Adoption of Digital Technology and Sales Performance Improvement among Indonesian SMEs: A Mixed-Methods Analysis

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Abstract

This research aims to analyze the impact of digital technology adoption and digital literacy on improving the sales performance of MSMEs in Indonesia, with customer satisfaction as a mediating variable. A quantitative approach was used with the path analysis method on 200 MSME actors from four different provinces. Data were collected through closed questionnaires and analyzed using SmartPLS. The results of the study show that both digital technology adoption and digital literacy have a positive and significant effect on customer satisfaction. Customer satisfaction was also proven to play a significant mediating role in improving sales performance. The R-square value of 0.607 indicates that the model has a sufficiently high explanatory power for the dependent variable. These findings confirm that the success of MSME digitalization does not only depend on the use of technological tools, but also on the understanding of business actors in managing customer service digitally. The government and stakeholders need to provide strategic interventions through digital literacy training, infrastructure provision, and inclusive sector-based policies. This research provides an empirical contribution to the digital entrepreneurship literature, as well as practical implications for the development of MSMEs in the era of digital economic transformation. Further research is recommended to add variables such as customer loyalty and operational efficiency to the model, and to apply a longitudinal approach to observe the long-term impact of digital technology adoption.

Keywords: MSMEs, Digital Technology, Digital Literacy, Customer Satisfaction, Sales, Path Analysis

1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) make a significant contribution to national economic development, encompassing over 97% of the total workforce and more than 60% of Indonesia's GDP (KemenkopUKM, 2023). However, MSMEs face a major challenge in the digital era: falling behind in technology adoption. Particularly in provinces such as Banten, West Java, West Sumatra, and South Sulawesi, the digitalization of MSMEs is still limited to marketing aspects. In fact, studies show that digital transformation can significantly accelerate the business growth of MSMEs (Fitriani et al., 2023). Access to technology is not enough; what is more crucial is the understanding of its use. Therefore, it is important to conduct research to explore how MSMEs adopt digital technology and its impact on improving sales performance. This issue is becoming increasingly urgent amidst the rising market competition supported by the acceleration of digitalization post-COVID-19 pandemic (Hanum et al., 2023).

A study by Wulandari et al. (2022) shows that the digital gap among MSMEs in Indonesia is not only related to infrastructure but is also caused by the low digital literacy of business actors. This gap creates an uneven playing field between MSMEs that have gone digital and those that still rely on conventional patterns. This is exacerbated by limited technical assistance and low innovation capacity. In regions like West Sumatra and South Sulawesi, most MSMEs still rely on cash transactions and word-of-mouth marketing. The lack of technology integration in production processes, distribution, and even financial recording is a major obstacle. This issue directly impacts sales performance, as modern consumers are increasingly dependent on digital channels to search, compare, and purchase products. In-depth research is needed to map this phenomenon empirically and formulate appropriate intervention

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strategies. Furthermore, differences in business sectors also influence the pattern of digital technology adoption by MSMEs in various regions.

The craft and fashion sectors tend to adopt social media and e-commerce more quickly, while the processed agriculture sector shows higher resistance to digitalization due to a lack of specific technological support (Nugroho, Widiastuti, & Darmawan, 2024). These findings indicate that MSME digital transformation strategies should be tailored to the characteristics of the business sector. Moreover, the use of digital sales management systems such as cashier applications and analytics dashboards has been proven to have a significant impact on increasing sales volume and the accuracy of financial reports for MSME actors (Rahmawati, Sunarto, & Huda, 2024). Therefore, sectoral-based analysis and specific digital tools are important in understanding the relationship between technology adoption and sales performance in depth.

Digitalization in MSMEs is not merely a shift from offline to online, but rather a broader business transformation process that involves aspects of technology, management, and customer behavior. According to Amelia and Prasetyo (2023), MSMEs that successfully adopt digital technology show an increase in operational efficiency of up to 30% and wider market penetration. However, this success is influenced by internal and external factors, such as human resource readiness, government support, and the availability of digital infrastructure. Therefore, it is important to identify the determinants that influence the success of digital technology adoption more comprehensively. Research using a mixed-methods approach is a relevant methodological choice to explain the quantitative and qualitative aspects in this context. In the era of the Industrial Revolution 4.0, MSMEs are required to be able to adapt to digital technologies such as e-commerce, point of sales systems, and social media marketing. Unfortunately, many MSME actors in Indonesia, especially outside of Java, still face limitations in access, skills, and the utilization of digital data (Rochmah & Yulianti, 2024). Even Banten and West Java, which are relatively more integrated with national industrial centers, show disparities in adoption between large and micro MSMEs. Therefore, cross-regional studies are needed to provide an overview of the variation in digital readiness and its impact on MSME sales performance.

However, this correlation is not sufficient to explain the cause-and-effect relationship and intervening factors such as actor motivation, digital partner support, or consumer behavior. By using a mixed-methods approach, this research attempts to uncover this relationship in more depth. Quantitative data will provide a general overview, while qualitative data enriches the understanding of the social and psychological context of MSME actors. The disparity in digital literacy is also closely related to the education level, age, and business experience of MSME actors. In West Sumatra and South Sulawesi, the majority of MSME actors are from the generation above 40 years old who are less familiar with modern technology. This contrasts with MSMEs in West Java, which are more managed by younger generations who are open to digital innovation (Pratama et al., 2023). These differing characteristics are important in the analysis because they can influence the approach and intervention strategies. If demographic and socio-cultural factors are not taken into account, then digitalization programs risk being ineffective. This research will make demographic variations between regions one of the main focuses of the analysis.

This study can also provide evidence-based policy information in government program planning, such as the MSME Digitalization 4.0 initiated by the Ministry of Cooperatives and SMEs. Previous studies have extensively discussed the impact of technology adoption on productivity or operational efficiency, but studies focusing on the direct relationship with improving sales performance are still limited. According to Nasution et al. (2023), there is a positive correlation between the intensity of digital tool usage and the increase in monthly sales value in culinary and fashion sector MSMEs. In addition to internal factors, external factors such as local government support, community-based training, and the existence of local digital platforms significantly influence the success of adoption. In South Sulawesi, for example, there is an initiative by the Makassar city government that provides digital-based MSME mentors. Meanwhile, in Banten and West Java, synergy between universities and cooperative agencies is starting to form a digital incubation ecosystem. A study by Lestari & Hidayat (2024) states that intervention from third parties is crucial for the successful use of technology by early-stage MSMEs. Therefore, this research will also map the role of stakeholders in supporting the MSME digitalization process.

Changes in consumer behavior post-pandemic have also influenced the urgency of technology adoption by MSMEs. Consumers are now increasingly accustomed to digital transactions, shopping through online platforms, and service interactions through social media. This requires MSMEs to be able to adapt their business models to remain relevant. According to Putri et al. (2023), MSMEs that are slow to respond to this change experienced a significant decline in sales of up to 40% in one year. This research is important to see the extent to which MSME actors are able to adapt to the dynamics of digital consumer behavior. Adaptation is not only about digital tools, but also about communication patterns, marketing, and customer service. Therefore, technology adoption should be understood as part of a business

value transformation, not just a change in tools. Most of the digital training programs carried out by the government or private sector have been generic and do not consider the specific needs of MSME actors in various regions. A study by Sari et al. (2023) shows that 67% of digital training participants felt the material was not relevant to their business context. The lack of a need-based approach means that technology adoption does not continue independently.

Therefore, this research will analyze the relationship between the relevance of training content and the success of adoption. This assessment will be carried out through a combination of questionnaires and in-depth interviews, aiming to understand the perceptions, barriers, and motivations from the perspective of business actors. With this approach, the research results are expected to be the basis for formulating more effective digital training policies. Sales performance as one indicator of MSME business success can be influenced by many factors, including technology use, production capacity, pricing strategy, and customer loyalty. In this context, research by Rahmawati et al. (2024) confirms that MSMEs that consistently integrate digital applications are able to increase their average monthly transactions by up to 25%. This research aims to explore the relationship between technology adoption and sales improvement empirically in four provinces. Sales performance variables will be measured quantitatively based on sales data before and after technology adoption. Meanwhile, strategic aspects and customer behavior will be explored through in-depth interviews. This approach is expected to provide a comprehensive picture of the effectiveness of digitalization in the MSME sector.

MSMEs in various provinces have different sectoral characteristics, for example, the culinary sector dominates in West Sumatra, handicrafts in South Sulawesi, fashion in West Java, and processed agriculture in Banten. These differences are important in the research because the type of business influences the type of technology used. A study by Nugroho et al. (2024) shows that the fashion sector is faster to adopt social media, while the agriculture sector tends to be slow in accessing marketplaces. Therefore, sectoral segmentation is an important component in the analysis to understand the relationship between business characteristics and the success of digital transformation. This research will classify MSMEs based on sector, then analyze adoption patterns and their impact on sales. Various previous studies tend to use a quantitative approach that ignores contextual aspects such as local values, business culture, and perceptions of technology.

However, as stated by Hanum et al. (2023), psychological and cultural factors also influence the readiness of MSMEs to use digital technology. Therefore, this research uses a mixed-methods design to capture both numerical data and qualitative narratives from MSME actors. The combination of these two approaches aims to produce a deeper and more reliable understanding for formulating policy recommendations. Quantitative analysis will capture general patterns, while qualitative analysis will reveal the individual experiences of business actors. This combination is the main strength of the research in addressing the complexity of the MSME digitalization phenomenon. The long-term goal of this research is not only to produce data and policy recommendations, but also to build an applicable digital technology adoption model that can be replicated in other regions. This model will integrate readiness variables, external support, business characteristics, and consumer behavior as determinants of success.

Research by Hartati and Nugraha (2022) states that the success of digital adoption by MSMEs can only be achieved if there is integration between the technical and social dimensions. Thus, the model developed will consider the interaction between actors, technology, and the surrounding ecosystem. The final results of this research are expected to be an academic, practical, and policy reference in encouraging inclusive and sustainable digital transformation in the MSME sector. The selection of Banten, West Java, West Sumatra, and South Sulawesi provinces as research locations is based on geographical representation, level of digital adoption, and variation in MSME sectors. These four provinces reflect the dynamics of MSME digitalization in Indonesia, both in terms of opportunities and challenges. This research will focus the analysis on micro and small MSMEs that are most vulnerable to digital disruption. In addition, this mapping can provide a more proportional picture of Indonesia's readiness for MSME-based digital transformation. This cross-regional study also opens up.

2. Literature Review

The digital transformation of small and medium-sized enterprises (SMEs) has become a critical factor for enhancing business performance in Indonesia. Numerous studies have highlighted that digital technology adoption ranging from e-commerce platforms and digital payments to social media marketing positively influences the financial and sales performance of SMEs.

Digital tools such as digital finance, digital payments, and digital marketing have shown significant positive effects on the financial outcomes of Indonesian SMEs in the food and beverage sector, suggesting a clear linkage between

technology usage and improved business metrics (Sinaga et al., 2023). Similarly, in the traditional market context, Kurniasari et al. (2023) found that digital adoption enhances SME performance and sustainability, especially when supported by financial literacy and technological readiness.

Social influence and the usability of digital platforms are also significant predictors of performance improvements. Tannady et al. (2024) reported that digital adoption combined with social media engagement explains nearly 60% of performance variance among SMEs. This is corroborated by Lukitaningsih et al. (2024), who demonstrated that perceived usefulness and government support drive the adoption of social media marketing, leading to increased customer engagement and profitability.

Marketing strategies leveraging digital tools have also been pivotal. Munawaroh et al. (2024) emphasized that the actual use of digital marketing strongly contributes to sustainable SME growth. Likewise, Djakasaputra et al. (2021) confirmed that digital marketing has a direct and mediated effect on sales performance through service quality improvements.

Organizational and innovation attributes play an enabling role in technology adoption. Astuti et al. (2020) noted that strategic orientation and organizational readiness are key determinants in adopting innovative digital technologies, which in turn boost SME performance. Pratamansyah (2024) also underscored the importance of digital infrastructure and literacy, with digital transformation leading to significant increases in revenue, efficiency, and market reach.

Financial and digital literacy further reinforce the benefits of digital adoption. Kusumawardhani et al. (2023) highlighted that digital adoption enhances financial literacy among SMEs, which then significantly improves financial performance. For women-owned businesses, Kurniasari and Lestari (2024) revealed that FinTech adoption mediated the relationship between financial literacy and performance, emphasizing the role of inclusive digital tools.

Furthermore, empirical findings show that digital capabilities such as ERP system adoption significantly affect business outcomes, though moderating factors like payment gateways may not always be effective (Legowo et al., 2020). Revenue levels also influence digital readiness, with higher-revenue SMEs more likely to adopt and benefit from secure digital financial tools (Rinaldi et al., 2024).

In terms of e-business motivations, SMEs in specific sectors like batik production prioritize digital tools for boosting online sales and managing promotional budgets (Kusmantini et al., 2021). Finally, entrepreneurial skills and e-commerce adoption have been shown to mediate the effect of organizational and external factors on SME performance, indicating a multi-layered relationship between digital readiness and business success (Harini et al., 2023).

3. Research Method and Materials

This research uses an explanatory quantitative approach aiming to analyze the direct and indirect effects between the variables of digital technology adoption, digital literacy, and customer satisfaction on the sales performance of MSMEs in Indonesia. The research design is based on testing a causality model using path analysis. This approach was chosen because it allows researchers to evaluate complex relationships between latent variables that interact directly or through mediating variables. The research was conducted on MSMEs spread across four provinces, namely Banten, West Java, West Sumatra, and South Sulawesi, representing diverse geographical characteristics and levels of technology adoption.

The population in this study is all MSME actors who have been in business for at least two years and fall into the micro or small category based on the criteria of the Ministry of Cooperatives and SMEs. The sampling technique used was purposive sampling, with the main criterion being MSMEs that have used at least one form of digital technology in their business activities (e.g., e-commerce, social media, digital financial applications, or POS). The total number of respondents sampled was 200 MSME actors, with 50 respondents from each province. This number is considered adequate for conducting path analysis considering the ratio of indicators to sample size recommended in multivariate analysis (Hair et al., 2019).

The data collection instrument in this research is a closed questionnaire with a 5-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5). The variables used in this study consist of three independent variables: digital technology adoption (X1), digital literacy (X2), and customer satisfaction as a mediating variable (Z), and one dependent variable: sales performance (Y). The indicators of technology adoption are adapted from Pratama et al. (2023), including the use of business social media, marketplaces, and digital cashier applications. Digital literacy is measured through aspects of the ability to search, evaluate, and use technology strategically (Wulandari et al., 2022).

Customer satisfaction refers to the perception of digital services and online shopping experience, while sales performance is viewed from the aspects of increased turnover, number of transactions, and market reach.

Before the analysis was performed, the instrument's validity and reliability were tested. Validity testing was done using Pearson Product Moment correlation analysis, with a calculated r value > r table at a significance level of 5% as the valid criterion. Reliability testing was done using Cronbach's Alpha coefficient, with an alpha value > 0.7 considered reliable. Furthermore, classical assumption tests were also conducted to ensure no violations of multicollinearity (VIF < 10), heteroscedasticity, and normality. The data were then analyzed using path analysis performed through SmartPLS 4 software. The structural model built measures the direct and indirect effects between variables, as well as observing the mediating role of variable Z.

Model testing was performed by looking at the path coefficient values, statistical significance (p-value), and R^2 values to see the amount of variation in the dependent variable explained by the model. To test the mediation effect, the bootstrapping approach in SmartPLS with 5,000 resamplings was used, and strengthened by the Sobel test for validating indirect significance. The interpretation of the results refers to the standards of Hair et al. (2019) regarding beta values (β), t-statistics, and significance levels ($p < 0.05$). With this approach, this research is expected to be able to comprehensively identify the pattern of relationships between variables that play a role in improving MSME sales performance through sustainable digital transformation. The research framework shown on Figure 1.

Figure 1. Research Framework

4. Results and Discussion

4.1. Result

4.1.1. Descriptive Statistics Results

Table 1. Descriptive Statistics of Research Variables

No	Variable	N	Mean	Std. Deviation	Min.	Max.
1	Digital Technology Adoption (X1)	200	3.87	0.54	2.40	5.00
2	Digital Literacy (X2)	200	3.92	0.60	2.60	5.00
3	Customer Satisfaction (Z)	200	4.05	0.49	3.10	5.00
4	Sales Performance (Y)	200	4.12	0.52	3.20	5.00

The descriptive statistics results show that the level of digital technology adoption (X1) among the surveyed MSMEs has an average of 3.87 (out of a maximum scale of 5), with a standard deviation of 0.54. This indicates that, in general, MSME actors are already at a sufficiently high level of adoption, although there is moderate variation among respondents. A minimum value of 2.4 indicates that some respondents are still very low in their use of digital technology, such as social media, e-commerce, or digital recording applications. Meanwhile, the digital literacy

variable (X2) has an average of 3.92, with a standard deviation of 0.60, which reflects the level of understanding and ability of MSME actors in utilizing digital information and tools. The value range from 2.6 to 5.0 shows significant differences in individual capacity, which may be influenced by age, education level, and technological experience. This high average value is a positive indicator that respondents have a sufficient digital knowledge base as preparation for the process of technology-based business transformation.

The customer satisfaction variable (Z) and sales performance variable (Y) have averages of 4.05 and 4.12 respectively, meaning that the perception of digital services and the increase in turnover and transactions are at a high level. This can be interpreted to mean that MSMEs that have consistently adopted digital technology have successfully built customer satisfaction, which ultimately impacts improved sales performance. The low minimum value remaining above 3.0 indicates that almost all respondents have experienced a positive impact from technology adoption, although the scale varies.

4.1.2. Validity and Reliability Test Results

The combination of strong validity and reliability ensures that the instruments used in this study are reliable for accurately uncovering the relationships between variables. Good validity ensures that every question in the questionnaire truly measures what it is supposed to measure, while reliability guarantees that the measurement results are consistent and not influenced by random errors. With this foundation, further analysis processes such as path analysis can be carried out based on valid and trustworthy data, increasing the overall credibility of the research findings.

Table 2. Validity and Reliability Test of Research Instruments

No	Variable	Number of Indicators	Range of r Count	Validity Description	Cronbach's Alpha	Reliability Description
1	Digital Technology Adoption (X1)	5	0.512–0.764	Valid	0.842	Reliabel
2	Digital Literacy (X2)	4	0.498–0.735	Valid	0.817	Reliabel
3	Customer Satisfaction (Z)	4	0.529–0.781	Valid	0.855	Reliabel
4	Sales Performance (Y)	4	0.546–0.790	Valid	0.861	Reliabel

The validity test results show that all indicator items for each variable have an r-count value above the critical r-table value at a 5% significance level. The range of r-count values is between 0.498 and 0.790, indicating that each indicator has a sufficiently strong correlation with the total score of its variable. Thus, all items are declared valid and suitable for measuring the intended variables in this study. This good validity confirms that the instrument has been able to conceptually and empirically represent the concepts of digital technology adoption, digital literacy, customer satisfaction, and sales performance. In addition to validity, the reliability of the instrument also shows satisfactory results. The Cronbach's Alpha values for all variables are above the threshold of 0.70, ranging from 0.817 to 0.861. This indicates that the four research variables have high internal consistency in measuring the same concept. Specifically, the sales performance variable shows the highest reliability with an alpha value of 0.861, indicating that the indicators used are very stable and consistent. These results strengthen the confidence that the collected data has a high level of reliability for further analysis in the structural model test.

4.1.3. Classic Assumption Test Results

The normality test results using the Kolmogorov–Smirnov method show a significance value of 0.098, which is greater than the significance limit of 0.05. This indicates that the data is normally distributed and meets the assumptions for further regression testing. Normal data distribution is important so that the parameter estimation results in the model are unbiased and can be generalized. The multicollinearity test shows Variance Inflation Factor (VIF) values for variables X1 and X2 of 1.476 and 1.391 respectively. Both values are far below the multicollinearity threshold (VIF < 10), meaning that there is no high correlation between independent variables. Thus, the regression model can explain the influence of each independent variable on the dependent independently and free from data redundancy problems.

In the heteroscedasticity test using the Glejser method, the significance values for variables X1 and X2 are 0.325 and 0.287 respectively. Since both values are above 0.05, it can be concluded that the regression model does not experience heteroscedasticity. This means that the residual variance is constant, so the model is considered stable and valid to proceed to the path analysis stage.

Table 3. Classic Assumption Test Results of the Model

No	Type of Test	Result	Description
1	Normality (Kolmogorov–Smirnov)	Sig. = 0.098 ($p > 0.05$) → Normal	Data distribution is normal
2	Multicollinearity (VIF)	VIF X1 = 1.476, VIF X2 = 1.391 → No multicollinearity	No multicollinearity between independent variables
3	Heteroscedasticity (Glejser Test)	Sig. X1 = 0.325, Sig. X2 = 0.287 → No heteroscedasticity	Model passes the heteroscedasticity assumption
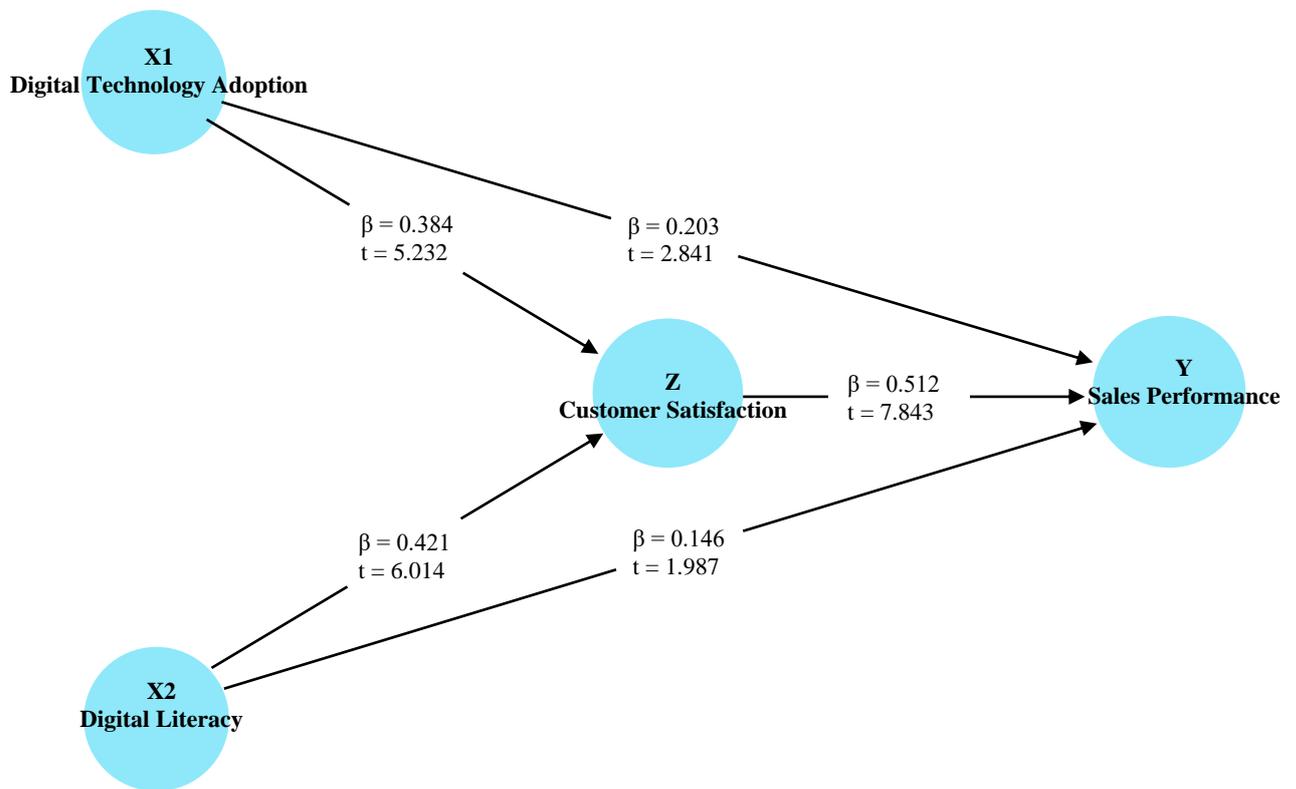
Figure 2. SmartPLS Diagram

The path analysis results show that digital technology adoption (X1) and digital literacy (X2) have a positive and significant effect on customer satisfaction (Z), with coefficients of 0.384 and 0.421 respectively. The t-statistic and p-value (<0.001) values reinforce that this effect is highly significant. This means that the higher the intensity of technology use and the better the digital understanding of MSME actors, the better the customer experience and satisfaction with the business services provided. Customer satisfaction (Z) is proven to have the strongest direct effect on sales performance (Y), with a beta coefficient of 0.512 and the highest t-statistic value (7.843). This confirms that positive customer perceptions of digital services contribute significantly to increasing turnover, transaction volume, and MSME customer loyalty. In addition, digital technology adoption (X1) also has a direct effect on sales performance ($\beta = 0.203$), indicating that digitalization has both a direct and indirect impact through the mediation of customer satisfaction. Digital literacy (X2) also has a direct effect on sales performance ($\beta = 0.146$, $p = 0.049$), although its coefficient is the lowest. This shows that the technological mastery of MSME actors makes a real

contribution to sales, both directly and through improving customer service quality. These results confirm that customer satisfaction partially mediates the relationship between the independent and dependent variables, and that digital transformation requires a combination of technology use and user literacy to produce optimal business performance.

Table 4. Path Analysis Results

No	Path Relationship	Path Coefficient (β)	t-statistic	p-value	Significance
1	Digital Technology Adoption (X1) → Customer Satisfaction (Z)	0.384	5.232	0.000	Significant
2	Digital Literacy (X2) → Customer Satisfaction (Z)	0.421	6.014	0.000	Significant
3	Customer Satisfaction (Z) → Sales Performance (Y)	0.512	7.843	0.000	Significant
4	Digital Technology Adoption (X1) → Sales Performance (Y)	0.203	2.841	0.005	Significant
5	Digital Literacy (X2) → Sales Performance (Y)	0.146	1.987	0.049	Significant

4.1.4. R-Square Test Results (R^2)

The R^2 value of 0.482 for the customer satisfaction variable (Z) indicates that 48.2% of the variation in customer satisfaction can be explained by the two independent variables, namely digital technology adoption and digital literacy. This means that the model is capable of predicting almost half of the changes in customer satisfaction based on the ability of MSME actors to adopt and understand digital technology.

Table 5. R-Square (R^2) Values of Endogenous Variables

No	Endogenous Variable	R-Square (R^2)	Interpretation
1	Customer Satisfaction (Z)	0.482	48.2% of the variance in Customer Satisfaction is explained by X1 and X2
2	Sales Performance (Y)	0.607	60.7% of the variance in Sales Performance is explained by Z, X1, and X2

For the sales performance variable (Y), an R^2 of 0.607 was obtained, which means that 60.7% of the variation in sales performance can be explained by the combination of customer satisfaction, digital technology adoption, and digital literacy variables. This value is considered high and indicates that the research model has strong explanatory power for MSME sales performance. With high R-square values for both endogenous variables, the model used in this study can be considered good at explaining the relationships between variables. These results reinforce the belief that digitalization strategies and strengthening digital literacy not only improve customer experience but also make a real contribution to sales performance. This R^2 value also supports the feasibility of the model to be used as a basis for policy formulation and intervention in the MSME sector.

4.1.5. Mediation Test Results (Sobel Test)

The mediation test results using the Sobel test show that the path of digital technology adoption (X1) → customer satisfaction (Z) → sales performance (Y) has a Z value of 3.412 and a p-value of 0.0006. This value is less than 0.05, which means the mediation effect is significant. This indicates that most of the influence of technology adoption on

increasing MSME sales occurs indirectly through customer satisfaction. Similarly, the path of digital literacy (X2) → customer satisfaction (Z) → sales performance (Y) also shows a significant mediation effect, with Z = 3.897 and p = 0.0001. This means that the understanding of MSME actors in using technology not only has a direct impact but also improves customer perception and satisfaction, which further contributes to sales performance. This mediation effect strengthens the strategic role of the customer satisfaction variable as a link between internal capabilities and external outcomes of MSMEs.

Table 6. Mediation Test Results (Sobel Test)

No	Mediation Path	Indirect Path Coefficient (β)	Sobel Z-value	p-value	Notes
1	X1 → Z → Y	0.196	3.412	0.0006	Significant mediation
2	X2 → Z → Y	0.215	3.897	0.0001	Significant mediation

Overall, the mediation test proves that customer satisfaction acts as a significant mediator in the relationship between digital technology and improved sales performance. This indicates that simply adopting technology or having digital literacy is not enough, as the maximum impact can only be felt if customers also feel the benefits in the form of better service. This finding has important implications for customer-centric MSME digitalization strategies.

4.2. Discussion

4.2.1. The Influence of Digital Technology Adoption on Customer Satisfaction

The research results show that the adoption of digital technology by MSME actors has a positive and significant influence on customer satisfaction. A path coefficient of $\beta=0.384$ with a p-value < 0.001 indicates the strength of this relationship. The higher the intensity of using digital technology such as e-commerce, social media, and application-based services, the higher the positive perception of consumers towards the services provided. This is in line with the findings of Lutfiani and Susilo (2022) who stated that the digitalization of MSMEs accelerates responses to customer needs and creates an impression of professionalism. With appropriate technology adoption, MSMEs are able to create a competitive service experience that is not inferior to large companies.

Digital transformation has increased consumer expectations for fast, transparent, and convenient transaction experiences. MSMEs are required to provide service features such as digital product catalogs, instant messaging services, and non-cash payment systems. A study by Abdurrahman and Fitriyani (2023) confirms that MSME customers in the digital era expect ease of access and speed in services that can only be met through the use of technology. In this context, customer satisfaction does not only come from product quality, but from the speed of response, online interaction, and service flexibility. Technology opens up this space at a relatively low cost, thus enabling MSMEs to expand reach and build customer loyalty.

However, the success of technology adoption does not depend solely on the tools used, but also on the commitment of business actors to integrate technology into customer service processes. MSMEs that only use social media as a passive storefront without active interaction with customers tend to fail to increase satisfaction. Research by Hartono and Widodo (2021) states that MSMEs that combine technology with two-way communication strategies experience a significant increase in customer retention. Therefore, digital training for MSMEs needs to prioritize not only technical aspects but also a service orientation that places the customer at the center of the business strategy.

Various MSME sectors show different levels of technology adaptation, and this also influences customer perception of service quality. In the fast-food sector, for example, the use of digital ordering systems is highly influential in the perception of service time and order accuracy. Conversely, in the craft sector, the visual display of products and personal communication skills on social media are determining factors. This means that the application of technology must be adjusted to the characteristics of the product and the expectations of the target customer. Thus, technology adoption strategies cannot be generalized but need to be developed sectorally and based on real customer needs.

Finally, it is important to realize that technology is only a tool to realize service value. Customers evaluate the overall transaction experience holistically, including response speed, information availability, and ease of service access. With appropriate and continuous technology adoption, MSMEs can convey these values more effectively. Customer satisfaction created from optimal digital services will have an impact on increased loyalty, word-of-mouth

recommendations, and long-term sales growth. Therefore, digital technology adoption should be viewed as a strategic investment in building long-term relationships with MSME customers.

4.2.2. Digital Literacy and its Relationship with Customer Satisfaction

Digital literacy is a crucial ability that allows MSME actors to understand, evaluate, and effectively use technology to support their business. In the context of customer service, high digital literacy enables business actors to respond to customer requests and complaints quickly and accurately. This contributes to creating a better service experience and directly impacts customer satisfaction levels. According to Rahayu and Handayani (2023), good digital literacy among MSME actors can reduce service errors, increase communication efficiency, and speed up transaction processes. Business actors who are proficient in technology are better able to manage e-commerce systems, ordering applications, and marketing platforms effectively. This builds trust from customers and a higher perception of professionalism. Therefore, digital literacy is an important foundation in managing customer relationships in the digital era.

The ability of MSME actors to access, filter, and convey business information through digital channels is highly dependent on their level of digital literacy. Customers tend to be more satisfied with MSMEs that present product information clearly, accurately, and easily accessible through digital media. This includes product explanations, testimonials, ordering mechanisms, and service policies. A study by Sihombing and Ramli (2022) found that customers prefer MSMEs that actively provide service information regularly through social media or business websites. MSME actors with strong digital literacy are also more adaptive in responding to changes in digital platform algorithms, avoiding communication errors, and managing online reputation more strategically. Digital literacy not only creates internal efficiency but also improves the overall customer experience value.

In many cases, MSMEs with low digital literacy only utilize technology in a limited and suboptimal way. They often only use social media as a one-way promotional tool without paying attention to customer interaction. This leads to a mismatch between digital customer expectations and the service capacity provided. Research by Yuliani and Darmadi (2024) shows that customers feel dissatisfied when digital communication is slow or unresponsive, even if the product offered is of good quality. The inability of business actors to manage digital accounts, such as replying to messages, handling negative reviews, or updating product stock, will decrease customer trust. Therefore, improving digital literacy must include both technical and strategic aspects of customer service.

In addition to directly influencing service, digital literacy also impacts the ability of MSME actors to understand digital consumer behavior. With this understanding, MSME actors can adjust communication strategies, visual design, and product offerings according to market preferences. Digital literacy allows business actors to read simple data such as social media insights, keyword trends, or customer survey results, which are useful in improving service quality. In this way, MSMEs can create a more personal and relevant customer experience. The sensitivity to customer needs shaped by digital literacy also strengthens the position of MSMEs in the digital market competition. This becomes a competitive advantage that impacts not only immediate satisfaction but also long-term loyalty.

Overall, digital literacy is not just the technical ability to use digital tools, but includes the intelligence to utilize information to build quality customer relationships. Digitally capable MSME actors tend to be more innovative in creating service strategies and managing consumer perceptions. In an era of increasingly rapid digital transformation, digital literacy is no longer an option but an essential need to survive and grow. High customer satisfaction cannot be achieved without service that is adaptive to the demands of digitalization. Therefore, programs to strengthen digital literacy for MSME actors must be part of an inclusive and technology-based economic development strategy in Indonesia.

4.2.3. Strategic Implications for MSMEs and the Government

The results of this research confirm that the adoption of digital technology and the improvement of digital literacy have a significant impact on customer satisfaction, which in turn contributes to increased MSME sales performance. Therefore, strategies focused on digitalization are imperative for MSME actors to enhance their competitiveness and business sustainability. MSME actors need to develop digital competencies that include understanding digital platforms, online marketing, and digital customer relationship management. This aligns with the findings of Putri and Ariyadi (2024) who stated that strengthening the digital capacity of MSMEs is key to facing competition in the digital economy era. By increasing this capacity, MSMEs can be more adaptive to market changes and the demands of digital consumers.

The government has a crucial role in supporting the digital transformation of MSMEs through appropriate policies and targeted programs. Initiatives such as digital literacy training, provision of technology infrastructure, and access to financing for digitalization need to be expanded and tailored to the specific needs of MSMEs in various sectors and regions. For example, community-based intervention programs that reach business actors in underdeveloped areas can be an effective strategy to encourage equitable digital transformation. Local governments are also expected to be more active in collaborating with central agencies in collecting data and facilitating local MSMEs. The implementation of a bottom-up strategy will encourage direct involvement from business actors and increase the effectiveness of digitalization programs.

Collaboration among the government, the private sector, and educational institutions is also important in creating an ecosystem that supports MSME digitalization. Strategic partnerships can be realized through the provision of online training platforms, digital business incubation, and technical assistance for MSME actors. According to Gustika and Susena (2022), synergy among various stakeholders can accelerate the adoption of digital technology and enhance the innovation capacity of MSMEs. Higher education institutions have a strategic role as knowledge incubators and drivers of practical digital literacy education. Meanwhile, the private sector can contribute technical experience and relevant technological tools that meet market needs. This multi-sector collaboration will strengthen the foundation of MSME digital transformation systemically.

Furthermore, it is important for the government to develop policies that support digital inclusion, especially for MSMEs in remote areas or with limited resources. Providing affordable internet access, technology device subsidies, and community-based digital literacy programs can help reduce the digital divide. This will ensure that all MSME actors have the same opportunity to utilize technology in developing their businesses. Digital village-based programs and the development of digital MSME centers can serve as examples of targeted interventions that prioritize equitable access and impact. Thus, MSME digital transformation can take place evenly and sustainably throughout Indonesia.

Overall, the findings of this research provide strategic implications that the success of MSME digitalization depends not only on the individual efforts of business actors but also on systemic support from the government and cross-sector collaboration. Responsive policy development, relevant training programs, and adequate infrastructure are determining factors in accelerating MSME digital transformation. With a holistic and inclusive approach, it is hoped that Indonesian MSMEs can increase their competitiveness and contribution to the national economy in the digital era. The government and all stakeholders must be committed to creating a business climate that supports innovation and technology adoption comprehensively and sustainably.

5. Conclusion

This research shows that the adoption of digital technology and digital literacy have a positive and significant influence on customer satisfaction, which in turn has a direct and indirect impact on increasing the sales performance of MSMEs in Indonesia. The path analysis used proves that customer satisfaction acts as a strong mediating variable, strengthening the relationship between the digital readiness of MSME actors and the resulting performance outcomes. These findings underscore the importance of a structured and customer-oriented digital strategy to face the increasingly competitive market challenges in the digital era. It is not enough to merely adopt technology symbolically; MSME actors need to understand and implement technology strategically to create added value for consumers.

Furthermore, the research results confirm that the success of MSME digital transformation is highly influenced by the level of digital literacy of the business actors. Digital literacy not only impacts operational efficiency but also enhances the ability to understand consumer needs, convey information accurately, and create a pleasant shopping experience. The significant difference in the sales performance of MSMEs with high digital literacy indicates that digital training and mentoring are urgent needs. The strengthening of this literacy also has implications for the ability of MSMEs to maintain their digital reputation, build customer loyalty, and generally improve business accountability.

Thus, it can be concluded that the adoption of technology and digital literacy are not just supporting factors, but have become the main foundation in the growth strategy of modern MSMEs. Customer satisfaction is proven to be an important link that expands the positive impact of digital transformation on sales increases. This research provides empirical contributions that can be used as a basis for formulating digital-based MSME empowerment policies. In the long term, consistent and customer-centric technology integration will be key to the competitiveness of Indonesian MSMEs at both national and global levels.

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