasts with the findings of Ghobakhloo & Ching (2019), who suggested that technology adaptation strengthens the relationship between digital technology integration and organizational performance. Likewise, Faiz et al. (2024) and Nurdin et al. (2012) reported that technology adaptation plays a

significant moderating role in organizational technology implementation. A possible explanation for this discrepancy is that many Indonesian MSMEs have already adopted user-friendly e-commerce platforms that require only basic technological capabilities. As a result, differences in technology adaptation among MSMEs may not be substantial enough to strengthen the relationship between e-commerce adoption and sales performance.

Overall, this study demonstrates that e-commerce adoption significantly enhances customer satisfaction and MSME sales performance, while customer satisfaction serves as a key mediating mechanism linking e-commerce adoption to improved sales outcomes. However, technology adaptation was not found to significantly moderate either the relationship between customer satisfaction and sales performance or the relationship between e-commerce adoption and sales performance. These findings reinforce the importance of e-commerce adoption and customer satisfaction as key drivers of MSME sales performance in the Indonesian context.

From a practical perspective, the findings suggest that MSMEs should prioritize the effective adoption of e-commerce and the delivery of positive customer experiences to improve sales performance. Although technology adaptation remains important for supporting digital business operations, the results indicate that higher levels of technological sophistication do not necessarily translate into better sales outcomes. Instead, MSMEs should focus on adopting digital technologies that directly enhance customer value and operational efficiency.

A possible explanation for the insignificant moderating effect of technology adaptation lies in the characteristics of Indonesian MSMEs and the country's digital marketplace. Major e-commerce platforms in Indonesia are designed to be user-friendly, allowing businesses to conduct online transactions without requiring advanced technological expertise. Consequently, both technologically advanced and less technologically sophisticated MSMEs generally rely on the same core platform features, resulting in limited differences in sales performance attributable to technology adaptation.

Furthermore, MSME performance in Indonesia is often influenced more by external factors, such as logistics infrastructure and internet connectivity, than by internal technological capabilities. Since most Indonesian MSMEs operate on a micro scale with relatively simple business structures, basic e-commerce activities, such as uploading product information, responding to customer enquiries, and processing online orders, are often sufficient to support business growth (Nuralam et al., 2024; Mofokeng, 2021). From the consumer perspective, purchasing decisions are also strongly influenced by competitive pricing, discounts, and free-shipping promotions. Consumer loyalty in Indonesia tends to be driven more by relational and emotional factors than by continual technological innovation. Once customer satisfaction has been established, repeat purchases are more likely to occur, thereby contributing directly to MSME sales performance. These contextual characteristics may explain why technology adaptation does not significantly strengthen the proposed relationships in this study.

Future research should further investigate the contextual conditions under which technology adaptation becomes a significant determinant of MSME performance. Incorporating additional variables, such as digital capability, organizational readiness, innovation capability, competitive intensity, or government support, may provide a more comprehensive understanding of digital transformation among MSMEs. Overall, this study contributes to the growing body of literature by demonstrating that customer satisfaction is a key mechanism through which e-commerce adoption enhances MSME sales performance, while the moderating role of technology adaptation appears to be limited within the Indonesian MSME context.

CONCLUSION

This study demonstrates that e-commerce adoption has a significant positive effect on both customer satisfaction and MSME sales performance. Furthermore, customer satisfaction serves as a key mediating mechanism through which e-commerce adoption enhances sales performance. These findings highlight the importance of adopting effective e-commerce strategies that improve customer satisfaction and ultimately contribute to better business performance. However, technology adaptation does not significantly moderate the relationships between e-commerce adoption and sales performance or between customer satisfaction and sales performance.

MANAGERIAL IMPLICATIONS

This study provides practical insights for MSME managers seeking to improve business performance through digital transformation. The findings demonstrate that e-commerce adoption enhances sales performance both directly and indirectly through increased customer satisfaction. Therefore, MSME managers should prioritize the effective implementation of e-commerce strategies that improve customer experience and strengthen customer satisfaction. By leveraging digital platforms, businesses can expand their market reach, improve service accessibility, and increase sales opportunities beyond those offered by traditional marketing channels.

Given the mediating role of customer satisfaction, managers should focus on developing customer-oriented e-commerce strategies. These include improving platform accessibility, offering competitive pricing, maintaining product quality, and providing responsive customer service. Such initiatives can strengthen customer satisfaction, encourage repeat purchases, and ultimately improve sales performance.

The findings also highlight the importance of accelerating the digital transformation of MSMEs from traditional business models to digitally enabled operations. Managers should continuously optimize the use of e-commerce platforms to improve operational efficiency, reduce transaction costs, and expand access to domestic and international markets. Although technology adaptation does not significantly moderate the relationships examined in this study, this does not diminish the importance of digital capability. Instead, managers should adopt technologies that provide clear operational and customer value rather than pursuing technological sophistication for its own sake. Finally, MSMEs should recognize that increasing digitalization also intensifies market competition. Since online markets have relatively low entry barriers, managers should continuously innovate by developing unique value propositions, strengthening customer relationships, and improving service quality to maintain a competitive advantage. Equally important is investing in employee training and digital skill development to ensure that e-commerce technologies are implemented effectively and contribute to sustainable business growth.

LIMITATION AND FUTURE RESEARCH

This study has several limitations that should be considered when interpreting its findings. First, the research was conducted within the Indonesian MSME context, which may limit the generalizability of the results to other countries or business environments. Second, the study employed a cross-sectional research design, with data collected at a single point in time. Consequently, the findings do not capture how the relationships among the variables may evolve over time. Third, the study

measured customer satisfaction and sales performance using a limited set of indicators, which may not fully reflect the multidimensional nature of these constructs.

Despite these limitations, the findings provide valuable insights into the role of e-commerce adoption in enhancing customer satisfaction and MSME sales performance. Future research should employ longitudinal designs to examine how these relationships develop over time and explore additional factors that may influence MSME performance, such as product innovation, service innovation, digital capability, organizational readiness, and competitive intensity. Furthermore, future studies could investigate the role of technology adaptation across different industries or national contexts to determine whether its moderating effect varies under different business environments.

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