

DIGITAL TRANSFORMATION STRATEGIES FOR SMES TO ACHIEVE SUSTAINABLE BUSINESS IN THE INDUSTRY 4.0 ERA

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Abstract: This study discusses digital transformation strategies for Small and Medium Enterprises (SMEs) to achieve sustainable business in the Industry 4.0 era. Digital transformation has become an essential strategy for SMEs due to rapid technological development, changing consumer behavior, and increasing market competition. This research uses a descriptive qualitative approach through a literature review method by analyzing various studies related to digital transformation, SMEs, digital strategy, competitiveness, and business sustainability. The findings show that digital transformation is not limited to the adoption of digital tools, but also involves changes in business strategy, operational processes, innovation capability, and entrepreneurial mindset. Key strategies include improving digital literacy, adopting e-commerce and digital payments, optimizing digital marketing, utilizing data for decision-making, strengthening innovation capabilities, and integrating sustainability principles into business operations. Digital transformation contributes to economic sustainability by improving efficiency, productivity, profitability, and market access. It also supports social and environmental sustainability through better resource management, inclusive business practices, and reduced operational waste. Therefore, a structured and sustainable digital transformation strategy is crucial for SMEs to enhance competitiveness, resilience, and long-term business sustainability in the Industry 4.0 era

PENDAHULUAN

Digital transformation has become an inevitable necessity for Micro, Small, and Medium Enterprises (MSMEs) as they navigate the rapid developments of the Industry 4.0 era. Rapid technological advancements such as the Internet of Things (IoT), Big Data, and artificial intelligence (AI) are impacting nearly every sector, creating both new opportunities and challenges. MSMEs that are able to adapt and integrate digital technology into their operations will be better prepared to face global competition and market changes. Therefore, it is important for MSMEs to understand and implement digital transformation strategies so they can grow sustainably in this digital era [1].

SMEs are a vital sector that serves as the backbone of the economies of many countries,

including Indonesia. According to data from the Ministry of Cooperatives and SMEs, more than 99% of businesses in Indonesia are SMEs, which make a significant contribution to the Gross Domestic Product (GDP) and create numerous jobs. Nevertheless, the SME sector often faces major challenges such as limited capital, restricted market access, and inadequate technology. Digital transformation offers a solution to these challenges, but its implementation requires a well-thought-out strategy and the right support [2].

The adoption of digital technology in business operations is not only intended to improve efficiency and productivity but also to support the creation of sustainable businesses. Sustainability in a business context encompasses three main pillars: economic, social, and environmental. Digital transformation enables SMEs to optimize their business processes, thereby generating a broader positive impact—not only in terms of profit but also in terms of community empowerment and more prudent management of natural resources [3].

Although the benefits of digital transformation are immense, many SMEs still face challenges in adopting it. One of the biggest obstacles is the lack of knowledge and skills in digital technology among SME owners and employees. In addition, most SMEs also face issues related to costs and the necessary technological infrastructure. Therefore, it is important for SMEs to have a deeper understanding of the technologies relevant to their industries and how to utilize them effectively [4].

A sound digital strategy will include the development of infrastructure that supports technology adoption, training and development of digital skills for human resources, and the effective and efficient implementation of technology. Without a clear and structured strategy, the adoption of digital technology will tend to be limited to applications that do not have a significant impact on business performance. Therefore, it is important for SMEs to formulate a digital transformation strategy that focuses on integrating technology into all aspects of their operations, from marketing to inventory management [5].

Integrating sustainability into the digitalization process of SMEs is crucial because it leads to the creation of long-term value. By leveraging digital technology, SMEs can use resources more efficiently, reduce waste, and improve the quality of their products or services. The social and environmental sustainability fostered by technology can enhance their reputation and customer loyalty, which ultimately contributes to the economic sustainability of SMEs [3].

Digital transformation empowers SMEs to innovate in the products and services they offer. Technologies such as artificial intelligence (AI) and data analytics allow SMEs to gain deeper insights into customer behavior and market trends. As a result, SMEs can make smarter decisions and respond to market changes more quickly and efficiently. Therefore, technology is not just about improving operational efficiency, but also about creating innovations that can open up new opportunities in the market [6].

Various case studies show that MSMEs that have successfully undergone digital transformation have seen positive impacts on their business performance. For example, MSMEs in the food and beverage sector that have adopted digitalization in their marketing and product distribution have been able to expand their market reach and improve customer satisfaction. By using digital technology, they can also collect valuable data to improve operational management and optimize production costs [7].

The implementation of digital technology has proven to enhance the competitiveness of

SMEs. By optimizing production processes, improving supply chain management, and reducing operational costs, SMEs can boost their profitability and competitiveness. In addition, digitalization enables SMEs to expand their markets—both locally and internationally—which were previously inaccessible through traditional means [8].

The success of SMEs' digital transformation depends on their ability to integrate technology with clear sustainability principles. By using technology to improve efficiency, reduce negative environmental impacts, and create more socially inclusive products and services, SMEs can achieve long-term sustainability. Therefore, a digital transformation strategy that prioritizes sustainability is the key for SMEs to survive and thrive in an increasingly competitive global market [9].

LITERATURE REVIEW

Digital transformation is the process of integrating digital technology into all aspects of business operations and strategy, thereby creating added value, innovation, and new competitive advantages for an organization. In the context of SMEs, digital transformation does not merely entail the use of simple digital tools such as social media or e-commerce, but also encompasses changes to business models, marketing strategies, and internal processes that are more adaptive and responsive to the digital environment. The literature indicates that digital transformation is a key driver of modern economic growth and fosters sustainable competitive advantage [1].

Although digital transformation offers a wide range of opportunities, MSMEs often face various challenges, such as low digital literacy, limited technological infrastructure, and a lack of financial access. These conditions result in suboptimal digital transformation for MSMEs, especially if not supported by appropriate adaptation strategies. Research on the challenges of SME digital transformation in Indonesia highlights the need for training, mentoring, and public policies that promote inclusive technology adoption so that digitalization can proceed sustainably [4].

In the strategic management literature, the appropriate implementation of digital strategies has been shown to have a positive impact on improving the operational performance of SMEs. The implementation of digital strategies—such as digital management systems, e-commerce, and digital marketing—not only enhances efficiency but also boosts market competitiveness. Results from a quantitative–qualitative study indicate that SMEs that integrate digital strategies with a culture of innovation have recorded significant increases in revenue and operational efficiency, which are essential foundations for achieving business sustainability [10].

Digital transformation is also key to achieving business sustainability goals, which encompass economic, social, and environmental aspects (the Triple Bottom Line). A systematic review of the literature reveals a strong link between digital transformation and sustainability, as digital technologies can drive resource efficiency, the integration of environmentally friendly practices, and broader stakeholder engagement. This study opens up new avenues for exploring the concept of digital sustainability [11].

Another study offers a digital transformation framework that specifically integrates sustainability practices into the digital strategies of SMEs. This framework emphasizes the importance of setting sustainability goals before adopting digital technologies, as well as

designing an implementation plan that simultaneously considers social, economic, and environmental aspects. This approach helps SMEs not only pursue digital efficiency but also ensure that the digitalization process reinforces sustainability values in the long term [5].

In addition to theoretical aspects and conceptual frameworks, sector-specific empirical studies on MSMEs show that digital transformation can strengthen the sustainability of microenterprises while opening up opportunities for market expansion. For example, research on halal food MSMEs in Indonesia integrates the principles of the circular economy and the digital economy to drive innovation in more adaptive and sustainable business models. Such studies underscore the importance of convergence between digital technology and adaptive business models as a successful digital transformation strategy for SMEs [7].

RESEARCH METHODOLOGY

This study employs a descriptive qualitative approach using a literature review method to analyze the digital transformation strategies of MSMEs in achieving business sustainability in the Industry 4.0 era. This approach was chosen because the research topic focuses on the collection, understanding, and synthesis of various scientific findings that have addressed the digitization of MSMEs, digital business strategies, competitiveness, and business sustainability. A descriptive qualitative method is relevant because several previous studies on the digitalization of MSMEs have also used a similar approach to identify strategies, business models, challenges, and opportunities for digitalization in enhancing business sustainability [2].

The data sources for this study were obtained from national and international journal articles relevant to the themes of digital transformation, MSMEs, sustainable business, digital strategy, and Industry 4.0. The literature used was selected based on topic relevance, relatively recent publication dates, and direct relevance to digital strategy and business sustainability. Several key reference articles discuss the digital transformation of SMEs as a critical factor in enhancing operational efficiency, competitiveness, innovation, and economic, social, and environmental sustainability. Studies on sustainable digital transformation in SMEs also emphasize the importance of measuring SME performance within the context of digitalization and sustainability [3].

Data collection was conducted by searching for scientific articles in journal databases such as ScienceDirect, MDPI, Taylor & Francis, and national journals using the Open Journal System (OJS). The keywords used in the literature search included “digital transformation of SMEs,” “digitalization of SMEs,” “business sustainability,” “sustainable digital transformation,” and “Industry 4.0 SMEs.” Subsequently, the collected articles were selected based on content relevance, methodological clarity, and their contribution to the discussion of SME digital transformation strategies. This approach aligns with the systematic literature review method used in studies of digital transformation and sustainability, which involves collecting, classifying, and analyzing articles to identify themes, conceptual relationships, and research gaps [11].

Data analysis was conducted by grouping literature findings into several main themes: the concept of digital transformation for MSMEs, challenges in technology adoption, digital strategies, enhancing competitiveness, and the contribution of digitalization to sustainable business. Each finding was compared to identify patterns in the relationship between the use

of digital technology and the sustainability of MSMEs. The results of this analysis were then used to formulate digital transformation strategies that can be implemented by SMEs, such as the utilization of e-commerce, digital marketing, improving digital literacy, using data in decision-making, and integrating sustainability principles into business operations. Previous research indicates that digital transformation holds significant potential for enhancing the performance and sustainability of SMEs in Indonesia [12].

RESULTS AND DISCUSSION

The study's findings indicate that digital transformation has become a critical strategy for SMEs in ensuring business sustainability in the Industry 4.0 era. It is no longer sufficient for SMEs to rely solely on conventional business models, as shifts in consumer behavior, the evolution of digital platforms, and market competition require businesses to be more adaptable. In Indonesia, the urgency of digital transformation is growing stronger because SMEs play a major role in the national economy, with approximately 65.5 million business units, contributing 61.9% to GDP, and employing more than 119 million workers—or about 97% of the national workforce. This situation indicates that the success of SME digitalization impacts not only individual business performance but also economic stability and national employment [13].

The key findings show that the digital transformation of MSMEs is not only about the use of technology, but also involves changes in strategy, business processes, and entrepreneurial mindset. Sagala and Ōri explain that the success of SME digital transformation is influenced by information systems, organizational, and financial aspects; therefore, digitalization must be understood as a comprehensive process, not merely the use of social media or marketplaces. Consequently, SMEs need to develop a well-planned digital strategy, ranging from identifying business needs, selecting appropriate technologies, strengthening human resource capacity, to periodically evaluating digital performance [14].

From an operational perspective, the use of digital technology has proven to help MSMEs improve efficiency, speed up transactions, and expand market access. A study of 5,035 ultra-micro, micro, and small businesses across 17 provinces in Indonesia showed that digital adoption can be measured through several business processes, namely e-procurement, point of sale, e-marketing, e-commerce, and digital payments. The study also found a positive and significant correlation between digital adoption and business performance, indicating that the better the utilization of digital technology, the greater the opportunity for MSMEs to enhance their competitiveness and business sustainability.

Digital marketing strategies are one of the most accessible forms of transformation for SMEs. The use of social media, marketplaces, websites, and digital content enables SMEs to reach a wider audience at a relatively lower cost compared to conventional marketing. Research by Purba et al. on SMEs in Banten indicates that digital marketing has a significant impact on business sustainability and the financial performance of SMEs. This underscores that digital marketing is not merely a promotional tool but also a strategic instrument for building brand awareness, retaining customers, and creating new sales opportunities [15].

In addition to digital marketing, e-commerce is also a key strategy for promoting the sustainability of SMEs. Through marketplaces and online sales platforms, SMEs can expand their markets without being limited by geographic location. Udayana et al. found that digital

marketing and e-commerce have a positive and significant relationship with marketing performance and business sustainability among SMEs in Indonesia. Therefore, the use of e-commerce must be integrated with consistent marketing strategies, effective inventory management, responsive customer service, and the use of transaction data to understand consumer needs [16].

The study's findings also indicate that digital literacy is a key determinant of the success of SMEs' digital transformation. Digital transformation will not be optimal if SME operators merely have access to technology but lack the ability to use it productively. Research by Sakti et al. indicates that digital literacy has a strong influence on SME productivity and marketing intensity, while marketing intensity acts as a mediator in enhancing productivity. This means that digital training, guidance on platform usage, and the ability to interpret digital market trends are essential needs for SME operators [17].

In the context of sustainability, digital transformation not only impacts economic aspects but can also support social and environmental dimensions. Sustainable digital transformation helps SMEs improve operational efficiency, reduce resource waste, enhance data-driven decision-making, and drive product and service innovation. Studies on sustainable digital transformation confirm that digitalization in SMEs can serve as a tool to measure and improve performance more comprehensively, including contributions to the Sustainable Development Goals [3].

Further discussion shows that the success of digital transformation is heavily influenced by an organization's innovation capabilities and capacity. Recent studies have found that digital transformation has a positive impact on sustainable innovation capabilities and sustainable organizational performance. However, this impact can be strengthened or weakened by environmental dynamics, such as market changes, competitive pressures, technological readiness, and business ecosystem support. Therefore, SMEs need to possess adaptive capabilities—that is, the ability to anticipate changes, manage digital resources, and quickly adjust business strategies [18].

From a modern sustainability perspective, digital transformation is also linked to ESG practices—that is, environmental, social, and governance. Studies in the SME context show that digital capabilities have a significant impact on business resilience and sustainable performance. Another study on manufacturing SMEs found that digital transformation has a positive effect on ESG performance, with innovation and servitization capabilities acting as mediators. This means that SMEs seeking to achieve sustainable business practices need to utilize digital technology not only to drive sales but also to improve corporate governance, transaction transparency, resource efficiency, and the quality of relationships with customers and partners.

Overall, the digital transformation strategy for MSMEs to achieve sustainable business in the Industry 4.0 era can be outlined through several key steps, namely improving digital literacy, adopting e-commerce and digital payments, optimizing digital marketing, strengthening innovation capabilities, utilizing data for decision-making, and collaborating with the government, communities, digital platforms, and financial institutions. Successful digital transformation is not an instant process, but rather a gradual journey that requires technological readiness, business leadership, a culture of learning, and adaptability. With the right strategy, SMEs can improve efficiency, expand markets, strengthen competitiveness,

and build more resilient and sustainable businesses amid the dynamics of Industry 4.0 [14].

CONCLUSION

The digital transformation of Small and Medium Enterprises (SMEs) is no longer optional but a necessity to ensure sustainability and competitiveness in the Industry 4.0 era. SMEs that embrace digital transformation can leverage technology to improve their operational efficiency, expand their market reach, and optimize business processes. However, the adoption of digital technologies alone is insufficient; SMEs must integrate these technologies into their overall strategy, focusing on innovation, efficiency, and sustainability. Digital transformation also fosters economic, social, and environmental sustainability, making it crucial for SMEs to adapt to these changes to survive and thrive in a highly competitive global market. The study highlights the importance of a well-structured digital strategy that includes improving digital literacy, adopting digital marketing, utilizing e-commerce, and embedding sustainability into business operations. SMEs that successfully execute these strategies will be better positioned to meet the challenges of Industry 4.0 while ensuring long-term business sustainability.

SUGGESTION

1. **Improve Digital Literacy:** SMEs should prioritize training programs to enhance digital literacy among owners and employees. This will ensure that the technology adopted is used effectively to enhance productivity and competitiveness.
2. **Adopt E-Commerce and Digital Marketing:** SMEs should expand their market reach by leveraging e-commerce platforms and digital marketing strategies. These tools provide affordable means to tap into new markets and boost customer engagement.
3. **Strengthen Innovation Capabilities:** To stay competitive, SMEs must foster an innovation-driven culture. This includes investing in research and development, and utilizing digital technologies such as AI and data analytics to better understand customer needs and market trends.
4. **Integrate Sustainability Principles:** SMEs should incorporate sustainability into their digital transformation strategies by reducing waste, optimizing resource use, and focusing on the social and environmental impacts of their operations. Sustainable practices will enhance their reputation and customer loyalty.
5. **Collaborate with Stakeholders:** SMEs should actively collaborate with government bodies, digital platforms, and financial institutions to gain access to resources and support for their digital transformation journey. Public policies and funding can play a significant role in helping SMEs overcome barriers to digitalization.
6. **Monitor and Evaluate Digital Performance:** Regularly evaluating the effectiveness of digital strategies will help SMEs fine-tune their approach, identify new opportunities, and address challenges as they arise.

By adopting these suggestions, SMEs can effectively navigate the complexities of digital transformation, ensuring that their business operations are more efficient, competitive, and sustainable in the long term.

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A third level heading in 9-point font size at the end of the paper is used for general acknowledgments, for example: This study was funded by X (grant number Y).

DISCLOSURE OF INTERESTS.

It is now necessary to declare any competing interests or to specifically state that the authors have no competing interests. Please place the statement with a third level heading in 9-point font size beneath the (optional) acknowledgments, for example: The authors have no competing interests to declare that are relevant to the content of this article. Or: Author A has received research grants from Company W. Author B has received a speaker honorarium from Company X and owns stock in Company Y. Author C is a member of committee Z.

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HALAMAN INI SENGAJA DIKOSONGKAN