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Organizational Readiness and Barriers to Digital Transformation in Indonesian SMEs

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ABSTRACT

Digital transformation (DT) is essential for enhancing competitiveness, efficiency, and innovation in the digital era. However, Small and Medium Enterprises (SMEs) in Indonesia face significant barriers to adopting digital technologies due to limited resources, lack of digital skills, and environmental constraints. **This study aims** to assess the organizational readiness and identify barriers to DT adoption among Indonesian SMEs using the Technology Organization Environment (TOE) framework. **A survey of 210 SMEs** from various sectors was conducted to evaluate their readiness levels and perceived barriers. The results indicate that while SMEs show moderate technological readiness, organizational readiness remains low, primarily due to inadequate human resource competencies, resistance to change, and limited financial capacity. Additionally, environmental factors such as regulatory uncertainty and weak institutional support further impede progress. **This study contributes** to the existing literature by highlighting the specific challenges faced by SMEs in emerging economies, particularly Indonesia. Based on the findings, the study offers practical recommendations for policymakers, industry associations, and SME owners to enhance organizational readiness and mitigate barriers, accelerating the digital transformation process for SMEs in Indonesia.

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1. INTRODUCTION

Digital transformation (DT) has become essential for organizations seeking competitiveness, efficiency, and innovation in the modern economy [1]. Emerging technologies such as cloud computing, data analytics, artificial intelligence, and Internet of Things (IoT) are reshaping organizational processes, customer engagement, and decision-making strategies [2]. While large enterprises often lead digital initiatives due to their resources and capacity, SMEs play a vital role in national economies, particularly in Indonesia, where they contribute over 60% of GDP and provide the majority of employment [3]. The digital transformation of SMEs is therefore not only a business necessity but also a strategic agenda for national economic growth, innovation, and global competitiveness [4].

However, Indonesian SMEs face a variety of obstacles that limit their ability to adopt and implement digital solutions effectively [5, 6]. Financial constraints, a shortage of skilled personnel with digital competencies, and inadequate technological infrastructure are key challenges [7]. In addition, organizational factors

such as resistance to change, lack of digital leadership, and absence of formal digital strategies reduce the effectiveness of digital adoption [8, 9]. Environmental factors, including regulatory uncertainty, weak institutional support, and immature digital ecosystems, further exacerbate these barriers [10]. Compared to SMEs in developed economies, where technology access is often the primary limitation, Indonesian SMEs confront multidimensional challenges that require targeted, context-sensitive interventions [11].

To address these challenges, this study applies the TOE framework to analyze SME readiness and barriers in Indonesia [12]. By extending the TOE framework to the context of an emerging economy, the research integrates recent empirical evidence from 2024 - 2025 and highlights the interactions between technological, organizational, and environmental factors [13]. The study also provides actionable insights and recommendations for policymakers, industry associations, and SME leaders to enhance readiness, strengthen leadership, and foster supportive ecosystems [14]. Furthermore, aligning digital transformation strategies with the United Nations Sustainable Development Goals (SDGs), particularly SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 12 (Responsible Consumption and Production), can promote inclusive, sustainable, and innovation-driven growth for SMEs in Indonesia [15].

2. LITERATURE REVIEW

2.1. Digital Transformation in SMEs

DT refers to the integration of digital technologies into organizational processes, culture, and strategies to enhance performance and create new value propositions [16]. For SMEs, DT opens up opportunities to expand market reach, improve efficiency, and innovate business models [17]. SMEs that adopt digital tools experience significant gains in productivity, customer satisfaction, and decision-making. However, DT in SMEs differs from large enterprises due to limited financial resources, smaller workforces, and a lack of strategic planning [18].

In Indonesia, DT adoption is linked to government initiatives like the ”Making Indonesia 4.0” roadmap, which aims to enhance digital infrastructure and encourage innovation across industries [19]. Despite this, SMEs show uneven progress in their DT journey, with urban SMEs adopting digital solutions faster than those in rural areas [20]. This disparity highlights the need to examine both readiness and the barriers affecting digital adoption in SMEs [21, 22].

2.2. Organizational Readiness for Digital Transformation

Organizational readiness is the degree to which a firm is prepared to adopt and implement digital initiatives successfully [23]. It involves technological capabilities, leadership commitment, employee skills, and organizational culture [24, 25]. High readiness levels increase the likelihood of successful DT adoption, while low readiness often leads to delayed or failed transformations [26].

Studies show that SMEs with strong digital leadership and skilled employees are more adaptable and resilient during the transformation process [27]. Key factors such as prior IT experience, investment in infrastructure, and a culture of innovation also contribute to readiness [28, 29]. In Indonesia, however, many SMEs lack sufficient IT personnel, formal digital strategies, and resources for continuous employee training [30], which reduces their ability to implement DT effectively [31, 32].

2.3. Barriers to Digital Transformation

Despite organizational readiness, SMEs face several barriers that hinder digital transformation [33, 34]. Technological barriers include high implementation costs [35], integration challenges, and cybersecurity risks [36]. Organizational barriers often involve resistance to change, lack of managerial knowledge, and absence of digital leadership [37]. Environmental barriers, such as regulatory uncertainty, weak institutional support, and underdeveloped digital ecosystems, further impede progress [38, 39].

Research conducted in Southeast Asia highlights financial constraints as the primary barrier, followed by the lack of a digitally skilled workforce [40]. Indonesian SMEs face similar challenges, compounded by fragmented digital ecosystems that make aligning their strategies with broader industry trends difficult [41]. These barriers collectively slow the pace of transformation and underscore the need for context-specific solutions [42, 43].

2.4. TOE Framework as an Analytical Lens

The TOE framework is a comprehensive approach to studying the adoption of organizational innovations [44]. It suggests that three factors technological, organizational, and environmental interact to influence a firm's decision and readiness to adopt innovations [45].

1. Technological factors include relative advantage, complexity, and compatibility of digital tools [46].
2. Organizational factors involve firm size, resources, top management support, and employee competencies [47].
3. Environmental factors encompass competitive pressure, industry characteristics, and the regulatory environment [48].

Although widely used in studies on e-commerce, cloud computing, and artificial intelligence, the TOE framework's application to SMEs in developing economies, particularly Indonesia, remains underexplored [49]. This study applies the TOE framework to bridge the gap between global literature and local realities, offering empirical insights into how SMEs balance readiness and barriers in their DT journey [50, 51].

2.5. Research Gap and Contribution

While the literature on DT is growing, most studies focus on large enterprises in developed economies [52]. Limited empirical research addresses the readiness and barriers of SMEs in emerging markets using structured frameworks like TOE [53]. Additionally, previous studies have often isolated technological or organizational aspects, without considering the interaction of these factors in a holistic manner [54].

This study makes three key contributions:

1. Extending the TOE framework to Indonesian SMEs, offering new insights into readiness and barriers [55].
2. Identifying the interplay between readiness and barriers in DT adoption [56].
3. Providing evidence-based recommendations for SMEs in emerging economies, aligned with the UN's SDGs, especially SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 12 (Responsible Consumption and Production) [57].

By filling this gap, the study contributes to both theoretical development and practical strategies for stakeholders involved in fostering SME digital transformation in Indonesia and similar contexts.

3. RESEARCH METHODOLOGY

3.1. Research Design

This study employed a quantitative survey-based approach to investigate organizational readiness and barriers to digital transformation among Indonesian SMEs. The TOE framework served as the theoretical foundation, allowing structured analysis across technological, organizational, and environmental dimensions. This framework is widely recognized for examining innovation adoption and provides a systematic lens to analyze factors affecting SME digital transformation.

Using a quantitative design enables the collection of measurable data that can reveal patterns and relationships among the TOE dimensions. It also facilitates statistical analysis through Structural Equation Modeling (SEM-PLS), which is suitable for exploring complex interactions among latent variables and providing actionable insights for policymakers, SME leaders, and industry associations.

3.2. Population and Sample

The population of this study comprised SMEs operating across manufacturing, services, and trade sectors in Indonesia. SMEs were selected due to their significant economic role, accounting for over 99% of national businesses and employing the majority of the workforce. A purposive sampling technique was used to include SMEs with at least minimal exposure to digital tools such as e-commerce, online marketing, or accounting software, ensuring that respondents had relevant experience with digital transformation.

A total of 210 SMEs from Jakarta, Bandung, Surabaya, and Yogyakarta participated in the survey, exceeding the minimum recommended sample size for SEM-PLS analysis. The selection of these regions captures the variation in digital adoption between urban and semi-urban areas. Additionally, a pilot test with 20 SMEs was conducted to refine the questionnaire, improving clarity, reliability, and content validity.

3.3. Data Collection

Data were collected via an online questionnaire distributed between March and May 2025. The questionnaire was structured to capture three main aspects: firm demographics, measures of organizational readiness, and perceived barriers to digital transformation. Using an online survey increased accessibility and allowed efficient data collection across multiple cities.

Respondents rated items on a five-point Likert scale from strongly disagree to strongly agree. Ethical considerations were addressed by obtaining informed consent from all participants, ensuring anonymity and confidentiality, and providing the option to withdraw at any stage. These measures guarantee compliance with research ethics and enhance the reliability of responses.

3.4. Measurement and Variables

Constructs were adapted from established literature to ensure validity and relevance. Technological readiness included compatibility, affordability, infrastructure, and perceived ease of use. Organizational readiness captured leadership support, human resource competence, financial capacity, and openness to change. Environmental readiness encompassed regulatory support, institutional infrastructure, and market pressure. Barriers measured financial limitations, lack of digital skills, resistance to change, regulatory uncertainty, and ecosystem immaturity.

All items were validated using Cronbach's Alpha and Composite Reliability (CR) to ensure internal consistency and measurement reliability. This process confirms that the instrument accurately reflects the constructs and provides a sound basis for SEM-PLS analysis.

3.5. Data Analysis

Data analysis was conducted using SEM-PLS, which is appropriate for exploratory research, predictive modeling, and handling complex latent constructs. The analysis included a measurement model assessment to evaluate reliability, convergent validity, and discriminant validity, followed by structural model assessment to test hypotheses, path coefficients, and the coefficient of determination (R^2).

Descriptive statistics were also employed to summarize readiness levels and barriers, while ANOVA tests compared differences across firm sizes and industry sectors. This methodology aligns with SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 12 (Responsible Consumption and Production) by providing evidence-based strategies to improve SME digital transformation and enhance sustainable economic development.

4. RESULT AND DISCUSSION

4.1. Respondent Profile

A total of 210 SMEs participated in the survey, covering trade (42%), services (38%), and manufacturing (20%). Most firms employed fewer than 50 workers (68%) and had been operating for less than 10 years (55%). Table 1 summarizes the demographic characteristics of the respondents.

Table 1. Profile of Respondent SMEs (n = 210)

Category	Subcategory	Percentage (%)
Sector	Trade	42.0
	Services	38.0
	Manufacturing	20.0
Firm Size	Micro (<10 emp.)	34.0
	Small (10 - 49)	34.0
	Medium (50 - 249)	32.0
Years of Operation	<5 years	28.0
	5 - 10 years	27.0
	>10 years	45.0

Table 1 shows that trade and service sectors dominate the sample, and most SMEs are micro and small enterprises. The distribution also indicates that a substantial portion of firms have been operating for more than 10 years, providing a mix of experienced and relatively new businesses. This demographic information is critical for understanding variations in digital transformation readiness across firm size and sector, as smaller

and younger firms may face distinct challenges compared to larger and more established ones. For instance, micro and small enterprises often have limited financial resources, fewer employees with digital expertise, and less formalized management structures, which can hinder the adoption of digital tools and processes. In contrast, more established SMEs may possess greater organizational knowledge and operational experience, allowing them to implement digital transformation strategies more effectively. Recognizing these differences helps policymakers and industry associations tailor training, financial support, and regulatory interventions to the specific needs of SMEs, ultimately enhancing their ability to adopt digital technologies and contributing to broader economic growth in line with SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure).

4.2. Descriptive Analysis of Readiness

Table 2. Readiness Levels of Indonesian SMEs

Dimension	Mean Score (1 5)	SD	Interpretation
Technological	3.42	0.71	Moderate readiness
Organizational	2.95	0.83	Low readiness
Environmental	2.88	0.79	Low readiness

Table 2 shows the average TOE readiness scores, with SMEs having moderate technological readiness (mean = 3.42) but low organizational (2.95) and environmental readiness (2.88). Although digital tools and infrastructure are available, limited leadership, low employee skills, and weak strategies constrain adoption. External factors, such as regulatory uncertainty and underdeveloped ecosystems, further impede progress. This indicates that technology alone is insufficient; SMEs need capacity building, leadership development, and policy support to enhance readiness, enabling effective digital transformation and contributing to SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure).

4.3. Barriers to Digital Transformation

The main barriers identified are illustrated in Figure 1. High implementation costs and limited digital skills were the most prominent challenges, followed by resistance to change, regulatory uncertainty, and weak digital ecosystems.

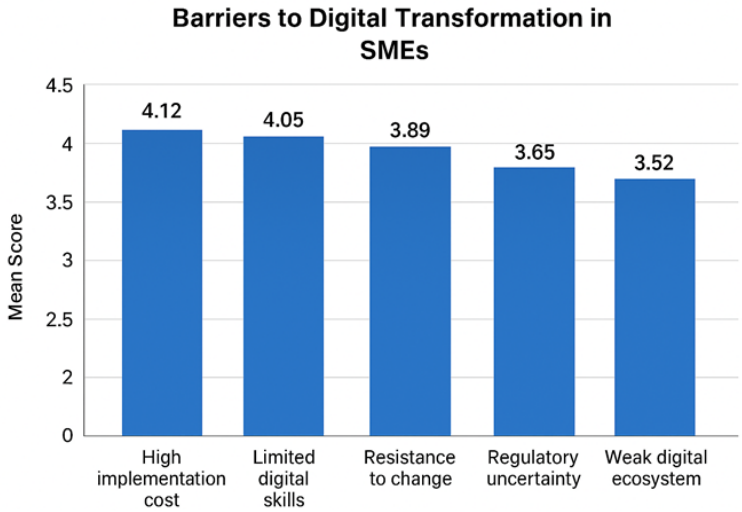

Figure 1. Barriers to Digital Transformation in SMEs

The main barriers to digital transformation identified in the survey are illustrated in Figure 1. High implementation costs and limited digital skills emerged as the most significant challenges, followed by resistance to change, regulatory uncertainty, and weak digital ecosystems. Figure 1 shows that both internal factors, such as employee skills and organizational resistance, and external factors, including regulatory uncertainty and fragmented ecosystems, hinder SMEs' digital adoption. Addressing these barriers will require a combined

effort in training, policy support, and the development of a more supportive digital ecosystem to facilitate transformation.

4.4. Structural Equation Model (SEM) Analysis

Table 3 summarizes the SEM-PLS results. All three TOE dimensions technological, organizational, and environmental significantly influenced organizational readiness, with environmental factors showing the strongest effect (β = 0.42). This indicates that regulatory support, institutional infrastructure, and market pressure are the most critical determinants for SMEs to successfully adopt digital transformation. While technological readiness and organizational readiness also contributed positively, their impact was relatively smaller, suggesting that access to technology and internal capabilities alone may not be sufficient without a supportive external environment. These findings highlight the importance of developing policies, fostering collaborative ecosystems, and enhancing institutional support to accelerate digital transformation among SMEs, ultimately improving competitiveness, operational efficiency, and alignment with SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure).

Table 3. Path Coefficients and Hypothesis Testing

Path	β	**t-value**	**p-value**
Technological → Readiness	0.38	6.12	<0.001
Organizational → Readiness	0.34	5.48	<0.001
Environmental → Readiness	0.42	6.89	<0.001

Table 3 indicates that environmental factors, such as regulatory support, institutional infrastructure, and market conditions, are the strongest determinants of SME readiness for digital transformation. Although technological readiness and organizational readiness also have positive effects, their influence is comparatively smaller. These results highlight that access to technology alone is insufficient; supportive policies, stable regulatory frameworks, and well-developed institutional ecosystems are essential to enable SMEs to adopt digital tools effectively. Strengthening these environmental factors can accelerate digital transformation, improve operational efficiency, and enhance SME competitiveness, while also contributing to SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure).

4.5. Discussion

The findings reveal a dual reality for Indonesian SMEs. While technological readiness is moderate, significant organizational and environmental challenges persist, confirming that successful digital transformation depends not only on technology but also on strong leadership, an adaptive organizational culture, and supportive institutional frameworks. SMEs must cultivate digital competencies among employees, establish formal strategies, and foster a culture of innovation to effectively leverage available technologies. Environmental factors, including regulatory clarity, institutional support, and market readiness, also play a pivotal role in enabling or constraining digital adoption.

Compared to SMEs in developed economies, where limited technology access is often the primary barrier, Indonesian SMEs face broader, multidimensional challenges. These include insufficient digital skills, fragmented digital ecosystems, weak regulatory enforcement, and limited access to external expertise. Addressing these issues requires coordinated efforts through targeted training programs, government and industry-led support initiatives, and the development of collaborative ecosystems that connect SMEs with mentors, technology providers, and financial resources.

Implementing these strategies will not only enhance SME readiness but also foster more inclusive and sustainable digital growth. Strengthening organizational and environmental readiness supports broader economic development, improves competitiveness, and drives innovation. In alignment with the United Nations Sustainable Development Goals, these efforts contribute to SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 12 (Responsible Consumption and Production), promoting sustainable business practices, resilient SME ecosystems, and a culture of continuous learning and technological adoption.

5. MANAGERIAL IMPLICATIONS

5.1. Internal Capacity Building

This study highlights that while Indonesian SMEs exhibit moderate technological readiness, organizational and environmental readiness remain low. One of the key managerial implications is the need to focus on leadership development and digital skills training. Managers should invest in strong digital leadership that can guide the organization through the complexities of digital transformation. Digital leaders must not only champion technological changes but also help navigate cultural resistance and internal organizational shifts.

Additionally, SMEs should prioritize employee training programs to bridge the digital skills gap. These programs should focus on both basic digital literacy and specialized training for specific tools such as data analytics, cloud computing, and artificial intelligence. Developing a digitally capable workforce will enable SMEs to leverage digital technologies more effectively and improve overall organizational efficiency. Creating a culture of innovation and openness to change is also crucial. Encouraging employees to embrace new technologies and processes as opportunities for growth rather than disruptions can lead to a more agile and adaptable organization.

5.2. External Environment Engagement

On the environmental side, managers must engage in advocating for better regulatory frameworks and collaborating with industry stakeholders to create a more supportive external environment. Regulatory uncertainty and weak institutional support are significant barriers to digital transformation in Indonesian SMEs. Managers can help by becoming active participants in industry associations, government initiatives, and digital transformation programs aimed at improving infrastructure and regulations.

By building networks and collaborating with other businesses, policymakers, and industry leaders, SMEs can influence and help shape favorable regulations and incentives for digital adoption. Engaging with external stakeholders also provides opportunities for SMEs to tap into resources such as funding, grants, and institutional support, which can ease the financial burden of digital transformation. These efforts contribute not only to the individual success of SMEs but also to a stronger, more resilient digital ecosystem in Indonesia.

5.3. Strategic Alignment with SDGs

Incorporating SDGs into the digital transformation strategy will allow SMEs to achieve both business growth and societal impact. Aligning digital transformation strategies with SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 12 (Responsible Consumption and Production) ensures that the digital shift is not just about profitability but also about contributing to broader goals such as inclusive economic growth, innovation, and sustainable consumption.

Managers should consider how digital tools and technologies can be used to promote sustainability and responsible production practices. This could involve adopting energy-efficient technologies, utilizing data analytics to optimize resource usage, and promoting digital solutions that contribute to the circular economy. By strategically aligning with SDGs, SME managers can position their businesses for long-term success while contributing to global sustainability objectives.

In summary, the study provides actionable insights for SME managers to overcome barriers and drive digital transformation. Key recommendations include investing in leadership development, fostering a culture of innovation, engaging with external stakeholders to improve regulatory environments, and aligning strategies with SDGs for sustainable growth. By adopting a holistic approach to digital transformation, SMEs can enhance their competitiveness, efficiency, and long-term viability in the digital age.

6. CONCLUSION

This study investigated organizational readiness and barriers to DT in Indonesian SMEs using the TOE framework. The findings indicate that SMEs exhibit moderate technological readiness, but organizational and environmental readiness remain low. This suggests that simply providing digital tools is insufficient; successful transformation also depends on strong leadership support, employee digital competencies, and a robust institutional infrastructure.

The analysis of barriers revealed that high implementation costs and limited digital skills are the most critical challenges hindering DT adoption. Additional constraints, such as resistance to change, regulatory uncertainty, and weak digital ecosystems, further slow the transformation process. Structural equation modeling confirmed that all three TOE dimensions significantly influence readiness, with environmental factors having the strongest effect. These results emphasize the importance of regulatory support, market incentives,

and collaborative institutional efforts to accelerate SME digital adoption and foster a supportive ecosystem for innovation.

From a practical standpoint, the study offers actionable insights for policymakers, industry associations, and SME leaders. Government initiatives should prioritize financial support, training programs, and policy frameworks that enhance digital competencies and reduce adoption barriers. At the organizational level, SMEs should cultivate a culture of innovation, adaptability, and continuous learning to maximize the benefits of digital technologies. Furthermore, aligning digital transformation efforts with the United Nations Sustainable Development Goals, particularly SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 12 (Responsible Consumption and Production), can promote sustainable and inclusive economic growth. Future research may consider longitudinal studies and cross-country comparisons to capture the evolving dynamics of SME digital transformation in emerging economies.

7. DECLARATIONS

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7.2. Author Contributions

Conceptualization: NZ; Methodology: NL, SW, and HD; Software: NZ; Validation: NL and SW; Formal Analysis: NL and HD; Investigation: NZ; Resources: NZ; Data Curation: NZ; Writing Original Draft Preparation: NL and HD; Writing Review and Editing: NL and SW; Visualization: SW; All authors, NL, SW, HD, and NZ, have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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