Digital Transformation Readiness: An Empirical Study And Support For MSMES Towards Business 4.0

Abid Muhtarom[1], Abdul Ghofur[2], Yuhronur Efendi[3], Vicky Dwi Septyawan[4]

[1234]Department of Master Management, Faculty of Economics and Business, Universitas Islam Lamonga

Abstract
This community service activity aims to improve digital transformation readiness for MSMEs in Tanggul Village, Mantup District, Lamongan Regency. The program was implemented through participatory training and mentoring involving thirty business actors from the culinary, agricultural, and home industry sectors. The activity materials included digital literacy, online marketing, digital financial management, and an introduction to the concept of Business 4.0. The results of the activity showed an average increase in participants' digital skills of 28 percent and an increase in business turnover of between 10-15 percent. As many as 60 percent of participants successfully implemented cashier applications, digital payment systems, and promotions through online platforms. In addition, the "Digital MSME Network Lamongan" network was formed as a forum for collaboration and experience sharing. This activity proves that participation-based training and mentoring are effective in strengthening digital readiness and fostering a culture of innovation for rural MSMEs towards the Business 4.0 era.

Keywords:
Digital Transformation Readiness; Empowerment of MSMEs; Digital Literacy; Community-Based Mentoring; Rural Digitalization; Business 4.0

*Corresponding author
E-mail:abidmuhtarom@unisla.ac.id

INTRODUCTION

The development of the Industrial Revolution 4.0 has had a significant impact on all aspects of life, including patterns of production, distribution, and consumption of goods and services. This era is characterized by the integration of digital technology with industrial systems, creating efficiency, transparency, and high speed in business processes. The concept of Business 4.0 has become a new paradigm that requires businesses to adapt to the use of technologies

such as artificial intelligence, big data analytics, cloud computing, blockchain, and the internet of things. Adapting to these changes is not only a necessity for large corporations but also a challenge for micro, small, and medium enterprises (MSMEs) to remain relevant and competitive amidst increasingly rapid digital disruption.

MSMEs are a strategic sector that plays a vital role in the national economy. According to data from the Ministry of Cooperatives and SMEs, more than 99% of business units in Indonesia are MSMEs, contributing significantly to employment and Gross Domestic Product (GDP). However, the biggest challenge facing MSMEs today is their low level of preparedness for digital transformation. Most MSMEs still rely on conventional business models, have limited access to technology, and have low levels of digital literacy. This situation has led to a decline in MSME competitiveness and a reduced ability to adapt to the demands of an increasingly digitalized modern market.

Lamongan Regency, as one of the economic buffer zones in East Java, has significant potential for developing the MSME sector. Various types of businesses, such as food processing, crafts, garment factories, and agricultural trade, are growing rapidly and contributing to community welfare. However, field observations indicate that most MSMEs in Lamongan still face obstacles in optimizing the use of digital technology, both for marketing, financial management, and operational management. Limited internet access in some rural areas, a lack of understanding of the benefits of technology, and minimal support from educational institutions and local governments are key obstacles to this digital transformation process.

In this context, digital transformation readiness is a crucial issue that needs to be studied and strengthened. This readiness encompasses the ability of individuals and organizations to accept, implement, and utilize technology to improve business performance. Previous studies have shown that factors influencing digital readiness include human resource competency, infrastructure support, managerial awareness of innovation, and a supportive policy environment for digitalization. Community service activities play a strategic role in bridging this gap by providing a practical and participatory approach focused on empowering business actors.

This community service activity is carried out as a form of academic and social support for strengthening the digital capacity of MSMEs in Lamongan Regency. Using an empirical approach, this activity involves needs mapping, digital literacy training, mentoring in the use of business applications, and monitoring the implementation of training outcomes in the field. This approach is designed to ensure that MSMEs not only understand the concept of digitalization but also are able to effectively integrate it into their daily business activities. This evidence-based approach (empirical support) is

expected to provide an empowerment model that is applicable, efficient, and replicable in other regions with similar characteristics.

Furthermore, this activity is expected to foster a sustainable local digital ecosystem in Lamongan. Universities, local governments, and business communities can collaborate to build support systems such as digital learning centers, local online marketing platforms, and digital business networking forums. With this ecosystem, the digitalization process will not be merely temporary but will become part of a business culture that adapts to changing times. By strengthening synergy between academics and the community, this activity also aligns with the Tri Dharma Perguruan Tinggi mission, particularly in the aspect of knowledge-based community service that has a tangible socio-economic impact.

From an academic perspective, this activity contributes to the development of empirical literature on the digital readiness of MSMEs in the region. The results of field data collection related to the level of technology adoption, implementation barriers, and business actors' adaptation strategies will form the basis for developing a conceptual model of a digital readiness framework for MSMEs in semi-urban areas such as Lamongan. This model is expected to serve as a reference for regional policymakers in designing more targeted and sustainable digital economic empowerment programs. Thus, this community service activity not only provides direct benefits to MSMEs but also strengthens the position of universities as centers of knowledge and agents of social change in the face of the Business 4.0 era.

LITERATURE REVIEW

1. Digital Transformation in the Context of MSMEs

Digital transformation is a process of comprehensive change in organizational systems and structures through the use of digital technology to create new added value (Bharadwaj et al., 2013). In the context of MSMEs, this includes not only the use of social media or online platforms, but also fundamental changes in governance, decision-making, and customer management (Matt et al., 2015). Recent studies show that digital transformation provides tangible benefits in the form of increased efficiency, market reach, and profitability, but still faces resource limitations and low technical skills and data security (Nurscience Institute Journal, 2023). According to Kusnadi and Setyowati (2021), the dominant obstacles faced by Indonesian MSMEs are low digital literacy and business actors' confidence in new technologies. This gap is very relevant to the conditions of MSMEs in Lamongan, most of which still operate traditionally.

2. Digital Transformation Readiness

Digital readiness describes the ability of individuals and organizations to accept and implement technology (Berghaus & Back, 2016). Its main dimensions include people, technology, organization, and environmental readiness. Recent research confirms that digital skills and e-readiness have a positive and significant impact on the digital transformation readiness of MSMEs (Performance Journal Unsoed, 2023). A study of Indonesian retailers shows that business actors have a positive perception of technology, but are still cautious about proactive innovation based on the Technology Readiness Index (TRI) (Brilliance Journal IT Science, 2024). In Lamongan, many MSME actors are highly motivated but lack technical knowledge; therefore, a coaching-based mentoring approach is more appropriate than one-way training.

3. Business 4.0 and its relevance for MSMEs

The Business 4.0 concept emphasizes four key principles: automation, agility, artificial intelligence, and analytics (Tata Consultancy Services, 2018). For MSMEs, implementing these principles can increase efficiency, expand markets, and strengthen customer loyalty.

Research by Verhoef et al. (2021) shows that successful Business 4.0 adoption depends on organizational readiness and managerial ability to manage change. Further empirical evidence in Palembang confirms that digital transformation has a positive and significant impact on MSME business resilience, with a correlation of 60.2% (IAPA Journal, 2023).

4. The Role of Higher Education in Strengthening the Digital Capacity of MSMEs

Universities play a strategic role through the Tri Dharma Perguruan Tinggi (Three Pillars of Higher Education) to support digital literacy and transformation (Etzkowitz & Leydesdorff, 2000). The triple helix model—collaboration between academics, government, and industry—has proven effective in strengthening the digital capacity of MSMEs. A study in the Ilomata Journal of Management (2024) found that internal organizational factors have the greatest influence on the success of digital adoption compared to technological and external environmental factors. Student involvement in community service activities also strengthens the two-way knowledge transfer process, forming a sustainable social learning ecosystem.

5. Collaboration-Based Digital Mentoring Model for MSMEs

Rahmawati and Nugroho's (2022) research shows that a collaborative mentoring model involving academics, local governments, and the business community is the most effective approach to improving the digital readiness of MSMEs.

In Lamongan, this model can be realized through collaboration between universities, the Cooperatives and MSMEs Office, and local business communities. This collaboration has the potential to create a digital empowerment ecosystem that promotes technology-based economic independence.

6. Conceptual Framework for Community Service Activities

This community service activity is based on three main pillars: (1) mapping the digital readiness of MSMEs in Lamongan; (2) capacity building through intensive training and mentoring; and (3) a measurable Business 4.0 implementation strategy. This framework integrates theoretical and applied approaches with a sustainable results orientation.

7. Digital Readiness of MSMEs in Indonesia: Recent Empirical Evidence

Anatan & Nur (2023) found that perceptions of digitalization drivers significantly influence MSME readiness, while internal barriers do not significantly reduce it.

Business Perspectives (2023) research shows that digital transformation mediates the relationship between digital strategy and market complexity on MSME performance, emphasizing that digital readiness must be accompanied by a clear business strategy.

8. Factors Affecting Readiness and Digital Transformation

A recent systematic review (ResearchGate, 2024) concluded that government support, digital literacy, and access to infrastructure are key enablers of MSME digitalization, while resistance to change and limited capital remain obstacles.

Research on the culinary sector in Semarang (Al-Hafi Indonesia Journal, 2025) found that 62% of MSMEs were in the "transition" stage, 23% were "basic," and 15% were "advanced," with the main influencing factors being digital literacy, financial support, and technological infrastructure. These results illustrate that digital readiness is a multidimensional phenomenon that cannot be viewed solely from a technological perspective.

9. Digital Transformation and MSME Resilience

Digital transformation has also been shown to improve the resilience of MSMEs in the post-pandemic era. A 2023 study by the IAPA showed that the use of digital technology has a positive and significant effect on MSME resilience, with a coefficient of 60.2%. This research recommends the importance of an adaptive work culture, a digital roadmap, and a supportive business environment in every community service intervention.

10. Relevance and Implications for Community Service Activities in Lamongan

Based on this series of studies, MSMEs' digital transformation readiness involves dimensions of human resources, technology, organizational culture, strategy, and the external environment. In the context of Lamongan, where the majority of MSMEs are still traditional-based, community service programs should include readiness mapping, digital literacy training, practical mentoring, and the development of local digital networks.

Thus, this literature review provides a solid conceptual basis for designing empirically based community service activities that can increase Digital Transformation Readiness and strengthen the competitiveness of MSMEs towards Business 4.0 in Lamongan Regency.

METHOD

1. Approach and Activity Design

This community service activity uses a participatory approach and is based on empirical research (research-based community engagement). This approach allows for the active involvement of MSMEs as key partners, ensuring that each stage of the activity is tailored to real-world needs.

1. The activity design combines two main approaches: Empirical study to map the level of digital transformation readiness of MSMEs in Lamongan Regency, and
2. The capacity building program includes training, mentoring, and evaluation of digital transformation implementation. This model is adapted from the Participatory Action Research (PAR) concept, which emphasizes collaboration between academics and the community in finding innovative solutions based on local contexts.

2. Location and Subject of Activities

The activity was held in Tanggul Village, Paciran District, Lamongan Regency, East Java, with a focus on MSMEs in the trade, culinary, and creative industries sectors. The location was selected based on the region's high potential for economic growth and the large number of small businesses that have not yet fully utilized digital technology.

The subjects of the activity were 30 MSMEs partners of the Cooperatives and MSMEs Service of Lamongan Regency, who were selected using purposive sampling based on the following criteria:

1. Has been operating for at least two years;
2. Have active production or service activities;
3. Not yet fully implementing digital systems in business operations;
4. Willing to follow the entire series of training and evaluation.

3. Stages of Activity Implementation

Community service activities are carried out through four main stages as follows:

a. Stage I: Assessment and Mapping

In the initial stage, a survey and in-depth interviews were conducted to identify the level of digital readiness of MSMEs (aspects of human resources, infrastructure, literacy, and business strategy). The data collection instrument was developed based on the Digital Transformation Readiness Model indicators (Berghaus & Back, 2016), modified to suit the context of regional MSMEs. Data were collected through questionnaires, direct observation, and semi-structured interviews. The results of this mapping served as the basis for designing training materials and intervention strategies.

b. Phase II: Literacy Training and Digital Transformation

The training was conducted in the form of a two-day interactive workshop with the theme:

1. Introduction to Digital Transformation and Business 4.0;
2. Introduction to Digital Applications for Business Management (Google Workspace, POS, Digital Accounting);
3. Online Marketing and Branding Strategies for MSMEs;
4. Digital Financial Management and E-commerce.
   The training was facilitated by lecturers and information technology practitioners using a blended learning method (face-to-face and online).

c. Stage III: Mentoring and Implementation

Mentoring is carried out for one month after training to help MSMEs implement relevant technologies, such as creating e-commerce accounts, digital payments, and online promotional media. Mentoring uses a mentoring by doing model, namely lecturers and students directly accompany the digitalization implementation process, accompanied by weekly progress monitoring.

d. Stage IV: Evaluation and Reflection

Evaluation was carried out by measuring changes before and after the activity using pre-post questionnaires (pre-test and post-test) and reflective interviews.

Indicators of success include:

1. Improvement in digital literacy scores and digital transformation readiness (≥20% from baseline);
2. Increased ability to use digital platforms for promotion/sales;
3. The formation of at least 3 sustainable digital MSME networks. In addition, focus group discussions (FGDs) were conducted to evaluate the effectiveness of the program and formulate follow-up plans with partners.

4. Data Analysis Techniques

Data analysis was conducted using descriptive qualitative methods. Qualitative data from interviews and observations were analyzed through reduction, presentation, and drawing conclusions according to the Miles & Huberman (2014) model. The results of the analysis were used to assess the effectiveness of activities and to develop recommendations for developing a digital empowerment model for Lamongan MSMEs.

FINDINGS AND DISCUSSION

The community service activity themed Digital Transformation Readiness: An Empirical Study and Support for MSMEs Towards Business 4.0 was held in Tanggul Village, Paciran District, Lamongan Regency, East Java, as one of the MSME centers that has high economic potential but still faces limitations in the application of digital technology. Most of the business actors in this village are engaged in agricultural processing, culinary, and small-scale household industries. The socio-economic characteristics of the community, which are still predominantly traditional, make this activity relevant and strategic to encourage digital transformation readiness at the grassroots level.

Initial mapping results conducted through surveys and interviews indicate that the digital transformation readiness of MSMEs in Tanggul Village is classified as medium, with an average score of 63 percent. Of the four dimensions measured, human resource readiness, technological readiness, organizational readiness, and environmental readiness, the human resource dimension ranked highest with a score of 72 percent, followed by organizational readiness at 65 percent. However, technological readiness remains a major obstacle, with the lowest score at 54 percent. These findings demonstrate that while the enthusiasm and motivation of business actors to adapt to technological developments are high, they are not matched by adequate technical mastery and access to digital tools. This condition aligns with the results of research by Anatan and Nur (2023), which showed that positive perceptions of digitalization drivers strongly influence MSMEs' digital transformation readiness, while technical limitations are not always the main obstacle. On the other hand, limited internet network infrastructure in several areas of Tanggul Village also affects the community's digital readiness, as emphasized in the study The State of Digital Transformation Among Indonesian SMEs (2024) that internet access and digital literacy are the main driving factors for the digitalization of MSMEs in Indonesia.

In-depth interviews revealed that most MSMEs in Tanggul Village have used social media platforms such as WhatsApp Business, Instagram, and

Facebook to market their products, but their use is limited to basic promotions without utilizing advanced features such as customer analytics, digital payment systems, or automatic transaction recording. Seventy percent of respondents stated that they were not yet familiar with the concept of Business 4.0 or did not understand how to integrate digital technology into business management. This reinforces Vial's (2019) view that digital transformation requires not only the adoption of technology but also a change in mindset, organizational culture, and a willingness to shift work systems towards data-driven efficiency.

The training and mentoring activities held at Tanggul Village Hall for two months had a significant impact on improving the digital competence of MSMEs. Based on the results of pre-tests and post-tests on 30 participants, an average increase in digital skills scores of 28 percent was obtained, particularly in the use of e-commerce applications, promotions through social media, and application-based financial management. Participants also demonstrated increased confidence in operating technology, with 85 percent stating they were ready to develop their businesses digitally after the training. Four weeks of follow-up mentoring resulted in 18 MSMEs (60 percent) successfully integrating digital systems into their business operations, such as the use of online cashier applications, digital bookkeeping, and cross-platform promotions. These results support research by the Unsoed Performance Journal (2023) which confirmed that digital literacy and e-readiness significantly influence the digital transformation of MSMEs.

Figure 1. Training and Mentoring Activities

In addition to improving individual skills, this activity also encouraged changes in business strategy. Several business owners in Tanggul Village began implementing Business 4.0 principles in their operations. Agricultural product processing MSMEs used online ordering systems integrated with

social media to expand their markets, culinary MSMEs optimized cloud storage for recipes and product catalogs, while home industry players began utilizing QR code applications on product packaging to facilitate customer access to information and online reviews. Seventy-five percent of participants reported increased efficiency and customer loyalty after implementing digital technology. These results align with the Business 4.0 concept proposed by Tata Consultancy Services (2018), which emphasizes four main pillars: automation, agility, artificial intelligence, and data analytics.

Figure 2. MOU with Village Government and MSME Association

The improvements achieved are also reflected in the economic side. Based on a post-program business performance evaluation, there was an average increase in turnover of 12 to 15 percent within one month of digitalization implementation. This indicates that the use of technology can improve operational efficiency and expand market share. These findings support research in Problems and Perspectives in Management (2023), which states that digital strategy is a critical variable strengthening the relationship between market complexity and MSME performance. Furthermore, this activity demonstrated increased interaction and networking among MSMEs in Tanggul Village through the Digital MSME Network Lamongan forum established during the program. This forum serves as a platform for business actors to share experiences, marketing strategies, and collaboration opportunities, thereby strengthening the digital ecosystem at the village level.

From a social perspective, this activity fosters a new awareness of the importance of digital literacy as part of the economic resilience of rural communities. Business actors understand technology not only as a business tool but also as a means to expand relationships and increase competitiveness. These results align with IAPA research (2023), which confirms that digital transformation has a positive impact on the resilience of MSMEs, especially in the context of post-pandemic recovery. Institutionally, this community service activity strengthens the synergy between universities, local governments, and

communities through the Triple Helix model (Etzkowitz & Leydesdorff, 2000). This collaboration creates a space for interaction between academics as providers of knowledge, village governments as facilitators of policies and facilities, and MSME communities as key actors in implementing digital transformation.

Overall, the findings of the activities in Tanggul Village indicate that readiness for digital transformation is determined not only by the availability of technology, but also by human factors, organizational culture, and social environmental support that encourages change. Digital literacy has been shown to increase business actors' confidence and adaptability in facing market changes, while ongoing mentoring is key to successful technology implementation at the local level. These findings align with the results of a study by Susanti et al. (2023), which stated that the success of MSME digital transformation is highly dependent on the synergy between human resource readiness, institutional support, and the sustainability of the business environment. With the participatory approach implemented, this community service activity not only provides direct benefits to the Tanggul Village community but also generates empirical data that can form the basis for formulating policies and models for strengthening the regional digital economy.

Thus, community service activities in Tanggul Village, Lamongan Regency, have successfully improved digital literacy, technological readiness, and the adaptability of MSMEs to the demands of the Business 4.0 era. This transformation not only impacts economic performance but also strengthens social networks and the culture of innovation within the village community. This program demonstrates that collaborative and sustainable digital empowerment can lay the foundation for an inclusive, resilient, and equitable digital economic ecosystem at the local level.

CONCLUSIONS

Community service activities conducted in Tanggul Village, Lamongan Regency, have yielded tangible results in improving the digital transformation readiness of micro, small, and medium enterprises (MSMEs). Mapping results indicate that prior to the activities, MSMEs' digital readiness was at an intermediate level, with major limitations in technology and digital application utilization. Through a series of participatory training and mentoring sessions, significant improvements were seen in digital literacy skills, understanding of Business 4.0 concepts, and entrepreneurs' willingness to integrate technology into their business processes.

The training program, accompanied by direct mentoring, has proven effective in building the confidence and technical skills of MSMEs in utilizing digital applications such as point-of-sale (POS), online marketing media,

digital recording systems, and cashless payment methods. These skills have a direct impact on operational efficiency and increased business turnover, which has increased by an average of 10 to 15 percent within one month of implementation. Furthermore, the formation of the Lamongan Digital MSME Network demonstrates the program's success in encouraging collaboration and the exchange of experiences among business actors at the village level.

This activity also strengthens the synergy between universities, local governments, and the community, in accordance with the Triple Helix principle, so that community service is not only educational but also contributes to the development of policies and strategies for regional digital economic development. The results of this activity demonstrate that readiness for digital transformation is determined not only by technological aspects, but also by human factors, institutional support, and a social environment that encourages innovation and adaptation.

Thus, this community service activity demonstrates that improving digital transformation readiness can be achieved through an integrated, collaborative, and contextual approach. Tanggul Village serves as a clear example of how sustainable digital empowerment can create more adaptive, innovative, and competitive business actors in the Business 4.0 era. Going forward, further mentoring is needed, including the development of a village digital training center and the integration of a community-based online marketing system to ensure the continued impact of this activity on strengthening the local economy and community well-being.

LIMITATION & FURTHER RESEARCH

This community service activity has several limitations that need to be considered when assessing the results and generalizing the findings. First, the activity was conducted on a local scale with limited coverage, specifically in Tanggul Village, Mantup District, Lamongan Regency. Therefore, the social, economic, and digital infrastructure characteristics of the local community may influence the results. This condition means that the results of the community service cannot be generalized comprehensively to the entire Lamongan Regency or other regions with varying levels of digital readiness.

Second, the number of participants involved in this activity was limited to thirty MSMEs, selected purposively based on their willingness and active involvement in the program. This limited number of participants impacted the depth of variation in the empirical data obtained, particularly in comparative analysis across business sectors. Therefore, the results of the evaluation and digital competency improvement obtained more accurately reflect the micro- and contextual conditions than the overall picture of MSMEs in Lamongan.

Third, the program's limited two-month implementation period limits the scope for follow-up mentoring, which ideally requires a longer period to

assess the sustainability of digitalization outcomes. Sustainability aspects such as long-term adaptation to new technologies, the formation of consistent digital behaviors, and changes in business management patterns require further monitoring. Therefore, the long-term impact of this program cannot yet be fully and comprehensively evaluated.

Fourth, limited digital facilities and infrastructure in Tanggul Village, particularly internet access and technological devices, are external factors that also impact the effectiveness of the program. Some participants faced challenges in using the app because not all areas of the village have a stable internet signal. This presents a unique challenge in the mentoring process and indicates the need for greater support from the local government in providing digital infrastructure in rural areas.

Fifth, methodologically, this activity focused on a participatory action research approach with an empowerment orientation, thus emphasizing capacity building and behavioral change rather than in-depth quantitative analysis. This approach is appropriate for community-based service, but it limits the scope for conducting more complex statistical tests on the relationship between digital readiness variables and business performance.

Despite these limitations, the results of this project still make an important contribution to the development of a community-based digital mentoring model at the village level. However, further research with broader coverage, a longer timeframe, and more adequate infrastructure and policy support is needed to ensure the sustainability and broadening of the impact of digital transformation for MSMEs in rural areas.

AUTHOR CONTRIBUTION

Authorship: The primary author played a role in the conceptualization and design of the community service activities, the development of the training and mentoring design, and the collection of field data. The author also developed the activity implementation methodology, supervised the training and mentoring process, and wrote and edited the entire manuscript until the final version. All authors contributed to the conceptualization, collection and analysis of activity results, editing, and layout of the article. All authors have read and approved the final version of the article before it was submitted for publication.

Declaration of Interest

The authors declare that they have no financial or personal conflicts of interest that could influence the outcome of this activity or the writing of this article. The entire community service process and manuscript preparation were conducted independently, based on observations, training, and mentoring conducted in Tanggul Village, Lamongan Regency.

Thank-you note

The author would like to thank the Tanggul Village Government, Paciran District, Lamongan Regency, for their support and cooperation during the community service activities. He also expressed his gratitude to the Lamongan Regency Cooperatives and MSMEs Office for their assistance in coordinating and facilitating field data collection.

High appreciation is expressed to all MSMEs in Tanggul Village who actively participated in the training and mentoring activities, and who demonstrated a passion for learning and innovation in applying digital technology to their businesses. The author also thanks the student mentors who assisted in the training and field mentoring process, as well as the anonymous journal reviewers for their valuable suggestions and comments in improving this article.

References

Anatan, L., & Nur, A. (2023). Micro, small, and medium enterprises' readiness for digital transformation in Indonesia. ResearchGate.https://www.researchgate.net/publication/371093840

Berghaus, S., & Back, A. (2016). Stages in digital business transformation: Results of an empirical maturity study. Proceedings of the 10th Mediterranean Conference on Information Systems, 1–17.

Bharadwaj, A., El Sawy, O.A., Pavlou, P.A., & Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. MIS Quarterly, 37(2), 471–482.

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From national systems and "Mode 2" to a triple helix of university–industry–government relations. Research Policy, 29(2), 109–123. https://doi.org/10.1016/S0048-7333(99)00055-4

Hess, T., Matt, C., Benlian, A., & Wiesböck, F. (2016). Options for formulating a digital transformation strategy. MIS Quarterly Executive, 15(2), 123–139.

Kusnadi, A., & Setyowati, E. (2021). Digital literacy and the readiness of micro, small, and medium enterprises in facing the industrial era 4.0. Journal of Administration and Business, 18(1), 45–56.

Matt, C., Hess, T., & Benlian, A. (2015). Digital transformation strategies. Business & Information Systems Engineering, 57(5), 339–343. https://doi.org/10.1007/s12599-015-0401-5

Science Institute Journal. (2023). Digital transformation and readiness among MSMEs: Challenges and opportunities in Indonesia. Journal of Management Development and Business, 5(2), 101–112.

Performance Journal Unsoed. (2023). Digital skills and e-readiness as determinants of MSME transformation in Indonesia. Performance: Journal of Business and Accounting, 23(1), 33–42.

Rahmawati, E., & Nugroho, D. (2022). A collaborative mentoring model to improve the digital readiness of MSMEs. Journal of Creative Community Service, 6(2), 58–67.

ResearchGate. (2024). The state of digital transformation among Indonesian SMEs: Insights from a systematic review.https://www.researchgate.net/publication/395430783

Susanti, D., Wibowo, H., & Hartono, R. (2023). Factors influencing SMEs' readiness for digital transformation in emerging markets. International Journal of Business and Society, 24(3), 1220–1234.

Tata Consultancy Services. (2018). Business 4.0: Rewiring organizations for digital growth. Mumbai: Tata Consultancy Services Ltd.

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. The Journal of Strategic Information Systems, 28(2), 118–144.https://doi.org/10.1016/j.jsis.2019.01.003

Verhoef, P.C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J.Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. Journal of Business Research, 122, 889–901.https://doi.org/10.1016/j.jbusres.2019.09.022

IAPA Proceedings Journal. (2023). Digital transformation for MSME resilience in the era of Society 5.0: Evidence from Palembang City. Proceedings of the Indonesian Association for Public Administration, 4(1), 55–64.

Problems and Perspectives in Management. (2023). Digital transformation to enhance Indonesian SME performance: Exploring the impact of market competition and digital strategy. Problems and Perspectives in Management, 21(1), 300–312. https://doi.org/10.21511/ppm.21(1).2023.23

Al-Hafi Indonesia Journal. (2025). Digital readiness of MSMEs in the Industry 4.0 Era: A study on culinary sector MSMEs in Semarang Regency. Journal of Micro Business Innovation, 7(1), 11–23.

Ilomata Journal of Management. (2024). Organizational readiness as a key factor of digital adoption among Indonesian MSMEs. Ilomata Journal of Management, 5(2), 210–222.