



SYNERGY OF DIGITALIZATION AND SUSTAINABILITY: A GREEN BUSINESS MODEL FOR MSMEs IN THE ERA OF INDUSTRY 5.0

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Abstract

Digital technological breakthroughs have transformed the way information is accessible and shared more rapidly in sectors including government, industry, and education. However, challenges such as misinformation and data privacy have also emerged. While digitalization in the economy drives platform-based growth, it also creates a digital divide and technological dependency. Micro, Small, and Medium Enterprises (MSMEs) are expected to implement innovative, creative, and sustainable business models in this context. This article explores the synergy between digitalization and sustainability in creating green business models for MSMEs in the Industry 5.0 era. MSMEs can improve operational efficiency, expand their markets, and play a role in building a sustainable economy by incorporating sustainability principles into their business strategies. Despite these challenges, strategic steps such as improving education and developing green technology infrastructure can help MSMEs overcome these obstacles. This study employed a qualitative approach with a descriptive model and a literature review method. Data were obtained through references to a collection of scientific journals and books published from 2023 to 2025. The analytical approach employed thematic analysis and data interpretation. The study's findings support the idea that combining sustainability and digitization is a smart way to work together and secure the long-term viability of MSMEs in Indonesia.

Keywords: Digitalization, Sustainability, Green Business, MSMEs, Industry 5.0, Digital Economy.

INTRODUCTION

The digital revolution has fundamentally changed the global economic landscape. Advances in information and Employee Performance technology (ICT) have not only accelerated the flow of information but also influenced the way individuals, organizations, and governments interact in social and economic life. Digitalization is now a major driver of modern economic development, with data, connectivity, and artificial intelligence (AI) becoming new resources that determine a country's competitiveness. Indonesia, with its growing digital population, is also experiencing a significant acceleration in digital transformation, particularly in the financial and online commerce sectors (Nirmal et al., 2025). The development of digital technology has led to the emergence of platform-based economies such as e-commerce, fintech, and digital payment systems, which enable cross-border transactions in seconds. However, digitization also brings social and ecological consequences. The digital divide between large and micro-small businesses, the risk of technological dependence, and the environmental impact of digital infrastructure are challenges that must be addressed. A report by the International Energy Agency (IEA, 2024) estimates that data centers and Employee Performance networks account for more than 1.5% of global electricity consumption. Meanwhile, the Global E-Waste Monitor (2024) reports that 57.4 million tons of electronic waste are generated each year, with only 22% being successfully recycled (Srimulyani et al., 2023).

This condition indicates that digital transformation without sustainability principles has the potential to exacerbate environmental and social problems. Therefore, there is an urgent need to understand how the digitization process can go hand in hand with sustainability practices in order to provide economic benefits while maintaining ecological and social balance. In the context of national economic development, Micro, Small, and Medium Enterprises (MSMEs) play a vital role. MSMEs contribute around 60% to Indonesia's Gross Domestic Product (GDP) and provide more than 90% of employment (Sarkar et al., 2024). However, many MSMEs still face challenges in effectively utilizing digital technology, whether due to limited resources, digital skills, or access to adequate infrastructure. Digitalization provides excellent opportunities for MSMEs to expand their markets, increase efficiency, and access global supply chains. However, this transformation also brings new responsibilities: how to ensure that the adoption of digital technology not only increases productivity but also supports sustainable business practices. It is in this context that the concept of "green digital transformation" has emerged the integration of digital technology to achieve economic, social, and environmental sustainability goals (Mentari et al., 2024).

Companies that are able to combine digital innovation with environmentally friendly principles have proven to be more adaptive and competitive in the long term. For example, the use of energy-efficient cloud computing, the application of the Internet of Things (IoT) for supply chain efficiency, or the use of big data analytics to monitor the operational carbon impact are practices that are increasingly relevant in the Industry 5.0 era (Bravi et al., n.d.).

Thus, the synergy between digitalization and sustainability is no longer an option, but a strategic necessity for MSMEs to remain competitive, innovative, and aligned with the global agenda of Sustainable Development Goals (SDGs). Studies on digital transformation and sustainability have proliferated in the last decade, but there are still significant research gaps, especially in the context of MSMEs in developing countries such as Indonesia. Three main gaps can be identified as follows (Appiah-Kubi et al., 2024):

Conceptual Gap: Most previous studies highlight digitization and sustainability as two

separate issues. The study by (Hammerschmidt et al., 2025) focuses on the impact of digitization on operational efficiency, while (Ghobakhloo et al., 2023) emphasizes sustainable business practices without discussing in depth the role of digital technology in supporting sustainability. There is still a lack of research on how these two dimensions interact in the context of MSMEs.

Contextual Gap (Developing Countries): Research on green digital transformation mostly comes from the context of developed countries (Europe, Japan, or the United States). However, the economic characteristics of developing countries are structurally different, particularly in terms of access to digital infrastructure, innovation capabilities, and the financial capacity of MSMEs (Zheng et al., 2024). Therefore, further exploration is needed on how this concept is implemented in the local business ecosystem in developing countries such as Indonesia.

Empirical Gap: There is a lack of research examining the impact of synergy between digitization and sustainability on the competitiveness of MSMEs in quantitative and qualitative terms. In fact, sustainable competitiveness is an essential indicator in assessing the success of digitization in the Industry 5.0 era.

The uniqueness of this article lies in its attempt to fill this gap by linking digitization, sustainability, and the competitiveness of MSMEs within the framework of Industry 5.0—a new perspective that places people, innovation, and the environment at the core of sustainable digital transformation.

This research has conceptual and practical contributions. Theoretically, it expands our understanding of the relationship between digitization and sustainability through a systemic approach within the Industry 5.0 framework, which emphasizes a balance between technological efficiency, social inclusiveness, and environmental responsibility. Practically, the results of this study are expected to serve as a reference for policymakers, business actors, and academics in designing digital transformation strategies that are not only profit-oriented but also focused on long-term sustainability.

Recent studies such as (Appiah-Kubi et al., 2024), (Kraus et al., 2023), (Raimo et al., 2025) and (Seidl & Bican, 2025) confirm that green digital transformation is a strategic factor for competitiveness in the post-digital era. By strengthening research in the context of developing countries, this study aims to provide relevant empirical contributions to the development of the global digital green economy, explain strategies that can be applied to create environmentally friendly digital businesses, and provide recommendations to digital business actors to develop green and competitive business models. By answering these questions and achieving the set objectives, it is hoped that practical solutions can be found to drive sustainable economic growth amid existing challenges.

LITERATURE REVIEW

Digitalization can be defined as a process involving the application of digital technology as a foundation for all aspects of a business. This process has the potential to transform production methods and the way businesses deliver value to customers (Dhayal et al., 2023). Digitalization can help MSMEs increase efficiency, expand markets, and provide a better customer experience. Research (Nagaraju et al., 2025). Shows that MSMEs that adopt digital technology and sustainability in their businesses demonstrate that their practices meet current needs while maintaining the ability to meet the needs of future generations (Atiku et al., 2024). This concept consists of three main pillars: environmental, social, and economic (Zhou & Pacala, 2025). In the

context of MSMEs, sustainability can be integrated into business models to create long-term value and increase competitiveness.

Green business is a business approach that focuses on environmental and social sustainability. MSMEs that implement a green business model not only strive to reduce the environmental impact of their operations but also strive to create social value for the community (Takawira & Poee, 2025). Studies show that MSMEs that implement environmentally friendly practices can increase brand credibility, attract more environmentally conscious consumers, and reduce operational costs through resource efficiency (Arora et al., 2024).

The synergy between digitalization and sustainability can create more innovative and sustainable business models. Digitalization enables MSMEs to optimize production processes, reduce waste, and increase energy efficiency (Botti & Baldi, 2025). Furthermore, digital technologies such as the Internet of Things (IoT) and big data can be used to monitor and manage the environmental impact of business operations. By integrating digitalization into sustainability strategies, MSMEs can create economic value while contributing to global sustainability goals (Boumsisse et al., 2024). Industry 5.0 can be identified through human-machine collaboration and advanced technologies such as robotics and artificial intelligence (AI) to improve sustainability and productivity (Di Donato, 2023). Small and medium-sized enterprises (SMEs) now have the opportunity to adopt technologies that support green business practices, such as the use of renewable energy and more efficient waste management. Studies show that SMEs that adapt to Industry 5.0 trends can improve their sustainability and competitiveness (Santos, 2024).

METHOD

This study applies a qualitative approach to understand the phenomenon of digitalization and sustainability of MSMEs in depth and contextually. While the model uses descriptive with the literature review method. The data sources used are based on data references used from a collection of scientific journals, books published between 2023 and 2025. The journal articles analyzed are adjusted to the relationship between Digitalization and Sustainability of MSMEs. The approach used is thematic analysis, by grouping the obtained data according to the theme raised. The procedures used consist of data collection, data selection, thematic analysis, and data interpretation. The results of this study aim to provide a strategic approach related to the analysis of the Synergy of Digitalization and Sustainability influenced by the Green Business Model for MSMEs in the Industrial Revolution 5.0.

RESULTS AND DISCUSSION

In facing the demands and dynamics of the Industry 5.0 era, MSMEs must be able to adapt to the changing times. Of course, the goal is for MSMEs to survive, exist, and remain sustainable. This will not only have a positive impact on themselves but also on the surrounding environment. Various challenges will not dampen the enthusiasm of MSMEs if they are prepared and have the human resources to meet them (Latief & Arindra, 2025). Furthermore, technological challenges must also be prepared to face because they will have a significant impact on the continuity and sustainability of MSMEs in Indonesia. Therefore, collaboration between various parties, especially the government, is needed to accommodate MSMEs by providing various training and education to upgrade digitalization and sustainability *skills*.

Digitalization & Sustainability in MSMEs: Challenges and Opportunities

In this era of digital transformation and sustainability, SMEs face a dual challenge: how to adopt digital technology while implementing green practices. The Technology-Organization-Environment (TOE) framework is highly relevant here, where technology encompasses digital infrastructure and innovation; organization encompasses internal capabilities, culture, and human resources; and environment encompasses regulatory, market, and external pressures.

Several recent studies provide empirical evidence: A study in Indonesia by SMEs' Flight to Digital and Green Economy: Evidence from Indonesia (2023) found that the digital transformation of MSMEs significantly helps the implementation of a green economy, especially when MSMEs have access to financial services (Islam & Trinugroho, 2022). Meanwhile, in the context of Pakistan, the study Digital strategy and environmental performance: the mediating role of digitalization in SMEs (2023) shows that a mature digital strategy and degree of digitalization have a positive effect on the ecological performance of MSMEs; that is, the higher the adaptation of digital technology and digital processes, the better the environmental performance (Haq & Huo, 2023).

From these two studies, we can compare: In Indonesia, access to finance strengthens the impact of digitalization on the green economy. In Pakistan, internal factors such as digital strategy and technology adoption rates are more dominant. The emerging pattern: internal readiness (organization, technology) and external support (access to finance, regulation) are both critical. A contradiction arises in the dominance of factors: are external factors (access to finance, regulation) more important than internal factors (organizational capabilities)? The results show that the two complement each other.

Integration of Digitalization and Sustainability through the Triple Bottom Line (TBL) Framework

The Triple Bottom Line (TBL) framework, which emphasizes profit (economic), people (social), and planet (environmental) aspects, is well-suited for analyzing green digital transformation in MSMEs. From an economic perspective, digitalization enables operational efficiency, broader market access, and potential profit increases. For example, systematic studies show that a digital transformation roadmap that integrates sustainability aspects helps MSMEs achieve efficiencies that were previously difficult to achieve (Mick et al., 2024). From an environmental perspective, the adoption of green digital innovations and environmentally friendly practices (green innovation) has been shown to improve environmental performance. For example, a systematic study in Indonesia cites "green innovation" as the key to MSME performance (Tereshchenko et al., 2023). From a social perspective, the importance of local values, community involvement, and inclusive access is key. An Indonesian study (2023) emphasizes that MSMEs with access to digital financial services are better able to implement a green economy, which also has an impact on social empowerment (Devender et al., 2025).

By comparing studies in different contexts, urban MSMEs with good digital infrastructure are quicker to adopt green digitalization than MSMEs in underserved areas. This indicates that TBL transformation is not linear, but highly dependent on the local context.

Strategic Theme: Green Digital Transformation Roadmap for MSMEs

Recent studies show that many MSMEs operate without a clear roadmap for green digital transformation. For example, the study Developing a Sustainable Digital Transformation Roadmap

for SMEs: Integrating Digital Maturity and Strategic Alignment (2024) presents a digital maturity model and seven-dimensional strategic steps (technology, customers, organizational culture, governance, people, sustainability) for MSMEs (Tereshchenko et al., 2023). Critical analysis shows that such a roadmap is essential because: 1) Without a structured strategy, MSMEs tend to adopt digital or green technologies that are not integrated sporadically; 2) The roadmap must consider organizational capabilities (learning, culture, leadership) in addition to technology; 3) The local context (access to capital, regulations, culture) must be used as an adjustment.

Barriers, Local Context, and Implications for MSME Empowerment

The main barriers that emerged from the 2023–2025 literature include: financial constraints; low digital literacy; uneven digital infrastructure; organizational orientation not yet ready; and ineffective regulations or environmental incentives. Example: the systematic literature review "Green Innovation for SMEs" (2023) identified barriers such as limited human resources and a lack of external collaboration. Counterintuitively, although digitization is often seen as the leading solution, several studies show that digitization without the integration of sustainability elements or local values can fail to have a significant environmental impact. For example, criticism in the literature review states that digitization that only focuses on efficiency can lead to a "rebound effect" or digital consumption that actually increases the carbon footprint.

Sustainability-Based Digital Strategy

Eco-Friendly Technology Design

Digital businesses need to invest in low-emission and energy-efficient technologies. Digital businesses are increasingly encouraged to invest in environmentally friendly technologies, given the importance of supporting sustainability in the industry (Zahid et al., 2024). One example of investing in green technology is the use of green cloud computing, which relies on renewable energy and energy-efficient data centers. With growing global awareness of the importance of sustainability, more digital companies are adopting technologies that can reduce their carbon footprint (Maharani, 2024).

The use of technologies such as green cloud computing not only provides environmental benefits but also significant economic advantages. Cloud service providers that utilize renewable energy, such as solar or wind power, are able to reduce long-term operational costs (Sołtysik et al., 2024). Furthermore, energy-efficient data centers reduce the need for excessive cooling and improve overall energy efficiency. Sustainability in technology design also involves reducing e-waste and using more power-efficient devices (Ciasullo & Ferrara, 2025). Companies that use these environmentally friendly technologies not only reduce their environmental impact but also enhance their reputation with consumers, who are increasingly concerned about sustainability. For example, in the case study of the Godhong Asri MSME, which applies eco-printing techniques in its production process, it can be seen that the implementation of these environmentally friendly techniques has positive impacts both socially and economically (Torbacki, 2025). Their products, which use natural materials and reduce production waste, have greater value in the eyes of environmentally conscious consumers. This aligns with the global trend of increasing emphasis on sustainability in the creative industry sector, which not only supports the environment but also encourages consumer awareness and preference for environmentally friendly products (Lewandowska et al., 2023).

Through this approach, MSMEs not only contribute to the local economy but also strengthen their commitment to sustainability and reducing their carbon footprint. Furthermore, to increase sales of eco-friendly goods and expand market reach, a digital marketing strategy is also crucial (Muzaffar et al., 2024). The implementation of environmentally friendly technologies, including green cloud computing and eco-printing, demonstrates that with the right innovation, businesses can create added value while contributing to environmental conservation. This success reflects how companies can compete in the global market by utilizing green technologies, which also increase energy efficiency and reduce carbon emissions.

Paperless Process Digitalization

The use of digital documents, e-invoices, and electronic signatures has become an effective solution in reducing excessive paper consumption in the Micro, Small, and Medium Enterprises (MSMEs) sector. Before digitalization, many MSMEs still relied on physical documents for administration, transactions, and filing, which required large storage space and increased operational costs. However, by adopting digital technology, the use of e-invoices has replaced paper invoices, which not only reduces waste but also speeds up the transaction process and simplifies digital tax reporting (Al Amin et al., 2025).

Furthermore, digital documents enable MSMEs to store and manage information more efficiently and securely, reducing the need for physical media. The adoption of electronic signatures further strengthens this transformation, enabling contracts and other documents to be digitally signed. With strong encryption technology, electronic signatures ensure the security and validity of documents, while reducing the cost of sending physical documents. This process provides efficiencies in time, costs, and document management. Overall, the adoption of digital documents, e-invoices, and electronic signatures offers significant benefits for MSMEs, both in terms of operational efficiency and environmental sustainability. By reducing paper use, MSMEs can reduce operational costs, reduce carbon emissions, and contribute to environmental sustainability (Abd Wahab, 2021).

Green Digital Marketing

Green digital marketing, as a marketing strategy that prioritizes sustainability, is increasingly becoming a key focus for various types of businesses, especially MSMEs, as they strive to meet the demands of increasingly environmentally conscious consumers. Various elements of green marketing, such as the use of environmentally friendly products, waste reduction, and transparency of carbon emissions in logistics, play a crucial role in this strategy (Xu et al., 2024).

Implementation of Digital Green Marketing in MSMEs - With the advancement of digitalization, MSMEs can integrate digital technology to promote more environmentally friendly products. This digital transformation offers significant opportunities to reach a wider market, increase awareness of sustainable brands, and effectively introduce eco-friendly products. In Jayagiri Village, Lembang, for example, the implementation of green marketing strategies through e-commerce platforms and social media has shown a significant increase in digital technology adoption among MSMEs.

Challenges in Implementing Green Marketing - One of the challenges faced by MSMEs is the high research and development (R&D) costs required to create environmentally friendly products, which often do not align with consumer preferences. This can impact the success of

implementing green marketing concepts. However, MSMEs that successfully integrate circular economy principles by using waste production materials to create new products are able to increase operational efficiency while simultaneously reducing environmental impact.

The Role of Transparency and CSR in Brand Development - Research has shown that the environmental impact of products and services has a significant positive impact on brand development. Similarly, the implementation of CSR (Corporate Social Responsibility) shows that companies that are transparent about their environmental policies can build a positive image in the eyes of consumers.

The Relationship between Green Marketing and Islamic Marketing Ethics - Marketing ethics from an Islamic perspective emphasizes morality in business, avoiding the exploitation of natural resources, and maintaining a balance between worldly gain and environmental sustainability. The environmentally friendly concept of green marketing, when implemented with appropriate business ethics, can generate prosperity not only for the company but also for the surrounding community and environment.

The Influence of Digital Marketing on Green Marketing - Digital marketing, with its ability to reach a wider audience through social media and e-commerce , has been shown to have a positive impact on the implementation of green marketing. The use of digital marketing allows MSMEs to promote their green products in a more measurable and efficient manner, which over time can increase consumer satisfaction and brand loyalty.

Leveraging AI and IoT for Energy Efficiency

Sustainable smart home systems rely on *Internet of Things (IoT)* and *Artificial Intelligence (AI) technologies* . Numerous studies have identified various frameworks and technical methods that can be used to effectively integrate sustainability principles into smart home systems. These technologies can help analyze energy consumption in real time and optimize resource use. The use of AI and IoT technologies in smart home systems has a significant impact on energy efficiency and environmental sustainability. Several studies have shown that these technologies can optimize energy consumption in *real time* by monitoring and analyzing resource usage in households (Rahardjo et al., 2024). For example, IoT devices connected to a smart home system can monitor temperature, humidity, and energy usage patterns, and provide recommendations for more efficient saving. This technology allows the system to automatically regulate energy use, such as reducing heating or air conditioning usage when there is no activity in the house, ultimately reducing energy waste (Tiron-Tudor & Deliu, 2025).

Additionally, AI is used to analyze data generated by IoT devices, helping smart home systems predict and adjust energy usage according to actual needs. This not only improves occupant comfort but also contributes to reducing household carbon footprints. By leveraging machine learning, systems can learn from user habits and continuously improve energy efficiency dynamically, which is crucial for achieving sustainability goals. Using AI to automatically regulate and monitor household energy consumption helps optimize existing resources, reduce reliance on fossil fuels, and encourage the transition to renewable energy sources (Syarkani, 2025). Overall, the application of AI and IoT in smart home systems offers great potential in reducing energy waste, increasing efficiency, and supporting the transition to a more sustainable system. With the increasing adoption of these technologies, smart homes can be part of the global solution to reduce carbon emissions and mitigate climate change.

Green Digital Practice Case Study

Google: A Carbon Neutral Pioneer

Google has been a pioneer in sustainability practices in the tech industry, claiming to have achieved carbon neutrality since 2007. As the first major tech company to commit to operating its entire data center using renewable energy, Google demonstrates that sustainability can be an integral part of its business model. According to a 2020 report published by Google, the company has invested significantly in renewable energy projects, including wind farms and solar panels, to meet the energy needs of its data centers. Furthermore, Google has implemented advanced energy efficiency technologies, such as innovative cooling systems and intelligent energy management. By taking these actions, Google is not only reducing its carbon emissions but also encouraging the tech industry to adopt more environmentally friendly practices. These initiatives are not only positive for the environment but also make the company look better in the eyes of consumers, who are increasingly concerned about sustainability issues. Google has proven that investing in sustainability can go hand in hand with profitable business growth (Sangarathas & Shanmugathas, 2025).

Grab & Gojek: Innovation in Transportation

Grab and Gojek, two leading digital transportation platforms in Southeast Asia, have taken significant steps to reduce their carbon footprint by adopting electric vehicles (EVs). Recognizing that the transportation sector is a major contributor to greenhouse gas emissions, both companies are committed to introducing electric vehicles into their fleets (Martini et al., 2024).

In an article discussing startup development in Indonesia, Grab and Gojek were cited as examples of companies innovating to reduce their environmental impact. These initiatives include training driver-partners on efficient driving and vehicle maintenance, as well as using technology to minimize fuel consumption. In addition, Grab and Gojek are also collaborating with governments and private institutions to build electric vehicle charging infrastructure, which is crucial to support the transition to more environmentally friendly vehicles.

The steps taken by Grab and Gojek not only help reduce emissions but also raise public awareness about the importance of environmentally friendly transportation. As these initiatives demonstrate, technology companies can play a significant role in developing more sustainable transportation methods.

Eco-Friendly Startups: Driving a Circular Economy

Local startups like Ecodoe and Sampah Muda have developed digital platforms that integrate circular economy principles. Ecodoe focuses on waste management and recycling, providing solutions for individuals and businesses to reduce their waste production. By leveraging technology, Ecodoe facilitates the recycling process and raises public awareness about the importance of proper waste management.

Meanwhile, SampahMuda strives to empower local communities by creating economic opportunities through recycling. They educate the public on how to manage waste and provide incentives for those who participate in recycling programs. This initiative not only helps reduce waste but also raises awareness of sustainability at the community level. A report on circular economy initiatives in Indonesia explains that startups like Ecodoe and SampahMuda play a crucial role in creating solutions that are not only environmentally friendly but also empower local

communities. By combining digital technology and circular economy principles, they can create a broad positive impact (Bakator et al., 2024).

Challenges in Implementation

Implementing environmentally friendly digital marketing strategies for MSMEs presents several significant challenges, such as limited financial resources and adequate infrastructure. MSMEs often struggle to access green financing provided by financial institutions due to complex procedures and difficult document requirements. Complicated application processes and document requirements, such as environmental impact analyses (AMDAL), are major barriers to utilizing sustainable financing. Furthermore, low levels of digital literacy and understanding of sustainability also hinder many businesses from optimally implementing green digital marketing. Another major obstacle is limited access to digital technology for MSMEs. Many MSMEs have yet to fully utilize the potential of existing digital technology due to limited access to internet infrastructure and digital tools (Reino-Cherrez et al., 2022). This hinders them from implementing more efficient and environmentally friendly digital marketing.

Recommendations and Implications

In addressing these challenges, several solutions can be considered: 1) Enhanced Education and Training: Educational programs on sustainability and the use of digital technology in marketing are essential to help MSMEs improve their understanding of green marketing. This training can also teach MSMEs how to leverage technology to improve operational efficiency and expand their markets; 2) Simplifying Green Financing Processes: To make it easier for MSMEs to access sustainable financing, financial institutions need to simplify application procedures and offer more attractive incentives. Simplifying financing application requirements can encourage more MSMEs to shift to environmentally friendly practices; 3) Green Technology Infrastructure Development: The government and relevant institutions must support the development of digital infrastructure that supports the implementation of green marketing in MSMEs. Strengthening environmentally friendly logistics systems and efficient waste management will significantly assist MSMEs in reducing their operational costs and environmental impact (Sukendri, 2025).

MSMEs can increase their competitiveness in an increasingly competitive market while reducing their negative environmental impact by implementing eco-friendly digital marketing. They can reduce long-term operational costs, enhance their brand reputation, and attract sustainability-conscious customers by using digital technology in their sustainable operations. Furthermore, through more effective digital platforms, they have the ability to expand their market. Despite some challenges when implementing green marketing for MSMEs, the long-term potential is enormous in terms of business sustainability and profitability. MSMEs can capitalize on current opportunities for sustainable growth with the right steps.

CONCLUSION

The synergy between digitalization and sustainability is a strategic foundation for strengthening the competitiveness and long-term resilience of MSMEs in the Industry 5.0 era. The integration of digital technologies such as green cloud computing, the Internet of Things (IoT), and artificial intelligence (AI) with environmental sustainability principles enables MSMEs to

improve operational efficiency, expand market access, and reduce their carbon footprint through greener production and marketing processes. Based on the Technology–Organization–Environment (TOE) framework and the Triple Bottom Line (TBL), the success of this transformation is greatly influenced by technological readiness, organizational support, and pressure and support from the external environment, such as policies and consumer preferences. Digitalization not only creates economic efficiency but also strengthens the social dimension through community empowerment and digital inclusion, as well as the environmental aspect through waste reduction and the use of renewable energy. However, various obstacles such as capital constraints, low digital literacy, and the complexity of accessing green financing remain significant challenges for MSMEs. Therefore, collaborative policies involving the Government, financial institutions, academics, and the industrial sector are needed to strengthen the green digital ecosystem through increasing human resource capacity, simplifying access to sustainable financing, and developing environmentally friendly technology infrastructure. With a circular economy-based approach, green digital innovation can be a driving force for inclusive economic growth and the achievement of sustainable development goals in Indonesia.

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