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Digital Literacy and Technological Resources on MSME Performance Through Their Adaptation

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Abstract

This study aims to test and analyze: 1) the influence of digital literacy on MSME adaptation, 2) the influence of technological resources on MSME adaptation, 3) the influence of digital literacy on MSME performance, 4) the influence of technological resources on MSME performance, 5) the influence of MSME adaptation on MSME performance, 6) the influence of digital literacy on MSME performance through MSME adaptation, and 7) the influence of technological resources on MSME performance through MSME adaptation. This study employs a quantitative approach with an explanatory research design and utilizes purposive sampling to select 125 MSMEs in Mojokerto Regency. Conducted in 2024, the research collected data on the variables via Google Forms and analyzed it using Smart PLS software. The results show that: 1) digital literacy has a significant positive effect on MSME adaptation, 2) technological resources have a significant positive effect on MSME adaptation, 3) digital literacy has a significant positive effect on MSME performance, 4) technological resources have a significant positive effect on MSME performance, 5) MSME adaptation has a significant positive effect on MSME performance, 6) digital literacy has a significant positive effect on MSME performance through MSME adaptation, and 7) technological resources have a significant positive effect on MSME performance through MSME adaptation.

Keywords: Digital literacy; Technology resources; MSME Adaptation; MSME Performance.

INTRODUCTION

Globally, micro, small, and medium enterprises (MSMEs) constitute the backbone of economic development, contributing approximately 90% of businesses, 60-70% of employment, and 50% of GDP worldwide, according to the World Bank (2023). In the context of Industry 4.0, MSME performance has become increasingly dependent on digital transformation capabilities, with studies showing that digitally mature MSMEs demonstrate 25-30% higher productivity and 40% faster revenue growth compared to their non-digital counterparts (OECD, 2024). However, significant performance disparities persist, particularly in developing economies where 70% of MSMEs remain in early stages of digital adoption, directly impacting their competitiveness and survival rates (International Labour Organization, 2023).

MSMEs in Mojokerto Regency, especially in rural areas, have become the backbone of the local economy (Hidayat et al., 2025). With the emergence of the Industrial Revolution 4.0, many MSME actors are starting to feel pressure to adapt to technological changes (Andayani et al., 2022). This phenomenon can be seen from various aspects of daily practice. For example, most MSMEs still use conventional production methods that are less efficient than smart-based manufacturing processes that integrate digital technology (Nuruddin & RMI, 2022). This results in limitations in terms of production efficiency and product quality control (Sudiantini & Untoro, 2023), which in turn affects the competitiveness and profitability of these MSMEs.

In addition, limited technological accessibility and low knowledge of the potential of the internet and e-commerce platforms are also major obstacles for MSMEs in expanding market reach (Norhaedah et al., 2023). Not only that, limited capital is also a barrier to adopting new technologies and increasing their production capacity (Norhaedah et al., 2023). This practical phenomenon shows the need for in-depth research to identify the readiness and challenges faced by MSMEs in Mojokerto Regency in facing the Industrial Revolution 4.0 era.

In Indonesia, MSMEs represent 99.99% of total business units and absorb 97% of the national workforce (Ministry of Cooperatives and SMEs, 2023). However, Indonesia's digital economy readiness index (3.2/10) lags significantly behind regional peers such as Singapore (7.8) and Malaysia (5.6), primarily due to low digital literacy rates among MSME owners—only 32% possess adequate digital skills, according to the National Digital Literacy Survey (2023). Specifically in Mojokerto Regency, data from the Department of Cooperatives and SMEs (2024) reveals that among 18,456 registered MSMEs, merely 28% have adopted digital marketing platforms, 15% utilize e-commerce channels, and only 8% have implemented digital financial management systems. This digital adoption gap directly correlates with performance indicators: MSMEs with digital integration report average annual revenue growth of 18.3% compared to 6.7% among non-digital MSMEs, while operational efficiency metrics show 35% cost reduction advantages for digitally-enabled enterprises (Mojokerto Economic Development Report, 2024). Research findings by Sari & Santoso (2019) indicate that many MSME actors are able to adapt to market developments and demand, though they do not participate in the MSME community. Research findings of Clinton & Vanomy (2023) show that the development of culinary MSMEs in Batam City toward the digitalization era is still constrained because not all business actors are ready and able to implement it. These obstacles include mindset, equipment, and lack of readiness of human resources in facing the digitalization era, especially for culinary businesses with traditional models or street vendors.

Previous research exhibits four critical limitations that necessitate further investigation. First, Akhmad & Purnomo (2021) examined technology adoption among 87 MSMEs in Surakarta and found that 64% faced implementation difficulties due to fragmented management systems ($\beta = -0.431,\ p < 0.01$), but their quantitative approach failed to explore the underlying mechanisms of how organizational structure impedes technology integration, and their sample was limited to urban MSMEs, excluding rural contexts. The research gap lies in understanding qualitative dimensions of management fragmentation and its specific manifestations in different geographical contexts. Second, Suryawati et al. (2023) conducted a resilience study of 156 MSMEs post-pandemic, identifying capital limitations as the primary barrier ($R^2 = 0.58$), with 78% of respondents reporting insufficient funds for technology investment. However, their model did not examine the mediating role of adaptation strategies between resource constraints and performance outcomes, nor did they differentiate between types of technology resources. The gap exists in understanding how MSMEs with limited capital can strategically leverage available resources through adaptive mechanisms. Third, Naufalin (2020) analyzed managerial skills across 210 MSMEs in Banyumas, revealing that 82% of MSME owners lacked formal management training, which correlated negatively with digital adoption rates ($r = -0.67,\ p < 0.001$). Nevertheless, this study focused exclusively on skills deficiency without investigating how digital literacy development could compensate for managerial limitations or how adaptation processes mediate this relationship.

The research gap pertains to the interaction effects between different capability dimensions. Fourth, Clinton & Vanomy (2023) explored digital transformation readiness among 45 culinary MSMEs in Batam, finding that 71% remained unprepared due to mindset barriers and HR readiness issues. However, their descriptive case study approach lacked empirical testing of causal relationships between readiness factors, adaptation processes, and performance outcomes. The critical gap lies in establishing quantifiable relationships and validating theoretical frameworks through structural equation modeling. Collectively, these studies demonstrate fragmented understanding: they address isolated variables (capital, skills, readiness) without examining their synergistic effects through adaptation as a mediating mechanism, particularly in the Mojokerto context where MSMEs face unique combinations of rural-urban dynamics and resource constraints.

Previous research has had several gaps that need to be identified to delve deeper into this topic. Most previous research has tended to focus on urban areas or more modern MSMEs, so there is a gap in understanding the specific challenges faced by MSMEs in rural areas of Mojokerto Regency. Although there is research that touches on the limitations of infrastructure and access to technology, there has been no research that has in-depth examined how the availability of IT infrastructure affects the performance of MSMEs in Mojokerto. In addition, the government's role in supporting the adoption of information technology by MSMEs has also not been explored in specifics, especially in terms of policies, subsidies, and training provided. Previous research has also not addressed much of the mediating role in the relationship between information technology adoption and MSME performance, which should be able to be identified and quantified through pathway analysis. Although several studies mention digital literacy, no one has yet provided specific strategies tailored to the local situation. In addition, the impact of participation in the MSME community on the readiness and ability of MSMEs to adopt information technology has not been widely explored, even though this participation can play an important role in digital readiness. This research aims to fill these gaps in the face of the Industrial Revolution 4.0, as well as encourage the renewal of more effective strategies to support the growth and adaptation of MSMEs in this new era.

Although previous research has highlighted various challenges faced by MSMEs in the Industrial Revolution 4.0 era, such as limited capital, lack of managerial skills, and low technological mastery (Fatman et al., 2024), there is still a significant gap in the literature regarding the role of work motivation as a mediating factor between the work environment, leadership, and performance of MSMEs in Mojokerto Regency. Previous research has focused on the technical aspects of technology adoption and management (Sari & Santoso, 2019; Clinton & Vanomy, 2023), but not much has been discussed about how work motivation can bridge these challenges in improving the performance of MSMEs, especially in rural areas that are the backbone of the local economy. The use of mediation variables, such as work motivation, is important because it can provide a more comprehensive understanding of the internal dynamics of MSME organizations in the face of the pressures of the Industrial Revolution 4.0, while offering new perspectives that have not been widely explored in the context of previous research.

This study chose digital literacy and the availability of technological resources as the main focus because both are crucial for MSMEs in Mojokerto Regency in facing the Industrial Revolution 4.0. Digital literacy is important for optimizing technology to improve operational

efficiency and expand markets. MSMEs in the region face gaps in understanding the potential of new technologies and managing the transition to digital business models, mainly due to limited capital and managerial skills. This research aims to address this challenge by developing a model that supports increasing digital literacy and technology access, so that MSMEs can be better prepared to face changes and take advantage of opportunities in this digital era.

Digital literacy is a multifaceted concept that involves informational, technical, communicative, and innovative components, which reflects the ability to make proficient use of modern media and communication technologies (Nazarova & Nazarov, 2021). The level of digital literacy is essential for safe and effective integration into the global digital space, requiring a systemic approach and sustainable competency development (Savina et al., 2019). Factors influencing digital literacy levels include age, gender, settlement, and territorial aspects, highlighting the issue of digital inequality and the need to address disparities in access and skills (Biezā, 2020).

The urgency of this research is underscored by three converging factors. First, the COVID-19 pandemic has accelerated digital transformation imperatives, with 67% of Mojokerto MSMEs reporting revenue declines exceeding 40% during 2020-2021, while digitally-adapted MSMEs demonstrated 15% revenue growth during the same period (Regional Economic Recovery Task Force, 2023). Second, Indonesia's participation in regional free trade agreements (RCEP, ASEAN Economic Community) intensifies competitive pressures, requiring MSMEs to enhance productivity and market reach through digital capabilities. Third, government initiatives such as the National Digital Literacy Movement (2022-2024) and MSME Digitalization Roadmap allocate IDR 3.5 trillion for capacity building, yet program effectiveness remains constrained by inadequate empirical frameworks linking digital literacy, technology resources, and adaptive mechanisms to measurable performance outcomes. This research addresses a critical policy need by providing evidence-based insights for optimizing resource allocation and intervention design.

The availability of technology resources is defined as the extent to which the hardware, software, and information technology infrastructure necessary for business operations are available and accessible to users. According to Brynjolfsson & McAfee (2014), technology resources include all the elements that enable an organization to implement and utilize information technology to improve its operational efficiency and effectiveness. The availability of technology resources refers to the readiness and accessibility of information and communication systems, *timber resources*, cloud resources, and machinery for efficient utilization (Maamar et al., 2021). The novelty of this research lies in three distinctive contributions: (1) Theoretical innovation—this study pioneers the integration of *Digital Literacy Theory* (Nazarova & Nazarov, 2021) with Resource-Based View (Brynjolfsson & McAfee, 2014) through the mediating mechanism of Organizational Adaptation Theory (Tushman & O'Reilly, 1996), creating a comprehensive framework that explains not merely direct effects but the dynamic pathways through which digital capabilities and technology resources transform into performance outcomes. No previous study has empirically validated this triadic theoretical integration in the MSME context. (2) Methodological advancement—utilizing Structural Equation Modeling with Smart PLS to simultaneously test seven hypotheses including both direct and indirect effects, enabling precise quantification of

mediation strength (specific indirect effects) that previous descriptive and correlation studies could not capture. (3) Contextual contribution—this research provides the first empirical evidence specific to Mojokerto Regency, where unique socio-economic characteristics (hybrid rural-urban dynamics, traditional craft heritage, proximity to industrial zones) create distinct adaptation challenges and opportunities not addressed in existing literature focused on purely urban (Akhmad & Purnomo, 2021) or purely rural settings.

MSME adaptation refers to the ability of MSMEs to adapt to changes in the business, technology, and market environment. According to Tushman & O'Reilly III (1996), adaptation is the ability of an organization to recognize changes in the external environment and implement internal changes necessary to remain competitive. Within the scope of MSMEs, this includes the adoption of new technologies, adjustments to business models, and operational changes to improve efficiency and effectiveness. The fundamental concept of MSME adaptation theory in the scope of digital literacy and technology resources is that MSMEs need to have strong capabilities in digital literacy, namely understanding and skills in using digital technology to optimize their business operations. In addition, the availability of adequate technology resources such as good IT infrastructure, relevant software, and fast internet access is also important to support the process of adapting MSMEs to technological changes.

MSME performance refers to the level of success of MSMEs in achieving predetermined business goals. According to Neely et al. (1995), organizational performance can be measured based on operational efficiency and effectiveness in achieving strategic goals. Within the scope of MSMEs, performance includes financial and non-financial aspects such as profitability, growth, customer satisfaction, and the level of adaptation of MSMEs. The performance of micro, small, and medium enterprises (MSMEs) is critical to economic growth, with various factors influencing their success. The study highlights the importance of networking, work culture, reputation (Abidin et al., 2023), financial information systems, work productivity, e-commerce (Adiningrat et al., 2023), competitive advantage, supply chain management practices, innovation (Linda et al., 2022), and the role of MSMEs in the economy (Shetty & S., 2022). MSMEs contribute significantly to GDP, job creation, and regional development, with strengths such as job creation and export contribution. To improve performance, MSMEs need to focus on optimizing their financial systems, productivity, e-commerce utilization, competitive advantage, and SCM practices while addressing challenges such as managerial skills and knowledge gaps (Lailla & Sriminarti, 2022).

This research aims to: (1) analyze the direct influence of digital literacy on MSME adaptation capacity in Mojokerto Regency; (2) examine the direct effect of technology resources availability on MSME adaptation processes; (3) investigate the direct impact of digital literacy on MSME performance outcomes; (4) assess the direct relationship between technology resources and MSME performance; (5) evaluate the direct effect of adaptation on MSME performance; (6) test the indirect influence of digital literacy on MSME performance mediated by adaptation; and (7) examine the indirect effect of technology resources on MSME performance through adaptation mechanisms. The expected benefits are threefold: Theoretically, this research advances organizational adaptation literature by empirically validating the mediating role of adaptation in technology-performance linkages specific to MSMEs, contributing to Resource-Based View and Dynamic Capabilities perspectives. Practically, findings provide actionable insights for MSME owners regarding priority areas for

capability development and resource allocation, while offering government agencies evidence-based frameworks for designing targeted intervention programs. For policymakers, results inform strategic decisions on digital infrastructure investment, training program design, and incentive structures that maximize MSME competitiveness and economic contribution.

METHOD

This study employed a quantitative approach with explanatory research design, aiming to test causal relationships among variables through hypothesis testing (Creswell & Creswell, 2018). The explanatory nature allows systematic investigation of how digital literacy and technology resources influence MSME performance directly and indirectly through adaptation mechanisms, utilizing structural equation modeling to establish empirical evidence of these relationships.

The research population comprises all registered MSMEs in Mojokerto Regency totaling 18,456 business units across manufacturing, services, and trade sectors according to the Department of Cooperatives and SMEs database (2024). The sample size of 125 MSMEs was determined using Slovin's formula with 9% margin of error, considered appropriate for PLS-SEM analysis which requires minimum sample size of 10 times the largest number of structural paths directed at a particular construct (Hair et al., 2017). The sampling technique employed is purposive sampling with the following criteria: (1) MSMEs operating for minimum 2 years to ensure established business operations; (2) business owners/managers aged 18-60 years with decision-making authority; (3) MSMEs with annual turnover between IDR 50 million - 2.5 billion consistent with Indonesian MSME classification; and (4) willingness to participate and provide complete information. This purposive approach ensures sample representativeness across MSME diversity while targeting respondents capable of providing reliable data regarding digital literacy, technology resources, adaptation, and performance.

Data collection was conducted during August-October 2024 using online survey method via Google Forms distributed through three channels: (1) official WhatsApp groups of MSME associations coordinated by the Department of Cooperatives and SMEs; (2) direct coordination with MSME cluster coordinators in 18 sub-districts; and (3) snowball referrals from initial respondents. Each survey package included informed consent, respondent demographic information, and structured questionnaire. The Google Form format was chosen for efficiency, cost-effectiveness, and ability to reach geographically dispersed MSMEs across urban and rural areas of Mojokerto Regency, while ensuring data quality through mandatory field settings and validation rules.

The research instrument consists of a structured questionnaire comprising five sections measured on a 5-point Likert scale (1=Strongly Disagree to 5=Strongly Agree): (1) Digital Literacy (X1): 12 items adapted from Indrajit (2020) covering information literacy (ability to search, evaluate, and use digital information), technical literacy (skills in operating digital devices and software), communication literacy (effective use of digital communication tools), and innovation literacy (capability to leverage technology for creative solutions). (2) Technology Resources (X2): 10 items adapted from Thong (1999) measuring hardware availability (computers, smartphones, production equipment), software accessibility (business applications, e-commerce platforms), infrastructure quality (internet connectivity, electricity

stability), and technical support availability. (3) MSME Adaptation (Y): 11 items adapted from Grant (1996) assessing strategic adaptation (alignment of business model with market changes), operational adaptation (process adjustments), technological adaptation (new technology adoption), and organizational adaptation (structural and cultural changes). (4) MSME Performance (Z): 13 items adapted from Venkatraman & Ramanujam (1986) evaluating financial performance (sales growth, profitability, cost efficiency), operational performance (productivity, quality), and market performance (market share, customer satisfaction, competitiveness). Prior to main data collection, the instrument underwent pilot testing with 30 MSMEs, demonstrating satisfactory validity (factor loadings >0.7) and reliability (Cronbach's alpha >0.8 for all constructs).

This research was conducted in Mojokerto Regency in 2024, with a sample of 125 MSMEs. Data related to research variables were collected with google form, then analyzed with Data analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 software through the following stages: (1) Descriptive Statistics Analysis—calculating mean, standard deviation, and frequency distributions to profile respondent characteristics and variable distributions; (2) Outer Model Evaluation (Measurement Model)—assessing construct validity through convergent validity (Average Variance Extracted ≥0.5, factor loadings ≥0.7) and discriminant validity (Fornell-Larcker criterion, HTMT ratio <0.85), and evaluating reliability using Composite Reliability and Cronbach's Alpha (threshold ≥0.7); (3) Inner Model Evaluation (Structural Model)—examining model fit through R^2 values for endogenous variables (Y and Z), predictive relevance via Q^2 (Stone-Geisser criterion), and effect size (f^2); (4) Hypothesis Testing—analyzing path coefficients and their statistical significance using bootstrapping procedure with 5,000 resamples, accepting hypotheses at significance level $\alpha=0.05$ (p-value <0.05, t-statistic >1.96); (5) Mediation Analysis—testing indirect effects through Specific Indirect Effects procedure to determine mediation type (full, partial, or no mediation) based on significance of direct and indirect paths (Zhao et al., 2010). PLS-SEM was selected as the appropriate technique for this study because it accommodates complex models with multiple relationships, works effectively with relatively small samples, does not require multivariate normality assumptions, and is particularly suitable for predictive and exploratory research contexts (Hair et al., 2019). Smart PLS software. However, previously a validity and reliability test was carried out as well as a good of fit test. The digital literacy indicator refers to Indrajit (2020), the technology resource indicator refers to Thong (1999), the MSME adaptation indicator refers to Grant (1996), and the MSE performance indicator refers to Venkatraman & Ramanujam (1986).

RESULT AND DISCUSSION

The results of the goodness of fit test using R2 values, for variables y, and z showed predictive-relevance values above 50%, indicating that the diversity of data can be explained by the model above 50%. This result is said to be that the Smart PLS model formed is good. Thus, the model can be used for hypothesis testing. Furthermore, the validity and reliability tests showed that the valid tests using the Pearson model were all smaller by 5% and the reliability test using the Cronbach alpa model were all greater by 0.6

The summary of the results of data analysis using Smart PLS software is summarized as follows:

Table 1. Summary of Direct and Indirect Influences

Explanation	Path Coefficients	p-value	Conclusion
H1: x1 => y (direct influence)	3.188	0.010	Influential
H2: x2 => y (direct influence)	1.263	0.027	Influential
H3: x1 => z (direct influence)	2.383	0.007	Influential
H4: x2 => z (direct influence)	2.293	0.009	Influential
H5: y => z (direct influence)	2.361	0.004	Influential
H6: x1 => y => z (indirect influence)	Specific Indirect Effects p-values 0.002< 0,05		Influential
H7: x2 => y => z (indirect influence)	Specific Indirect Effects p-values 0,000 < 0,05		Influential

Source: secondary data processed by researchers 2024

Based on table 1, the results of the hypothesis test can be explained that: first, the p-value of the influence of x1 on y (direct influence) of 0.000 < alpa 5%, means that digital literacy has a significant positive effect on the adaptation of MSMEs. Thus the first hypothesis is accepted. Second, the p-value of the influence of x2 on y (direct influence) of 0.000 < alpa 5%, means that technological resources have a significant positive effect on the adaptation of MSMEs. Thus the second hypothesis is accepted. Third, the p-value of the influence of x1 on z (direct influence) of 0.000 < alpa 5%, means that digital literacy has a significant positive effect on the performance of MSMEs. Thus the third hypothesis is accepted. Fourth, the p-value of the influence of x2 on z (direct influence) of 0.000 < alpa 5%, means that technological resources have a significant positive effect on the performance of MSMEs. Thus the fourth hypothesis is accepted. Fifth, the p-value of the influence of y to z (direct influence) of 0.000 < alpa 5%, means that the adaptation of MSMEs has a significant positive effect on the performance of MSMEs. Thus the fifth hypothesis is accepted. Sixth, the Specific Indirect Effects path of indirect influence x1 => y => z, the p-value is 0.002 < alpa 5%, meaning that digital literacy has a significant positive effect on the performance of MSMEs through MSME adaptation. Thus the sixth hypothesis is accepted. Seventh, the Specific Indirect Effects path of indirect influence x2 => y =>z, the p-value is 0.000 < alpa 5%, meaning that the influence of technological resources has a significant positive effect on the performance of MSMEs through MSME adaptation. Thus the seventh hypothesis is accepted.

The results of this research prove that digital literacy has a significant positive effect on MSME adaptation. Thus the first hypothesis is accepted. These results support his research McKinsey & Company (2021). Digital literacy includes the ability to understand, operate, and utilize digital technology in daily business operations. MSMEs that have a good level of digital literacy tend to adapt more easily to technological developments, which ultimately has a positive impact on their performance. This is supported by research that shows that MSME actors who are skilled in utilizing digital technology are able to improve operational efficiency, expand market access, and optimize services to customers. Thus, digital literacy is a key element for MSMEs to remain competitive in the midst of rapid global change. In addition, digital literacy also plays a role in strengthening the innovation and creativity capabilities of MSMEs. Digital technology provides various opportunities for MSMEs to create new products

and services that are more relevant to market needs. For example, with a good understanding of e-commerce platforms and social media, MSMEs can increase their market exposure and penetration more effectively. This creates a more dynamic business environment, where MSMEs can quickly adapt to changing customer demands and industry trends. In this context, digital literacy is not only about technical understanding, but also about the use of technology to create sustainable added value. High digital literacy allows MSMEs to be better prepared to face global challenges and become more resilient in the face of technological disruption.

The results of this study prove that technological resources have a significant positive effect on the adaptation of MSMEs. Thus the second hypothesis is accepted. These findings support the research of Rahayu and Day (2020). Adequate technological resources play a significant role in supporting MSMEs in their adaptation process to changes in the digital environment. The availability of technology such as up-to-date hardware and software and good digital infrastructure accelerate the adaptation process, enabling MSMEs to respond more efficiently to market and technological changes. These results support theories that emphasize the importance of technological resources in facilitating organizational adaptation, such as the Resource-Based View theory which highlights the role of technology as a strategic asset in improving organizational capabilities. These findings confirm that technology is not only an operational tool, but also a key factor in increasing the flexibility and responsiveness of MSMEs. With adequate technological resources, MSMEs are better able to adapt to dynamic market trends and demands, supporting their operational effectiveness and efficiency. This analysis is important because it provides a deeper understanding of how the availability of technology affects the ability of MSMEs to adapt, especially in today's digital era. This shows that investment in technology is not only important for day-to-day operations but also for long-term adaptation strategies. These findings also contribute better than other models that may not explicitly include technological variables in adaptation analyses. It is hoped that these results can replace or improve previous models by emphasizing the importance of technology investment as an integral part of the MSME adaptation strategy.

The results of this study prove that technological resources have a significant positive effect on the performance of MSMEs. Thus the seventh hypothesis is accepted. MSMEs that are able to effectively implement digital technology tend to be more innovative, which allows them to compete better in the global market. Good digital literacy allows MSMEs to be more responsive to changing market demands and consumer trends. In their research, it was found that MSMEs with high digital literacy are better able to perform accurate data analysis, which helps in strategic decision-making and overall business performance improvement. MSMEs that have a good understanding of digital technology tend to be better able to leverage social media and e-commerce to reach a wider market, which in turn increases sales and profitability

The results of this study prove that technological resources have a significant positive effect on the adaptation of MSMEs. Thus the fourth hypothesis is accepted. These findings support his research Rahayu and Day (2020) in their research proving that the availability of technological resources is a key factor that supports the adaptability of MSMEs in the digital era. They found that MSMEs with technology resources have access to the latest technologies, such as advanced hardware and relevant software, are better able to adopt new business models and adapt to changing business environments, and MSMEs supported by adequate technology are able to optimize supply chains, improve customer service, and expand their market reach

and the availability of good technology resources allows MSMEs to Transform their business processes more flexibly and responsively

The results of this study prove that MSME adaptation has a significant positive effect on the performance of MSMEs. Thus the fifth hypothesis is accepted. MSMEs that are able to adapt their business strategies quickly to changing consumer demand and market dynamics show better performance in terms of revenue growth and business continuity. Proactive adaptation to global market changes, such as consumer trends and technological developments, allows MSMEs to take advantage of new opportunities and reduce risk. They noted that MSMEs that actively monitor and respond to changes in the global market have superior performance compared to less adaptive competitors. High adaptability, which includes rapid response to risks and market changes, is a key indicator of good MSME performance, especially in the context of long-term business resilience.

The results of this study prove that digital literacy has a significant positive effect on the performance of MSMEs through MSME adaptation. Thus the sixth hypothesis is accepted. Digital literacy not only affects performance directly, but also through the ability of MSMEs to adapt. A high level of adaptation allows MSMEs to make maximum use of digital literacy to improve performance. With high digital literacy, they can adapt more quickly to technology and market changes, which in turn improves their performance indirectly through better adaptation. MSMEs that have strong digital skills tend to be more innovative and adaptive, which then improves their performance in a competitive market.

The results of this study prove that technological resources have a significant positive effect on the performance of MSMEs through MSME adaptation. Thus the seventh hypothesis is accepted. MSMEs that have access to adequate technology can better adapt to market changes, which in turn contributes to improved business performance. MSMEs supported by adequate technology are faster in adjusting their strategies and operations, which then contributes to improved business performance indirectly and MSMEs that have access to adequate technology can better adapt to market changes, which in turn contributes to improved business performance. MSMEs through adaptation level mediation, reinforcing the argument that adequate technology allows MSMEs to adapt more effectively and, as a result, improve their performance. And also supports the hypothesis proposed with empirical evidence showing how digital literacy and the availability of technological resources affect the adaptation and performance of MSMEs. With good technological resources, MSMEs are better able to adapt to market changes in the end to improve their performance.

CONCLUSION

This study concludes that digital literacy exerts a significant positive effect on MSME adaptation and performance, both directly and indirectly through adaptation as a mediator; similarly, technological resources significantly enhance MSME adaptation and performance via direct and indirect pathways mediated by adaptation. These findings underscore the critical interplay among digital literacy, technological resources, adaptation capacity, and overall MSME performance in Mojokerto Regency amid Industry 4.0 pressures. Consequently, MSMEs are recommended to prioritize investments in digital literacy training, technological infrastructure upgrades, and adaptive strategies to boost competitiveness and profitability. For future research, scholars could longitudinally examine these relationships across diverse

Indonesian regions or incorporate moderating variables like government policy support or community participation to validate generalizability and uncover contextual nuances.

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