JASF | Journal of Accounting and Strategic Finance
Vol.7 No.1 June 2024, pp. 158-180.

ISSN 2614-6649 (online)
http://jasf.upnjatim.ac.id

Drivers, Barriers and Key Success of Digital Transformation on SMEs: A Systematic Literature Review

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DOI: https://doi.org/10.33005/jasf.v7i1.505

***Received**: March 21, 2024. **Revised:** April 18, 2024. **Accepted:** June 17, 2024*

Abstract

Digital transformation represents a critical initial step for Small and Medium Enterprises (SMEs) in adapting to digitalization. This process involves technological innovations, efficient economic operations, and strategic initiatives to support SMEs. The SME sector holds significant importance as a cornerstone of national economic development. This study employs a systematic literature review to synthesize insights into the driving factors, barriers, and success strategies for SMEs undertaking digital transformation. The driving factors are categorized into individual, technological, environmental, and organizational contexts. Conversely, the barriers include challenges faced by individual business actors, as well as technical, environmental, organizational, and cultural constraints. The success of SMEs in this transformation depends on both internal and external factors. Internally, success is fostered through adequate knowledge and education on digitalization, the development of innovative business models, digital capabilities, organizational functions, culture, and effective human resource management. Externally, success depends on adapting to environmental shifts, building partnerships, and utilizing government regulatory support, which serves as a key driver of digital transformation for SMEs. These results imply that policymakers, SME practitioners, and SME stakeholders have to collaborate in overcoming challenges and seizing opportunities for SME digital transformation.

***Keywords:** Digital transformation, SMEs, driving factors, barriers, key success.*

How to cite (APA 7th style)
Krismajayanti, N. P. A., Darma, G. S., Mahyuni, L. P., & Martini, I. A. O. (2024). Drivers, Barriers and Key Success of Digital Transformation on SMEs: A Systematic Literature Review. *JASF – Journal of Accounting and Strategic Finance, 7* (1), 158-180.

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INTRODUCTION

Industrial Revolution 4.0 brought rapid change to the entire world industry. Characterized by the emergence of technology that forces companies to survive in global industry competition. The core tenets of Industry 4.0 include modularity, autonomous control, and the seamless digital integration of business operations both within and outside organizational borders. Industry 4.0 drives product innovation through the use of smart sensors and actuator systems, enabling the production process to be streamlined through technological integration (Prause, 2019). Digital Transformation is a process for all industries to attempt.

Through the changes that happen within all jobs, strategies for gaining income, implementation of the strategy of management to be more competitive, moving quickly for shifting the demands, reinventing business identity, and digitizing operations (Bouwman et al., 2019; Ulas, 2019; Jumaroh & Suryaningrum, 2024). Adaptation is a major milestone for the success of a company or organization. Besides being concerned with technology, an organization is able to implement more flexible systems and business management models. By minimizing expenses to achieve more income. McKinsey defines digital transformation as the restructuring of a business to incorporate technology, adapt business models, and refine processes, aiming to deliver new value to customers and employees in the evolving digital economy (Bouncken et al., 2021; Bouncken & Kraus, 2022). The pace of digital transformation is driven by market-driven consumer demand (Rahardjo et al., 2020; Purwanto et al., 2020; Susilowati & Auliah, 2023). Industry shifts have become more efficient, supply chains have been optimized, energy and infrastructure costs have declined, and the need for a large workforce has diminished. Income and profits increase (Ulas, 2019). Nowadays, businesses that are able to survive are adapted to the technology (Dyatmika et al., 2023).

Small and Medium Enterprises (SMEs) play a pivotal role in the nation's economic growth. This sector significantly contributes to the shift toward a market-based economy by creating employment opportunities, boosting income levels, advancing technological innovation, and fostering various aspects of social progress (Zamberi Ahmad et al., 2010). According to (Prause, 2019; Yu & Schweisfurth, 2020) SMEs are included in an industry that is flexible and can quickly adapt, catch the market opportunities and implement the innovations compared to large companies. However, the opinion differs from (Chen et al., 2016; Ramantoko et al., 2018) which states that SMEs are an industry that is slow in adopting digital transformation. This is due to limited capital, human resources, and market uncertainty. Similar opinion from (Barann et al., 2019; Heberle et al., 2017; Kesting & Günzel-Jensen, 2015) SMEs continue to fall behind larger companies, which have begun to grasp the concept of digital transformation, while SMEs still struggle to fully understand what digital transformation entails.

In today's world, leveraging technology in all business operations is both essential and necessary to remain competitive and sustain success (Roy et al., 2016). Many SMEs have yet to adopt technology as a foundation for their operations. For instance, in Indonesia, a developing country, data from the Ministry of Cooperatives and SMEs shows that only about 13%, or 8.3 million out of 64.2 million SMEs, utilize technology (Kompas, 2020). This may stem from limited understanding, insufficient education, or even reluctance to step out of the comfort zone. To

address these challenges, this article seeks to identify the factors driving, hindering, and enabling successful digital transformation for SMEs, serving as a guide to provide educational insights on the topic.

Digital transformation can be seen as the shift of socio-technical systems that were once facilitated by physical tools or non-digital interactions into those driven by digital tools and connections. (Levy et al., 2022). It involves enhancing organizational processes to achieve operational excellence through data-driven workflows (Matthias Lederer et al., 2017). Technology is used to significantly enhance and achieve better performance within a company. Digital transformation is driven by the rise of Industry 4.0, which compels SMEs to adapt to technological advancements.

The driving factors for SMEs in carrying out digital transformation are as follows: Individual context, Organizational Context, Environmental context, and Technological Context (Chen et al., 2021; Fadillah & Suryaningrum, 2021; Chen et al., 2016). Unfortunately, the drivers of Digital Transformation cannot be separated from the barriers. Barriers can not only be interpreted as challenges but can also be a process that cannot be avoided and one step towards to success (Jones et al., 2021; Vogelsang et al., 2019). A company must view obstacles as challenges to remain competitive. To achieve success, certain barriers need to be addressed, which, according to a literature review, include: individual barriers, technical barriers, organizational and cultural barriers, and environmental barriers.

Digital transformation is an ongoing learning process that involves integrating technology, business strategies, and educational approaches within entrepreneurial-focused organizations (Truong, 2023). Therefore, a business should have the key to success to compete in the market. This key can assist SMEs in recognizing and seizing growth opportunities driven by digital advancements. It can also kickstart a project-based learning approach to help organizations evolve and stay competitive in a shifting environment. The key to driving SMEs in digital transformation comes from 2 factors, which are internal and external business-driving factors. Internal factors consist of Individual Characteristics, Business Models, Digital Capabilities, Organizational Functions and Cultures, and Human resources. External factors that drive SMEs in their digital transformation include environmental adaptation, collaboration, and government regulations.

RESEARCH METHOD

This study uses the Literature Study method, namely by conducting a literature review of various studies that have been conducted previously. In the form of a Systematic Literature Review (SLR) literature review by synthesizing, comparing, and drawing conclusions from existing literature (Snyder, 2019). It seeks to offer more extensive and detailed information that is aligned with this study's goals. Figure 1 illustrates the article selection process.

Based on Figure 1, the selection process begins with identifying articles related to the topics from the Scopus database. In the process of identification, searching for articles using the

keywords; "Digital", "SME", and "Digital Transformation" and found 1,588 documents. Second, in the screening process, a search conducted from 2014 to 2024, and resulted in finding 439 documents. The period from 2014 to 2024 was selected to find the development of SME digital transformation for the last decade. The targeted 10 years of past research is to avoid outdated information that may no longer align with current contexts or practices. After finding documents based on years, the next step is to assess the eligibility of documents. Citing research is crucial to ensuring the relevance and contemporaneity of findings, as scientific knowledge evolves continuously, often impacting the validity of older data. Referencing recent sources enhances the credibility of a study and demonstrates that the author remains informed about the latest advancements in their field.

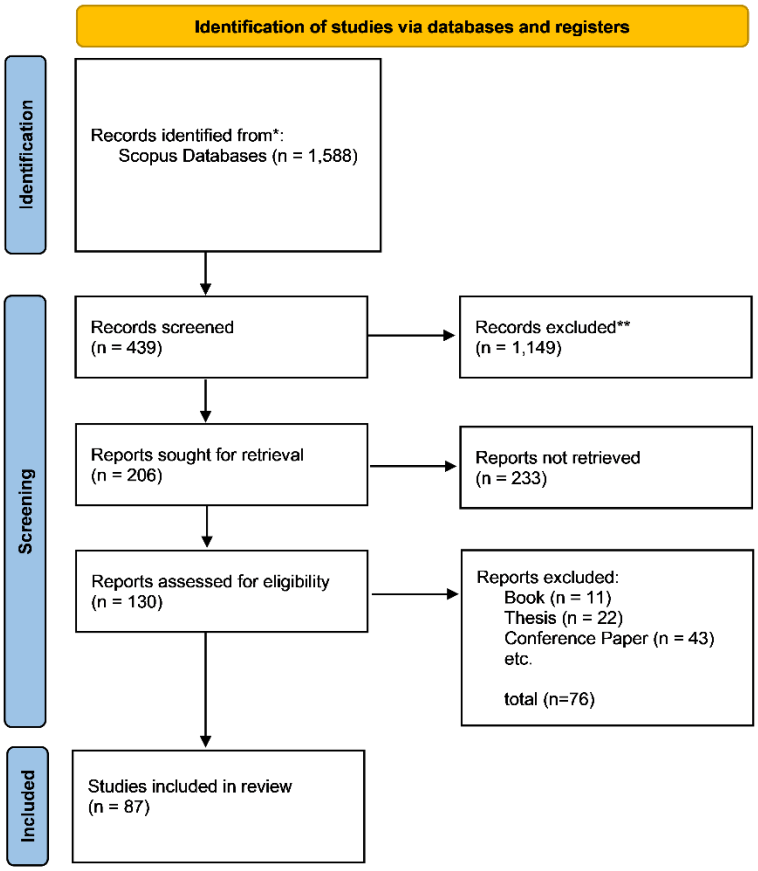

Figure 1. Literature selection scheme for articles

The eligibility process includes obtaining more targeted supporting research, and choosing documents from the fields of "Business, Management and Accounting" and "Economics, Econometrics and Finance," resulting in a total of 206 documents. Of the 206 documents screened by selecting the type of document from the "Article" category alone, there were 130 documents. In the final process, 130 documents were re-selected based on the contents of the articles as a

whole, and the final articles used in the literature review were 87 for the further synthesis process. The selected articles are adjusted to the purpose of writing research. The following is a literature search process to support the literature review results related to drivers, barriers, and key success of digital transformation in SMEs.

RESULTS AND DISCUSSION

The progression of the Industrial Revolution marks the inception of the digitalization era. To sustain and advance, businesses are compelled to adopt digitization through the utilization of technology. The emergence of digital transformation signifies a gradual shift in the global landscape. Digital transformation can be understood as the evolution of socio-technical systems, transitioning from being mediated by physical artifacts or non-digital interactions to being driven by digital artifacts and relationships. (Lee & Berente, 2012; Matthias Lederer et al., 2017; Warner & Wäger, 2019) which pertains to enhancing organizational processes to achieve operational excellence through data-driven workflows. (Matthias Lederer et al., 2017; Philbin et al., 2022) and by leveraging technology to significantly enhance and achieve better performance within a company.

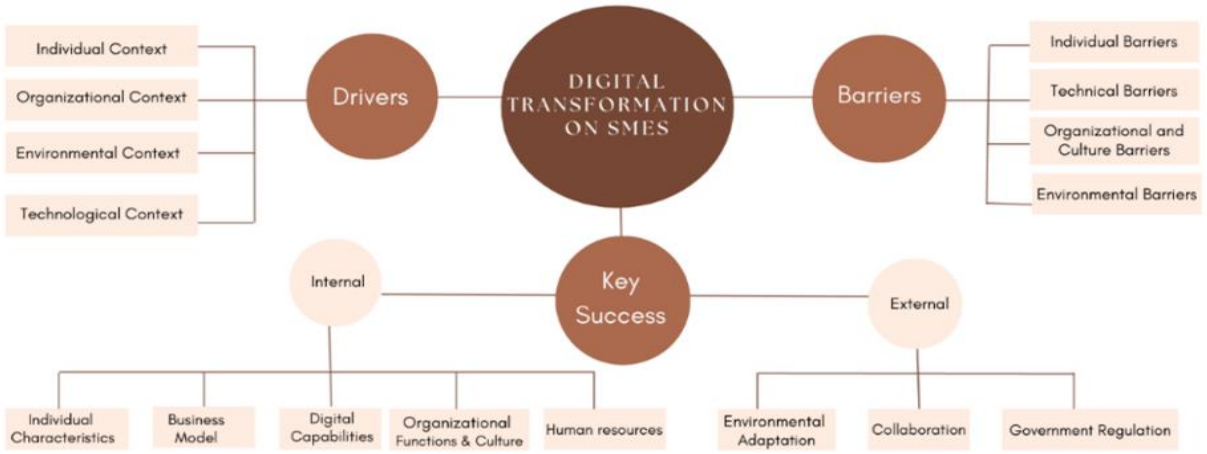

Figure 2. Framework of the Literature Review
Source: Data processed (2024)

Based on the conducted literature review, Figure 2 presents the framework and key components that influence digital transformation in SMEs, organized into Drivers, Barriers, and Key Success Factors. The drivers are categorized into four contexts: individual, organizational, environmental, and technological, which facilitate the digital transformation process. On the other hand, barriers are grouped into individual, technical, organizational and cultural, and environmental challenges that impede progress.

The key success factors are further divided into internal and external dimensions. Internally, factors such as individual characteristics, business models, digital capabilities, organizational functions and culture, and human resources are emphasized. Externally, attention is given to environmental adaptation, collaboration, and government regulation, all of which play a crucial role in the effective implementation of digital transformation in SMEs.

Drivers on Digital Transformation

Digital transformation is driven by the advent of Industry 4.0, which compels SMEs to adapt to technological advancements (see Figure 2). The SMEs driving factors to carry out digital transformation include individual, organizational, environmental, and technology contexts.

Individual Contexts

The motivation of individual business actors is a key driver in adopting digitalization. This includes their awareness and willingness to shift from traditional methods to new approaches in conducting all SME business activities. The courage to move from their comfort zone is a challenge for the business actors themselves. Based on (AlBar & Hoque, 2019; Matthias Lederer et al., 2017; Saihi et al., 2022; Suroso & Rafinda, 2021; Truong, 2023) curiosity about new things is the driver. The emergence of Information Technology, which is increasingly widespread due to digitalization, requires SMEs to continue to innovate. Qualified knowledge and skills are needed, some researchers argue that the success of a current business and its future depends on how the business actors took decisions. It is said that the more innovative the business actors are, the more successful the business will be, especially by adopting technology (AlBar & Hoque, 2019).

Organizational Contexts

The advent of technology has made things easier and more practical. It has realized greater profits obtained by a business in the era of digitalization. It is also proven that operational activities carried out using information technology systems make it easier for business actors in order to work it. Organizational context refers to internal characteristics. This fosters innovation and promotes change, which is anticipated to boost the adoption of new technologies. Both top and middle management can play a pivotal role in encouraging innovation to advance the company's vision and mission (Brandl et al., 2024; Huang et al., 2021; Sargut, 2019).

In this case, it has a role in disseminating information that includes the importance of innovation in the strategy of the company and respecting innovative behavior among subordinates and company resourcesIt is described as both formal and informal resources that enhance technology adoption, including support from top management within a company, (D. Q. Chen et al., 2015; Heberle et al., 2017; Horváth & Szabó, 2019) human skills and competencies (Chasanah et al., 2021; Sousa & Rocha, 2019; F. Yang & Gu, 2021) and financial resources (Jöhnk et al., 2021). The integration of digital technology acts as a key driver for both strategy and operations. Numerous SMEs are actively developing digital strategies as a fundamental aspect of their business model.

SMEs perceive the adoption of digital technology as a catalyst for both incremental and disruptive innovation (Bin et al., 2021; Huang et al., 2021; M. Yang et al., 2021). The adoption of

digital technology is also significantly shaped by internal operational challenges. Specifically, there is an increased demand for companies to acquire new business insights and knowledge, as well as to share strategic information (Sousa & Rocha, 2019), engage with both internal and external business stakeholders. (Cenamor et al., 2019), and cut operational costs (AlBar & Hoque, 2019). Based on (AlBar & Hoque, 2019) Within the organizational structure, a manager or business owner plays a crucial role in ensuring the continuity of the business. Proficiency in technology and organizational culture are the driving force and key to success for SMEs in carrying out digital transformation. A successful organization cannot be separated from the intervention of workers and SME business actors themselves.

Environmental Contexts

Experts argue that digital transformation is related to environmental changes adapting to technological advancements and fostering strong collaboration with external partners are key external drivers for many companies in adopting digital technology (Beliaeva et al., 2020; Sun et al., 2020; Truong, 2023). When a company chooses to implement a particular digital system, its partners often face the challenges of adapting to that system (Holmström & Partanen, 2014; Nylén & Holmström, 2019). Another external driver stems from the competition among businesses (D. Q. Chen et al., 2015; Verhoef et al., 2021).

Adopting digital technology is viewed as a strategy to enhance company competitiveness, driven by environmental uncertainty, challenging traditional business models, and serving as a crucial catalyst for business innovation (Bouncken et al., 2021; Bouncken & Kraus, 2022; Warner & Wäger, 2019). The business environment comprises external influences and/or support that drive adoption, such as industry characteristics, market dynamics, and competitive forces (Sherer et al., 2016), government regulations (Sherer et al., 2016), and business infrastructure (Cui et al., 2021; Zhang et al., 2022). This dimension pertains to the paradigm shifts catalyzed by digital competition and technological innovation, as well as evolving consumer behaviors (Holbrook & Hirschman, 1982; Warner & Wäger, 2019; Winkelhaus & Grosse, 2020).

Technological Contexts

Adopting digital technology is contingent upon the perceived advantages and value it offers. Companies embrace new information technology only when they recognize its potential to create business opportunities or address existing shortcomings (Holmström & Partanen, 2014; Lytras & Visvizi, 2019; Oliveira et al., 2014). (Oliveira et al., 2014) stated Technology adoption, such as Cloud Computing, is more likely to happen when the advantages of the new technology surpass current practices and processes. The perceived value of new technology is also influenced by its complexity, how well it aligns with existing organizational practices, and its trialability—meaning the ability to test and evaluate its performance before full implementation (H. Chen et al., 2021; Ramdani et al., 2013).

During the adoption stage, perceived benefits are associated with the advantages gained and the value provided to the organization through the implementation of digital technology

(Ghobakhloo, 2020; Ghobakhloo & Ching, 2019). From this viewpoint, both cybersecurity maturity and digitalization maturity are recognized as factors that impact SMEs' decisions to adopt digital technology. Digital maturity is defined as “a company's capability to strategically utilize digital technologies, channels, and expertise to drive process transformation, engage talent, and evolve production models.” (Ghobakhloo, 2020). Digital maturity allows companies to successfully utilize digital technologies to transform their business models. Similarly, a comprehensive cybersecurity system that guarantees secure, safe, and reliable communications is essential and enhances the value of adopting digital technology (Tuptuk & Hailes, 2018). From this perspective, (Neumeyer et al., 2021) emphasize the important role of technological literacy in promoting technology adoption for entrepreneurship and innovation..

Barriers to Digital Transformation

Barriers (see Figure 2) cannot only be interpreted as challenges but also as a process that cannot be avoided and is one step further towards success (Jones et al., 2021; Vogelsang et al., 2019). A company must be able to see barriers as stones in order to survive. According to the findings of the literature review, the barriers that SMEs face in digital transformation are individual, technical, organizational, cultural, and environmental barriers.

Individual Barriers

In this fast-paced era, the primary factor for a business's success is its human resources. The need for adaptation to the changes that occur. Barriers in this case cannot be separated from existing resources in a SME. The barriers that occur are inadequate knowledge and the ability of human resources (Astuti et al., 2020; Indrawati et al., 2020; Tarutė et al., 2018). One of them is lack of adaptability skills.

In today’s era, technology has a very important role in business (Tarutė et al., 2018; Troise et al., 2022; Vogelsang et al., 2019).The process becomes more important because Digital Transformation cannot be successful "if you only apply new technology without seeing and feeling the process" (Vogelsang et al., 2019). At the organizational level, the company must first identify, and select the appropriate technology for the business from various fields.Lack of employee resistance to changing times, reluctance to make changes, and lack of motivation are individual barriers that are certainly obstacles to a business in developing its business (Fitriasari, 2020; Garzoni et al., 2020; Javaria et al., 2020; Tarutė et al., 2018; Troise et al., 2022; Vogelsang et al., 2019). Self-learning and self-improvement, are considered to be the key to overcoming these barriers. Independent learning, which means being able to learn on your own by conducting an analysis related to the environment that is happening around, accompanied by self-improvement, namely self-development independently without the interference of others. Which in this case, human resources must intelligently innovate and improvise in this business.

Technical Barriers

Technology has undeniably become a pivotal factor that facilitates business development. However, another significant barrier that may arise is the threat of hacker attacks, which can steal data and even disrupt business continuity. According to (H. Zaied, 2012; Tarutė et al., 2018; F.

Yang & Gu, 2021) Challenges arise from the complexity and the extensive efforts needed to achieve robust security and privacy. It was pointed out that digitization raises Worries about data security and privacy have the potential to impede user acceptance of the new mobility concept (Barann et al., 2019; Priyono et al., 2020; Saihi et al., 2022) It is stated that emerging digital technologies, such as the Internet of Things (IoT) and cloud computing, are generating new entry points that hackers rapidly exploit. Furthermore, the growing complexity of IT systems has made securing the corporate environment increasingly challenging.

Organizational and Cultural Barriers

Work culture is a reflection of the company's work in carrying out its activities, the development of the era also demands developments for the organization in managing and managing the company. For example, SMEs are still in a comfort zone. Do not want to take risks, do not apply digitization in production or service. Spelled tends to stay put and just follow the flow of the organization's path. According to (Remane et al., 2017; Vogelsang et al., 2019) adhering to traditional roles, principles, or working conditions obstructs digital transformation. Based on the interviews conducted, it was stated that some of the informants said, "We also did it this way before, and it worked." The answers were based on the innovations carried out related to digital transformation. The approach taken is to measure the impact on organizational performance emerging digital transformation. Digital transformation leads to higher customer integration and collaboration between companies, and the impact and conditions need to be investigated.

Environmental Barriers

The business environment greatly influences the success of a business. One of the barriers to carrying out digital transformation is related to the government's role in making changes. The government does not support digital change and has no rules or laws that focus on its transformation (Nair et al., 2019; Truong, 2023; Vogelsang et al., 2019). As a result, many SMEs still feel anxious and worried if the transformation is carried out and problems occur due to the lack of government attention to help them overcome them. National policies and regulations can hinder the adoption of digital transformation. The study's findings indicate that regulatory limitations are the primary obstacle attributed to the absence of ICT policies and regulations. Additionally, the insufficient and inconsistent funding for digital initiatives provided by the national government is also a restrictive factor (Kutnjak, 2021; Maheswari & Gorda, 2019; Matt et al., 2020; Ulas, 2019).

Key Success in Digital Transformation

Based on Figure 2, digital transformation is an ongoing learning process. It involves integrating technology, business strategies, and educational approaches within organizations focused on entrepreneurship (Nguyen, 2021; Truong, 2023). Therefore, a business must have the key to success in order to compete in the market. This key can assist SMEs in identifying and seizing growth opportunities driven by digital capabilities, as well as initiating a project-based learning

process to transform organizations and maintain competitiveness in an evolving environment. The key to driving SMEs in digital transformation comes from 2 factors, which are internal and external business-driving factors. Internal factors consist of Individual Characteristics, Business Models, Digital Capabilities, Organizational Functions and Cultures, and Human resources. External factors that drive SMEs toward digital transformation include environmental adaptation, collaboration, and government regulations.

Internal Factors

The key to success comes from the company's internal factors (see Figure 2). Internal factors include first, individual characteristics that represent the traits of each individual SME's owner. Second, business models that must be changed when digitalization occurs. Third, digital capabilities for SMEs to sustain in the digital era. Fourth, the organizational culture and workforce within these SMEs of their human resource.

Individual Characteristics

The traits of each individual are crucial for the success of digital transformation in SMEs. The success of SMEs begins with business managerial techniques, which are certainly marked by leadership skills or the leadership of managers and owners in these SMEs (Fitriasari, 2020; Murniati et al., 2019; Peter et al., 2020; Philbin et al., 2022; Priyono et al., 2020; Van Houtven et al., 2023). Leadership competence greatly affects the performance of SMEs. A leader must be able to see opportunities in the digital transformation that will occur. In this case, also forming a great mindset and understanding of how to disseminate education is needed.

SME leaders need to be capable of executing digital visions and strategies. Business owners possess a conceptual grasp of the vision for digital technology, evidenced by their preparations for digitalization. Disseminate information and create members who are also accountable for implementing digital technology in an organized and systematic way (Priyono et al., 2020). Business owners should reconsider the approach of waiting for the business environment to stabilize, as it is not an effective decision. Conversely, these SMEs could be worse off if they don't jump into the change. As a result, SMEs aim to cultivate a sense of urgency for mastering digital technology among individuals within the business.

The next managerial ability is related to Dynamic Capabilities. Dynamic capabilities where SMEs can adapt to changes that occur focus on changes in digital transformation analytics (Bouncken & Kraus, 2022; Bouwman et al., 2019; Korherr et al., 2022). Based on the literature from (Bouncken & Kraus, 2022; Korherr et al., 2022; Röntynen & Tunkkari-Eskelinen, 2022) business actors can change depend on the situation that occurs, especially in digital transformation. SME leaders can become Analytical Thinkers, the Guide, Coaches and the Strategist to be able to sense, and read opportunities and carry out transformations related to digitalization (Horváth & Szabó, 2019; Huang et al., 2021; Korherr et al., 2022). An analytical Thinker is a lead character who can provide new thoughts and breakthroughs in change. Next is the Guide is a way to feel and read market opportunities. The coach is assessed for the role of the leader to provide strength in transformation. In this case accompanying cultural changes and focusing on all business members throughout the process of digital transformation. Diplomatic and social skills facilitate the

restructuring of internal and external resources and promote knowledge sharing (Korherr et al., 2022) ties, and organizational culture and human resources in these SMEs.

Business Models

With the changing times and the emergence of digitalizationit compels all SMEs to develop diverse business models (Berman, 2012; Priyono et al., 2020; Remane et al., 2017). Exploring, developing, and even seeking more knowledge related to digitalization (Fitriasari, 2020). According to (Philbin et al., 2022) Creating new business models is essential for SMEs to balance the costs of digital transformation with the benefits it yields and to set business learning goals that support sustainable growth. The core of the business model is tied to the value proposition and consumer relationships, transforming these values and fostering interactions and collaborations among consumers through the changes that take place (Berman, 2012). The Value in this case is what will be given by SMEs to the consumers themselves. It identifies the main change objectives of the business model that have a comprehensive impact on the business throughout the digital transformation process. (Aramburu et al., 2018; Coghlan & Noakes, 2012; Fichman et al., 2014; Hidayat-ur-Rehman & Alsolamy, 2023).

Establishing a new business model is also associated with a new marketing strategy as well. Consumer central point, constant consumer focus, and digital business development (Peter et al., 2020; Philbin et al., 2022; Ramantoko et al., 2018). According to (Tarutė et al., 2018) to achieve the sales function of an SME based on digitalization, efforts can be made to reshape its distribution and sales channels. Integrate multiple digital technologies at once, such as social media platforms, WhatsApp, email, LINE, Facebook, Twitter, and Instagram, to broaden consumer outreach. However, in some cases, the use of technology may not always yield effective results.

Digital Capabilities

Utilizing technology is an important role in the changing times that occur (Fitriasari, 2020). Digital capabilities are created in various organizational functions, Relevance to the automation and standardization of business processes. Including process engineering with optimized workflows and automation, digital marketing through new platforms, tools, and channels, emerging technologies like apps and the Internet of Things, cloud computing and data for modern IT infrastructure, and the generation of new business insights (Fichman et al., 2014; Ramdani et al., 2013; Winkelhaus & Grosse, 2020). Based on (Klein & Todesco, 2021; Pueblos & Jr, 2023; Tarutė et al., 2018) The article discusses the situation during the COVID-19 pandemic, where the circumstances compelled the company to digitize its sales operations. During the pandemic, digitization expanded and was adopted across other functions as well. For example, in the process of digitizing business, companies collaborate with digital-based shopping platforms, such as Lazada, Bukalapak, Blibli, and so on. This triggers market advancement markets and influences other organizational functions to adapt and adopt digital technologies (Nair et al., 2019; Putu et al., 2024).

Based on Philbin et al. (2022), digital capabilities are greatly influenced by a leader in an SME or company. Managerial leadership competencies, digital skills, and knowledge related to digitalization. Leadership and the factors that impact the digital transformation of SMEs are represented by the Technological, Organizational, and Environmental (TOE) model (Philbin et al., 2022; Sun et al., 2020; Truong, 2023). Therefore, SME leaders must be capable of developing a strategy to meet both organizational and technological requirements so that the transformation runs smoothly and has digital capabilities and high competitiveness even on an international scale. This transformation is a parameter for workers and even managers in running their businesses.

Organizational Functions and Culture

Not only on developing their business. SMEs rather create an understanding of digital developments and communicate strategies to workers within SMEs. This is also driven by the success of a business, which is not solely measured by the profit generated but by its ability to remain resilient in all circumstances. Organizational culture will never be separated. However, cultural modifications must still be made. As an example, leadership, before digitalization occurs, will be much different form after digitalization. Currently, Leaders must possess the ability to transform into effective digital leaders and create ways to manage their teams and workers. The effective thing that can be done is to transform and stimulate knowledge sharing among employees. Innovative is the main thing in starting digital transformation (Barann et al., 2019; Brune et al., 2021; Matthias Lederer et al., 2017; Peter et al., 2020).

The preliminary phase in implementing digital transformation is to help provide education and facilities. Understanding of SMEs related to digitalization, and providing supporting facilities that can guide SMEs in competing with current trends. It also demonstrated the importance of digitalization in the practical world. Such as providing a tool that is light, simple, easy to use, fast, and practical as well. With the aim of helping develop an understanding regarding specific education, the best practices, and related to daily business activities.

Human Resources

SME activities will not be separated from human resources. Become the main factor supporting the success of a business. SMEs need the critical skills and expertise to chart a course toward sustainable development. SME employees can be nurtured through education and training, with an emphasis on the leadership approaches needed for digital transformation. Within the framework of organizational resilience, elements such as business models, strategic planning, digital transformation, leadership, organizational structure, and supply chain management play a crucial role in signaling SME readiness for digitalization. In addition, a culture of communication among interdisciplinary departments and employees, supported by management and organizational strategy, facilitates the implementation of Industry 4.0. As SMEs gain an understanding of digital technology, business leaders strive to foster a sense of urgency for mastering digital skills among individuals within the organization (Tarutė et al., 2018; Warner & Wäger, 2019). (Garbellano & Da Veiga, 2019; Kesting & Günzel-Jensen, 2015; Puspitawati et al., 2022; Warner & Wäger, 2019) Highlights the importance of team building by recognizing the essential human resource

competencies—cognitive, social, and process-related—that are needed for successful digital transformation (Tarutė et al., 2018).

External Factors

A business's success is shaped not only by internal dynamics but also by external forces that can significantly enhance its prosperity. The literature review highlights three critical external factors that can be instrumental in driving the success of SMEs: environmental adaptations, collaboration, and government regulations (see Figure 2).

Environmental Adaptations

Support the success of a business, it takes the establishment of a supportive environment. Creating sensitivity to the conditions that occur, where it is necessary to convince SMEs before carrying out digital transformation (Barann et al., 2019; Horváth & Szabó, 2019). The environment does not only come from places, conditions, or competition between SMEs engaged in the same field. However, the challenge lies in adapting to the systems and business tools that support these SMEs (Dyatmika et al., 2023). Technology is the initial milestone of environmental adaptation in question. SMEs strive to keep pace with emerging technologies and leverage them in innovative ways. For instance, one example highlighted in the article is an SME that (Akbari et al., 2022; Amirrudin et al., 2024; Ghazwani & Alzahrani, 2024; Mwaanga & C. Hapompwe, 2024; Priyono et al., 2020) is where SMEs use the TikTok platform to promote their products. The initial adoption led to a temporary disruption in the company's operations, as the transition required a shift to a new customer segment.

Following the implementation of digital transformation, it has become evident that technology is not only reshaping production methods but also influencing competitor behavior, customer expectations, and the overall business landscape. The newly established business processes operate with greater efficiency after the necessary adjustments are made. To facilitate this transition, SMEs realign their organizational structures to align with the new business processes. This adaptation is bolstered by flexible resources and individuals committed to continuous learning. A culture of creativity and adaptability among employees is essential for SMEs to navigate and thrive in an evolving environment (Martínez-Carazo et al., 2021; Priyono et al., 2020; Yudhistira et al., 2022).

Collaboration

Collaboration can occur in two phases: first, prior to the digital transformation of SMEs, and second, through partnerships with other similar SMEs. As stated by (Peter et al., 2020) the integration of external supports is needed before SMEs carry out the transformation. Incorporate external support institutions such as competency centers or research institutes, which can help SMEs to understand and bring about digital transformation desires. Similarly, the literature mentioned about the collaboration with SME helpers, innovation labs, research institutes, and other intermediaries (Peter et al., 2020; Sunyoung Leih et al., 2015). Collaboration is an iterative process

in which multiple organizations join forces to achieve a shared objective. Furthermore, the synergistic benefits resulting from partnerships between diverse entities can act as a catalyst for digital transformation within SMEs (AlBar & Hoque, 2019; Philbin et al., 2022; Priyono et al., 2020). The customization factor pertains to the capability to adapt products or services to meet the unique requirements specified by market demands.

Government Regulations

Government regulations (Hafseld et al., 2021; Heberle et al., 2017; Priyono et al., 2020; Tarutė et al., 2018; F. Yang & Gu, 2021) i Government regulations are recognized as a crucial external factor impacting the digital transformation process within companies. Such regulations are essential to ensure that digital activities are conducted in a structured and measurable way. Regulations or rules are needed as signs that want to regulate orderly in the long term, not hinder the ongoing transformation process. Furthermore, regulations within the digital sector should be applied with a digital mindset. It is anticipated that these regulations will foster the creation of a supportive digital ecosystem that benefits SMEs.

CONCLUSION

Entering the era of Industry 4.0, characterized by the central role of technology in sustaining human activities. This is especially apparent in the business sector, where nearly every aspect, including operational systems, is heavily influenced by technological advancements, financial management, human resources, and marketing—are deeply intertwined with technological advancements. The key drivers behind digital transformation in small and medium enterprises (SMEs) can be categorized into individual, technological, environmental, and organizational contexts. However, SMEs face several barriers in their journey toward digital transformation. Individual barriers include a lack of technological literacy among business actors, while technical barriers pertain to SMEs' readiness to adopt new technologies. Environmental barriers reflect the need for businesses to adapt to external changes. Additionally, organizational and cultural challenges arise as technological adoption often necessitates shifts in organizational norms and practices, leading to both support and resistance. The achievement of SMEs in their digital transformation efforts is rooted in internal and external factors. Internally, success depends on adequate knowledge and education regarding digitalization, the creation of novel business models and the incorporation of digital competencies into tools, systems, organizational functions, and human resource management. Externally, success is propelled by the ability to adapt to environmental shifts, foster collaboration, and benefit from supportive government regulations, all of which act as facilitators for SMEs throughout their transformation journeys.

Theoretically, this research enhances the comprehension of digital transformation in SMEs by classifying the factors that drive it, barriers, and success determinants into individual, technological, environmental, and organizational contexts. It enriches existing literature by offering a structured framework that highlights the interaction among these factors and their influence on the transformation journeys of SMEs. Moreover, it paves the way for further

academic exploration into post-transformation conditions, as well as sector-specific studies, to uncover nuanced dynamics and tailor strategies for various industries.

Practically, this research equips SME practitioners with actionable insights, emphasizing the importance of technological literacy, innovative business models, and strategic incorporation of digital competencies. It emphasizes the significance of external collaboration and government policies as enablers, assisting SMEs in overcoming challenges and seizing opportunities for digital transformation.

From a policy perspective, the study stresses the necessity of establishing supportive regulations, capacity-building programs, and infrastructure enhancements to cultivate an environment that allows SMEs to thrive in the Industry 4.0 landscape. It is recommended that future research investigate the post-transformation conditions of SMEs in greater depth and to concentrate on specific sectors or industries within the SME landscape, enabling more focused and actionable findings. Exploring the long-term impacts on business performance, resilience, and innovation. Additionally, sector-specific studies are encouraged to provide tailored insights and strategies for digital transformation within diverse industries.

List of Abbreviation

Small and Medium Enterprises (SME), Information and Communication Technology (ICT), Systematic Literature Review (SLR)

Authors' Contribution

NPAK analyzed and interpreted the data. *GSD* and *LPM* performed an analysis of the data article and *IAOM* helped create the final manuscript.

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Funding
This research received no external funding.

Conflict of Interest
The authors declare no competing interests

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