Strategic Change

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From Survival to Growth: Digital Strategies for Micro and Small Enterprises

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ABSTRACT

This study investigates the critical factors influencing Digital Transformation (DT) in micro, small, and medium enterprises (MSMEs) within the post-pandemic context. Data were collected through an online survey of 341 respondents and analyzed using Partial Least Square Structural Equation Modeling (PLS-SEM). The results indicate that Information System (IS) capacity, competitive pressure, and government support significantly contribute to DT, while perceived benefits and complexity have weaker effects. The findings also reveal that the influence of these factors varies by enterprise size: micro-enterprises rely on external pressures and technological capabilities, small businesses depend on internal management support and Information System Capacity (ISC), and medium enterprises require further exploration of alternative drivers. This study addresses gaps in existing research by exploring DT in a unique socio-economic setting and contributes to the literature on MSME resilience and competitiveness. Limitations include the use of convenience sampling and a focus on a single geographic context. Practical implications include recommendations for tailored policies, skill development initiatives, and improved IS infrastructure. Social implications emphasize inclusive digitalization to enhance enterprise sustainability and reduce inequality.

1 | Introduction

Micro, small, and medium enterprises (MSMEs) serve as pivotal drivers of economic growth by generating employment, reducing poverty, and boosting national income (Tambunan 2019). Beyond these economic benefits, MSMEs spur innovation and entrepreneurship, thereby stabilizing and diversifying national economies (Kussudyarsana et al. 2023). They also foster regional development by redistributing income, thus narrowing economic disparities (Nursini 2020). Recognizing their significance, many governments have implemented a range of initiatives—such as financing programs, capacity-building workshops, and regulatory reforms—to enhance MSME competitiveness and efficiency (Latianingsih et al. 2022). Despite these efforts, MSMEs increasingly encounter hurdles in a fast-evolving business landscape that demands the adoption of Digital Transformation (DT) for sustained resilience and growth (Ben-Zvi and Luftman 2022; Azmi et al. 2025). The COVID-19 pandemic underscored this urgency by revealing how digitally equipped enterprises could swiftly adapt to market disruptions and maintain operational continuity (Uvarova and Pobol 2021). Post-pandemic recovery has only intensified these imperatives, as digitally driven strategies have proven essential for meeting customer expectations and sustaining a competitive edge (Kuczewska et al. 2023; Mohammadi et al. 2025).

Although substantial scholarship details the benefits of DT—such as operational streamlining, market expansion, and

Summary

- This paper explores digital transformation (DT) strategies for micro and small enterprises (MSEs) in a post-pandemic landscape, emphasizing key enablers such as Information System (IS) capacity, competitive pressure, and government support to enhance resilience and growth.
- Introduces a strategic framework for digital transformation in MSEs, identifying critical factors such as Information System Capacity (ISC), competitive pressure, and government support as key drivers.
- Utilizes Partial Least Square Structural Equation Modelling (PLS-SEM) to analyze survey data from 341 Indonesian MSMEs, providing empirical validation of DT determinants.
- Demonstrates the role of external and internal pressures in shaping digital adoption strategies, emphasizing the distinct influences of market competition, policy support, and managerial leadership across different enterprise sizes.
- Highlights practical applications for MSME sustainability, proposing tailored policy interventions, capacity-building initiatives, and digital infrastructure improvements to accelerate DT adoption.
- Contributes to the theoretical advancement of the Technology-Organization-Environment (TOE) framework, expanding its applicability to emerging economies and micro-enterprises, and offering data-driven recommendations for digital inclusion and economic resilience.

customer satisfaction (Matt and Rauch 2020; Almasarwah et al. 2025; Straková et al. 2022)—the path to successful adoption is fraught with barriers like inadequate funding, limited digital skills, and organizational resistance (Rupeika-Apoga and Petrovska 2022). Moreover, existing studies often overlook how specific internal (e.g., managerial support, IS capacity) and external (e.g., government support, competitive pressure) factors interact to drive DT in emerging economies. This gap is especially pronounced in the Indonesian context, where MSMEs form the backbone of employment, poverty alleviation, and regional equity, yet grapple with distinct socio-economic constraints. Accordingly, this research systematically investigates key drivers—competitive pressure, managerial support, IS infrastructure, government support, perceived complexity, and more—to clarify how they shape DT adoption among Indonesian MSMEs. By addressing these factors in a post-pandemic setting, the study advances understanding of how digital initiatives can bolster resilience and competitiveness, while offering actionable insights for policymakers and business leaders aiming to foster sustainable growth (Belas et al. 2025).

2 | Literature Review

Digital transformation (DT) represents a profound change within organizations, driven by the application of digital technologies to enhance performance, optimize customer satisfaction, and foster innovative solutions. Technologies such as Artificial Intelligence (AI), Machine Learning (ML), big data, and the Internet of Things (IoT) empower organizations to redesign processes and achieve competitive advantages (Wroblewski 2018; Straková et al. 2022).

2.1 | Theoretical Framework

The Technology-Organization-Environment (TOE) Framework developed by Tornatzky et al. (1990) provides the theoretical foundation for this study. The TOE framework examines three essential contexts that influence an organization's adoption of new technologies: technological, organizational, and environmental. This model has been widely employed to explore technology adoption in various domains, including e-commerce, cloud computing, and enterprise resource planning systems (Arpaci et al. 2012; Wang et al. 2010; Bai et al. 2023; Koraus et al. 2015).

The technological context emphasizes the attributes of the technology itself, including perceived benefits, compatibility, and perceived complexity. These attributes significantly shape an organization's willingness to adopt digital technologies. Perceived benefits such as enhanced efficiency and competitiveness motivate adoption, while perceived complexity can hinder the process. In the context of MSMEs, the simplicity and usability of technologies are critical due to limited resources and technical expertise (Straková et al. 2022; Rupeika-Apoga and Petrovska 2022). The alignment of digital tools with the specific needs of MSMEs is essential for their successful implementation.

The organizational context encompasses internal factors such as size, structure, management support, and available resources. Larger firms often have greater capacity to adopt innovative technologies due to their ability to bear risks and invest in innovation. However, MSMEs face distinct challenges, including financial constraints and skill gaps, which necessitate strong leadership and strategic vision for successful digital transformation. Managerial support and a commitment to fostering an innovative organizational culture play pivotal roles in overcoming these barriers (Khurana et al. 2022; Ismael 2022; Břečka and Koraus 2016; Vrtana and Gogolova 2019). Effective management ensures the alignment of technological initiatives with organizational goals and facilitates the adoption process.

The environmental context includes external factors such as competitive pressure, regulatory frameworks, and market dynamics. Competitive pressure often serves as a catalyst for digital transformation, compelling organizations to innovate and adapt to maintain their market position. Government support, in the form of favorable policies, financial incentives, and infrastructure development, is crucial for enabling MSMEs to overcome structural barriers to digitalisation (Latianingsih et al. 2022; Aidi et al. 2023; Gombár et al. 2022; Vrtana and Krizanova 2020). In Indonesia, for instance, government initiatives have played a significant role in promoting digital literacy and providing resources to support MSMEs in their digital journey. These external factors create an ecosystem that either facilitates or hinders the adoption of digital technologies.

While the TOE framework is effective for modeling technology adoption, it has limitations. Its broad categorization may overlook unique industry-specific factors or evolving technological trends. For example, the framework does not account for the dynamic interplay between internal and external factors or the rapid advancements in digital technologies that can alter adoption dynamics. Despite these drawbacks, the TOE framework remains a robust tool for understanding digital transformation in MSMEs, particularly in contexts where contextual factors significantly influence adoption decisions. By integrating insights from the TOE framework, this study aims to provide a nuanced understanding of the determinants of digital transformation, offering a foundation for addressing the challenges faced by MSMEs in their digital journey.

2.2 | Hypothesis Development

Information System Capacity (ISC) emerges as a critical enabler of digital transformation, providing the technological foundation for adopting and integrating digital tools. Firms with robust ISC can streamline operations, enhance productivity, and respond effectively to market demands. During the COVID-19 pandemic, organizations with advanced IS infrastructures demonstrated resilience and adaptability, highlighting the essential role of ISC in navigating disruptions (Ben-Zvi and Luftman 2022; Uvarova and Pobol 2021; Koraus et al. 2019; Vrtana and Krizanova 2018). Furthermore, ISC facilitates the seamless integration of advanced technologies such as cloud computing and data analytics, enabling firms to make data-driven decisions and maintain operational continuity. Given its pivotal role, ISC is particularly crucial for MSMEs, which often face resource constraints yet require efficient systems to compete effectively (Latianingsih et al. 2022). Consequently, we hypothesize:

H1. *Information System Capacity (ISC) positively influences digital transformation adoption.*

Competitive pressure acts as a significant motivator for organizations to adopt digital technologies, particularly in highly dynamic and competitive markets. For MSMEs, competition drives the need for innovation, efficiency, and customer engagement. Competitive pressure often stems from the need to differentiate products or services, address customer demands for digital interactions and respond to competitors' advancements in technology. In the Indonesian context, competitive pressure has been identified as a primary driver, compelling firms to integrate digital solutions to maintain relevance and expand market reach (Latianingsih et al. 2022; Straková et al. 2022). Moreover, firms operating in sectors heavily influenced by globalization and technological advancements are more likely to prioritize digital transformation to enhance their competitive edge (Tambunan 2019). Accordingly, we propose:

H2. *Competitive pressure positively influences digital transformation adoption.*

Government support provides a critical foundation for enabling digital transformation, particularly for resource-constrained MSMEs. Through financial incentives, regulatory reforms, and capacity-building initiatives, governments can address structural barriers and promote digital literacy. In Indonesia, for example, government policies have been instrumental in supporting MSMEs by providing grants for technology adoption, training programs to improve digital skills, and infrastructure investments to enhance internet connectivity in rural areas (Aidi et al. 2023; Tambunan 2019). This support not only reduces the financial burden associated with digitalisation but also fosters an environment conducive to innovation and growth. Furthermore, collaborative efforts between government and private sectors, such as public-private partnerships, amplify the impact of these initiatives, making digital transformation more accessible to MSMEs (Khurana et al. 2022). Thus, we hypothesize:

H3. *Government support positively influences digital transformation adoption.*

Managerial support and leadership play a central role in fostering an organizational culture conducive to digital transformation. Effective leaders drive strategic initiatives, allocate resources, and champion innovation within their organizations. Managerial support includes not only decision-making but also fostering an environment that embraces change and mitigates resistance to technology adoption. For small businesses, managerial support is particularly influential in aligning digitalisation efforts with organizational goals (Khurana et al. 2022; Ismael 2022). Additionally, the presence of tech-savvy managers accelerates the adoption process by ensuring that the organization's digital strategies align with emerging technological trends and market demands (Rupeika-Apoga and Petrovska 2022). Therefore, we posit:

H4. *Managerial support positively influences digital transformation adoption.*

Perceived benefits, such as enhanced operational efficiency, improved customer satisfaction, and expanded market opportunities, motivate firms to embrace digital transformation. These benefits extend to cost reductions, better resource allocation, and increased agility in responding to market changes. Although the study findings suggest that perceived benefits are less influential compared to other factors, they remain an important consideration for organizations evaluating the value of digital technologies (Straková et al. 2022; Wroblewski 2018). For MSMEs, perceived benefits often serve as a justification for initial investments in digital tools, particularly when tangible outcomes such as revenue growth and market share improvements are evident (Latianingsih et al. 2022; Vrtana et al. 2020). Consequently, we hypothesize:

H5. *Perceived benefits positively influence digital transformation adoption.*

Perceived complexity, on the other hand, poses a significant barrier to digital transformation, particularly for MSMEs with limited technical expertise and resources. Complex technologies can deter adoption due to the challenges associated with implementation and integration. For MSMEs, these challenges are often exacerbated by a lack of access to skilled personnel and the high costs of acquiring and maintaining sophisticated systems

(Rupeika-Apoga and Petrovska 2022; Dobrovič and Koraus 2015; Moravcikova et al. 2019). However, findings indicate that the impact of perceived complexity is less significant than other drivers, such as ISC and competitive pressure. Simplifying technology interfaces and providing training programs can mitigate these challenges, enabling MSMEs to overcome initial hesitations and proceed with digital adoption (Tornatzky et al. 1990; Tambunan 2019). Thus, we hypothesize:

H6. *Perceived complexity negatively influences digital transformation adoption*.

These hypotheses reflect the multifaceted nature of digital transformation, capturing both enablers and barriers. The influence of these factors varies across enterprise sizes, with external pressures and government support being more critical for micro-enterprises, while internal management and ISC are pivotal for small businesses.

3 | Methodology and Data

3.1 | Data and Sampling Method

This study employs a quantitative research design based on a structured survey to explore the determinants of digital transformation (DT) adoption among MSMEs. Data were collected between October 15, 2023, and February 20, 2024, from 341 MSMEs in Indonesia using an online distribution method facilitated by Google Forms. Platforms such as Instagram, Twitter, and email networks were utilized for dissemination due to their efficiency in reaching a large, diverse, and digitally active audience (Bellet et al. 2022; Tsen and Cheng 2021).

The target population included owners, managers, or representatives of MSMEs aged 18 and above, ensuring respondents possessed sufficient knowledge of organizational processes and digital transformation initiatives. The selection of social media platforms as a dissemination tool ensured the survey's accessibility across diverse demographics and regions, aligning with the study's objective to capture comprehensive insights on DT adoption. Convenience sampling, while not probabilistic, was employed to gather responses efficiently from accessible and willing participants. This method proved particularly effective given the study's focus on digitally active individuals who frequently interact with technology. By targeting a broad demographic spectrum across various regions and industries in Indonesia, the survey mitigated potential biases associated with convenience sampling. The use of online platforms further enhanced accessibility, efficiency, and cost-effectiveness, supporting the study's aim to understand DT adoption in a digitally connected demographic (Bellet et al. 2022; Tsen and Cheng 2021).

3.2 | Survey Instrument and Variables Measurement

The survey instrument was designed based on a comprehensive review of the literature, focusing on six key constructs identified as critical drivers of DT: Information System Capacity (ISC), Competitive Pressures (CP), Government Supports (GS), Managerial Supports (MS), Perceived Benefits (PB), and Perceived Complexity (PC). These constructs were operationalized using validated measurement scales from prior studies to ensure reliability and relevance.

To measure Information System Capacity (ISC), items captured the availability, usability, and robustness of technological infrastructure within MSMEs. Respondents assessed their organizations' ISC based on criteria such as technological integration, data analytics capabilities, and IT resource adequacy (Ben-Zvi and Luftman 2022; Uvarova and Pobol 2021). Competitive Pressures (CP) were measured using indicators that reflected the intensity of market competition, the need for differentiation, and external pressures to adopt new technologies (Latianingsih et al. 2022; Straková et al. 2022).

Government Supports (GS) were evaluated through items examining policy interventions, financial incentives, and infrastructural support aimed at facilitating DT adoption. The inclusion of GS reflects the influence of external institutional factors on MSMEs' digital initiatives (Aidi et al. 2023; Tambunan 2019). Managerial Supports (MS) focused on leadership commitment, strategic vision, and the role of managers in fostering an environment conducive to digital innovation (Khurana et al. 2022; Ismael 2022). Perceived Benefits (PB) were captured by assessing respondents' views on the potential advantages of DT, including operational efficiency, customer satisfaction, and market expansion (Wroblewski 2018). Conversely, Perceived Complexity (PC) examined the challenges associated with DT adoption, such as technological intricacy and integration difficulties (Rupeika-Apoga and Petrovska 2022). Each construct was measured using a multi-item Likert scale, with respondents rating their level of agreement or disagreement on a five-point scale. The Likert scale was chosen for its efficacy in capturing nuanced attitudes and perceptions, providing a granular understanding of the factors influencing DT adoption. The scales were pretested with a small group of MSME representatives to refine the survey items for clarity and relevance, ensuring the instrument's validity.

4 | Analytical Approach

Data analysis was conducted using Partial Least Square Structural Equation Modeling (PLS-SEM), which offers multiple advantages for this study's objectives. First, PLS-SEM is particularly effective for exploratory research that seeks to identify and predict key drivers of a target construct—in this case, digital transformation (DT)—rather than merely confirm established theories (Hair et al. 2019). Second, unlike covariance-based SEM, PLS-SEM handles complex models and smaller or non-normally distributed samples more robustly, making it suitable for a context where data normality cannot always be assumed (Nitzl 2016). Third, PLS-SEM simultaneously assesses both the measurement model (i.e., reliability and validity of latent constructs) and the structural model (i.e., hypothesized relationships among these constructs), providing a comprehensive view of how factors interact to influence DT adoption. These methodological strengths align with the study's intent to uncover the multifaceted relationships among competitive pressure, IS

capacity, government support, and other drivers of DT, thereby justifying the choice of PLS-SEM for this research.

5 | Results and Interpretations

As presented in Table 1, most of the respondents were over 36 years old (average 32 years) and were operating micro-enterprises with less than 10 employees. Their levels of education were mostly at high school or below, thus indicating a factor that might emerge as an area to be enhanced by education and developing relevant skills. As can be seen from this demographic profile, this is a landscape overwhelmed by small-scale, owner-operated enterprises; improving education opportunities and support to business is likely to make a remarkable difference in terms of growth and sustainability. While the gross split by gender is relatively even, thus inclusive, the high percentage of micro businesses underlines that business growth for economic development needs targeted support. Thus, the organization and participant profiles support sample representativeness.[1]

Further, the study utilized the measurement model of PLS in order to test the reliability and validity of the constructs in the structural equation model. Specifically, the results affirm that all the constructs—PB, PC, MS, IC, GS, CP, and DT—possess significant psychometric properties. All the value of items loadings, specifically, are greater than 0.70, confirming good indicator reliability. Moreover, the values of VIF for all the items are below or near 3.3, thereby ruling out multicollinearity. Further, all Cronbach's alpha values for constructs fall within the acceptable range of 0.795 to 0.910, indicating good to excellent internal consistency. In addition, reliability ranges from 0.867 to 0.937, thereby showing further high reliability. Finally, the AVE is above 0.50 for all, thereby indicating adequate convergent validity. Together, these findings suggest that the measurement model is robust—that each construct is being measured with reliability and validity.[2] The detailed finding is presented in Table 2.

Additionally, based on the examination of the discriminant validity by the Fornell-Larcker criterion as presented in Table 3, we can infer that the constructs in the model have satisfactory discriminant validity.[3] In fact, the square root of the average variance extracted for each construct is higher compared to its correlations with other constructs. Accordingly, the data supports the discriminant validity of the constructs, thereby confirming that they are distinct from one another and appropriate for further structural analysis in hypothesis testing. This strengthens the validity of any conclusions drawn from subsequent analyzes of these constructs.

Further, Table 4 presents the Heterotrait-Monotrait (HTMT) test for further investigation of the discriminant validity of our contract.[4] It is observed that the HTMT ratio calculation shows good discriminant validity for all constructs; in fact, all ratios fall below the threshold of 0.85, proving that the constructs are truly different from one another. This could be subject to one exception: the pair MS-IC, whose HTMT ratio was 0.849, precisely at the threshold, which may indicate it would call for closer examination. The overall fit indices provide evidence that the constructs specified in this research are both well-defined and differentiated; hence, it supports a robust measurement model.

Table 5 provides the results of a structural model, investigating the impact of various factors on DT. The results of structural modeling show that ISC and competitive pressure are

TABLE 1 | Demographic and business statistics of the respondents.

Item	Frequency	Percentage (%)	Item	Frequency	Percentage (%)
Gender			Type of business		
Male	179	52.49%	Micro business	258	75.66%
Female	162	47.51%	Small business	50	14.66%
Age (in years)			Medium business	33	9.68%
Less than 25	25	7.33%	Position in business		
Between 26 and 30	31	9.09%	Owner	312	91.50%
Between 31 and 35	50	14.66%	Manager	29	8.50%
Between 36 and 40	56	16.42%	Number of employees		
Between 41 and 45	83	24.34%	Less than 10	288	84.46%
More than 45	96	28.15%	Between 11 and 20	9	2.64%
Education			Between 11 and 20	9	21–30
Highschool and less	201	58.94%	Between 31 and 40	12	3.52%
Diploma	20	5.87%	Between 41 and 50	10	2.93%
Bachelor	101	29.62%	More than 50	15	4.40%
Postgraduate/Master	19	5.57%			
Number of total respondents	341	100%			

TABLE 2 | PLS measurement model output.

Construct	Item	Item loading	VIF	Cronbach's alpha	Composite reliability	AVE
Perceived benefits (PB)	PB-1	0.896	2.881	0.889	0.922	0.749
	PB-2	0.897	2.715			
	PB-3	0.780	1.848			
	PB-4	0.883	2.538			
Perceived complexity (PC)	PC-1	0.752	1.500	0.795	0.867	0.619
	PC-2	0.786	1.648			
	PC-3	0.794	1.763			
	PC-4	0.814	1.728			
Management supports (MS)	MS-1	0.816	2.774	0.828	0.886	0.661
	MS-2	0.877	2.209			
	MS-3	0.816	1.927			
	MS-4	0.736	1.701			
Information system capacity (ISC)	ISC-1	0.876	2.546	0.910	0.937	0.788
	ISC-2	0.889	2.791			
	ISC-3	0.909	1.181			
	ISC-4	0.875	2.601			
Government supports (GS)	GS-1	0.839	2.995	0.907	0.934	0.779
	GS-2	0.923	1.901			
	GS-3	0.894	2.293			
	GS-4	0.873	1.868			
Competitive pressures (CP)	CP-1	0.739	1.677	0.854	0.901	0.696
	CP-2	0.854	2.294			
	CP-3	0.884	2.610			
	CP-4	0.852	2.195			
Digital transformation (DT)	DT-1	0.879	2.811	0.889	0.923	0.751
	DT-2	0.920	1.585			
	DT-3	0.835	2.202			
	DT-4	0.829	2.019			

TABLE 3 | Discriminant validity of Fornell-Larcker criterion).

	CP	DT	GS	ISC	MS	PB	PC
CP	0.834						
DT	0.740	0.866					
GS	0.400	0.441	0.883				
ISC	0.628	0.700	0.413	0.888			
MS	0.629	0.688	0.386	0.731	0.813		
PB	0.441	0.519	0.338	0.490	0.702	0.865	
PC	0.438	0.412	0.296	0.493	0.511	0.421	0.787

TABLE 4 | Heterotrait-Monotrait ratio.

	CP	DT	GS	ISC	MS	PB	PC
CP							
DT	0.837						
GS	0.433	0.472					
ISC	0.708	0.776	0.436				
MS	0.741	0.797	0.431	0.849			
PB	0.485	0.572	0.369	0.540	0.811		
PC	0.533	0.491	0.350	0.579	0.635	0.515	

TABLE 5 | Structural model results.

Hypothesis	Structural path	*T* statistics	*p*
H1	Perceived benefits	1.335	0.182
H2	Perceived complexity	0.889	0.369
H3	Management supports	1.946	0.052
H4	Information system capacity	**3.556****	**0.000**
H5	Government support	**2.249***	**0.025**
H6	Competitive pressure	**6.139****	**0.000**
R^2			0.670
Adjusted R^2			0.664
Q^2			0.643
Number of observations			**341**

Note: Bold values indicate statistically significant paths at $p < 0.05$ (two-tailed).
**$p < 0.01$.
*$p < 0.05$ (two tailed).

highly significant drivers of DT, with *p*-values way below 0.01. Government support was also very important, with $p < 0.05$. Management support was marginally significant; $p = 0.052$, which means it could have some effects, although weaker compared with the other significant drivers. Moreover, perceived benefit and perceived complexity do not have a significant influence on DT, as indicated by their high *p*-values of 0.182 and 0.369, respectively. The model explains 67% of the variance for DT, concluding it fits and is predictive in relevance with $Q^2 = 0.643$. These results underline the paramount roles of ISC, competitive pressure, and government support for DT, while perceived benefits and complexity are not that powerful.

Table 6 presents a summary of results derived from the structural model adopted to investigate the relationships among the different factors and DT in MSMEs. The influence of many factors on DT differs greatly between micro, small, and medium businesses. For instance, for micro businesses, competitive pressure, government support, and ISC are really important drivers, indicating the importance of external pressures and capabilities in terms of technology. For small businesses, paramount is the role of management support and ISC; thus, there must be proper managerial direction and IS infrastructure in place for DT. In the case of medium enterprises, however, none of the variables analyzed appeared to play a major role, suggesting there may be other variables that might be relevant. Thus, external pressures and supporting mechanisms are critical to the micro-enterprises, and strong internal management and technology infrastructure are more important in small businesses, the medium businesses should obviously need to explore some other major drivers for the DT.

6 | Discussion

The results confirm that ISC, competitive pressure, and government support are critical enablers of DT. ISC emerges as the backbone of DT, enabling MSMEs to integrate digital tools seamlessly into their operations, improve productivity, and enhance resilience. During the COVID-19 pandemic, robust

TABLE 6 | Structural model results by MSMEs.

	Micro business		Small business		Medium business	
Relationships with DT	***T* statistics**	***p***	***T* statistics**	***p***	***T* statistics**	***p***
Perceived benefits	0.644	0.520	0.312	0.755	0.522	0.602
Perceived complexity	0.350	0.727	0.734	0.463	0.203	0.840
Management supports	1.698	0.089	2.237*	0.025	1.744	0.082
Information system capacity	2.374*	0.018	3.675**	0.000	0.234	0.815
Government support	3.072**	0.002	0.189	0.850	0.496	0.620
Competitive pressure	6.809**	0.000	1.226	0.220	0.174	0.862
Number of observations					341	

**$p < 0.01$.
*$p < 0.05$ (two tailed).

IS infrastructures allowed organizations to adapt quickly to disruptions, reinforcing the importance of technological readiness (Ben-Zvi and Luftman 2022; Uvarova and Pobol 2021). This aligns with Matt and Rauch (2020), who emphasize the role of ISC in maintaining operational efficiency during volatile periods. Indonesian MSMEs' reliance on ISC highlights the importance of tailored technological investments that meet the unique needs of smaller enterprises with constrained resources.

Competitive pressure is another significant driver of DT, reflecting the dynamic and highly competitive environment in which MSMEs operate. Firms face constant challenges to innovate, enhance efficiency, and meet evolving customer expectations. The findings align with Latianingsih et al. (2022), who highlight the role of market pressures in compelling firms to adopt digital solutions. This dynamic is particularly pronounced in the Indonesian context, where MSMEs must navigate global competition and local market dynamics simultaneously. Competitive pressure fosters a culture of agility and innovation, essential for sustaining relevance in rapidly evolving markets.

Government support is identified as a cornerstone of DT adoption, particularly for resource-constrained MSMEs. Policy interventions, financial incentives, and capacity-building initiatives play a pivotal role in addressing structural barriers to digitalisation. As Aidi et al. (2023) and Tambunan (2019) suggest, the Indonesian government's focus on digital literacy, infrastructure development, and financial support has been instrumental in facilitating MSMEs' digital journeys. This finding underscores the importance of a supportive regulatory environment and the necessity of public-private partnerships in promoting digital inclusion and innovation.

Interestingly, perceived benefits and perceived complexity do not significantly influence DT in Indonesian MSMEs. While perceived benefits such as improved efficiency and customer satisfaction are often cited as motivators for DT (Straková et al. 2022), the findings suggest that these factors are secondary to external pressures and tangible support mechanisms in the Indonesian context. This divergence highlights the unique socio-economic conditions shaping MSME behavior, where immediate survival needs and external stimuli take precedence over long-term perceived advantages.

The insignificant impact of perceived complexity contrasts with the concerns often raised in the literature about technological barriers (Rupeika-Apoga and Petrovska 2022). This could indicate that Indonesian MSMEs have either developed strategies to mitigate complexity or rely heavily on external support to navigate technological challenges. Simplified user interfaces, government-led training programs, and increasing digital literacy may have alleviated concerns about complexity, reducing its deterrent effect.

The study also reveals variations in the influence of DT drivers across different enterprise sizes. For micro-enterprises, external pressures such as competitive dynamics and government support are paramount. These businesses, characterized by limited resources and capacity, are more reactive to external stimuli and rely on external enablers to embark on digital transformation. This aligns with findings from Sunoko et al. (2022), who emphasize the vulnerability of micro-enterprises to external market and policy shifts.

Small enterprises, on the other hand, demonstrate a stronger reliance on internal factors such as managerial support and ISC. Effective leadership and robust technological infrastructure emerge as critical enablers, underscoring the need for strategic vision and internal alignment in driving digital initiatives. This finding echoes the observations of Khurana et al. (2022) and Ismael (2022), who highlight the role of managerial commitment in overcoming internal resistance and fostering a culture of innovation.

For medium enterprises, the lack of significant influence from the analyzed factors suggests the presence of other strategic or resource-intensive drivers. These businesses may require a deeper exploration of variables such as market positioning, advanced technological capabilities, or internationalization strategies. This highlights a potential avenue for future research to address the unique needs and challenges of medium-sized enterprises in their digital transformation journeys.

The study's findings also underline the critical role of capacity building and skill development in supporting DT. Addressing digital literacy gaps among MSME owners and employees is essential for leveraging the full potential of digital tools. Educational initiatives tailored to the specific needs of MSMEs can empower businesses to innovate, adapt, and sustain competitive advantages. Filling this educational gap aligns with the recommendations of Straková et al. (2022), who advocate for targeted training programs to enhance digital competencies.

Furthermore, the results emphasize the importance of fostering a culture of innovation within MSMEs. Encouraging experimentation, risk-taking, and the adoption of emerging technologies can create a resilient and agile business environment. Government and private sector collaboration in providing platforms for knowledge exchange, mentorship, and funding can further accelerate this cultural shift.

7 | Theoretical and Managerial Implications

This study makes two critical contributions: one to theory and one to practice. Theoretically, it advances the Technology-Organization-Environment (TOE) framework by emphasizing the pivotal role of government support as an environmental factor uniquely influential in emerging economies. The inclusion of government support demonstrates how targeted policy supports, infrastructure investments, and digital literacy programs serve as enablers of digital transformation (DT) in contexts characterized by resource constraints. This addition provides a nuanced understanding of the environmental dimension within the TOE framework, broadening its relevance beyond developed economies to encompass emerging markets.

Furthermore, this research introduces enterprise size as a moderating variable within the TOE framework. It highlights that micro, small, and medium enterprises exhibit distinct responses

to DT drivers. Micro-enterprises are more sensitive to external pressures, such as competitive dynamics and government incentives, while small enterprises rely heavily on internal factors like managerial support and ISC. Medium enterprises, however, appear to be influenced by strategic and resource-intensive factors, suggesting the need for further theoretical exploration to identify these variables. This differentiation underscores the necessity of tailoring the TOE framework's constructs to reflect organizational scale and the diverse operational realities of businesses.

The study also challenges existing assumptions within the TOE framework, particularly the role of perceived benefits and complexity. While prior literature often highlights perceived benefits as a major motivator for DT, this study finds that these factors are secondary to immediate pressures and tangible support mechanisms in the Indonesian MSME context. This insight suggests that the TOE framework should incorporate a hierarchy of factors, prioritizing external enablers over individual perceptions in resource-constrained settings. By refining the framework in these ways, the study offers a more adaptable and context-sensitive tool for understanding DT across varying environments.

8 | Conclusions

This study examined the critical factors influencing digital transformation (DT) adoption among Indonesian MSMEs in the post-pandemic context. The findings show that Information System (IS) capacity, competitive pressure, and government support are significant enablers of DT, offering the technological, motivational, and structural resources needed for successful adoption. IS capacity equips firms with the infrastructure to enhance operations, while competitive pressure drives innovation. Meanwhile, government interventions—through policies and incentives—help MSMEs surmount key barriers to digitalisation. Additionally, the study highlights notable differences across enterprise sizes. Micro-enterprises are more receptive to external pressures and government incentives, whereas small enterprises benefit substantially from internal factors, including managerial support and IS infrastructure. Medium enterprises, however, appear to be influenced by additional strategic considerations not fully captured in this research, signaling a direction for further inquiry. Collectively, these insights underscore the importance of external and internal readiness in shaping robust DT outcomes, with each enterprise type requiring tailored strategies to navigate the evolving digital landscape.

While this study offers valuable insights into the drivers of digital transformation among Indonesian MSMEs, several limitations warrant attention. First, the reliance on convenience sampling constrains the representativeness of the sample and, consequently, limits the generalizability of the findings. Second, the focus on Indonesian MSMEs restricts the applicability of the results to other cultural, economic, and regulatory contexts, necessitating caution when drawing broader inferences. Third, the study does not thoroughly investigate strategic factors that may uniquely influence medium-sized enterprises, thereby leaving unexplored avenues for future research. Finally, because this study employed a cross-sectional design, it captures a moment-in-time perspective and cannot shed light on the dynamic, long-term processes involved in digital transformation. Addressing these limitations in subsequent studies—through random or stratified sampling techniques, comparative research across diverse geographic regions, targeted exploration of medium-sized enterprises' strategic considerations, and longitudinal designs—would deepen the understanding of digital transformation adoption and enhance the applicability of findings across different contexts.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

Endnotes

[1] Micro business = Max net assets IDR 50 million and max annual sales IDR 300 million.

Small business = Net assets IDR 50–500 million and annual sales IDR 300 million–2.5 billion.

Medium business = Net assets > IDR 500 million and annual sales IDR 2.5–50 billion.

[2] In the table, a construct is an abstract concept measured by a number of observed variables; these are called items. For instance, Perceived Benefits, Perceived Complexity, and DT. Each of the constructs is operationalized by items, for example PB-1 and PB-2. "Item loading" refers to the correlation of an item with its construct. High item loadings above 0.70 would suggest that items reliably measure their respective constructs.

[3] The Fornell-Larcker criterion is one of the tests that assesses the construct discriminant validity in a model. Discriminant validity ensures that a construct is really distinct from other constructs by contrasting the square root of the average variance extracted of each construct to the correlations between that construct and others. In the table below, diagonal elements (in bold) capture the square root of the AVE for each construct, and off-diagonal elements capture the correlation of constructs.

[4] The Heterotrait-Monotrait ratio is a measurement method to evaluate the discriminant validity between the constructs in structural equation modelling, concerned with ensuring that the respective constructs are related to different concepts. In general, an HTMT ratio below 0.85 (or sometimes 0.90) is considered acceptable for good discriminant validity.

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