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Turning Digital Technology into Performance: Transformation Capability and Digital Culture in MSMEs

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Abstract

While prior research often treats technology adoption as sufficient for performance gains, this study argues that digital technology capability alone is insufficient without transformation capability and cultural readiness. This study examines how digital technology capability improves the operational performance of micro, small, and medium-sized enterprises (MSMEs) by investigating the mediating role of digital transformation capability and the moderating role of digital culture. Data were collected from 300 MSMEs across multiple business sectors in West Java and analyzed using partial least squares structural equation modeling (PLS-SEM). The results indicate that digital technology capability has a significant direct effect on operational performance and an indirect effect through digital transformation capability. In addition, digital culture significantly strengthens the relationship between digital technology capability and both digital transformation capability and operational performance. This study contributes to the digital transformation and MSME literature by clarifying the hierarchical relationship between technological capability and transformation capability and by demonstrating the boundary condition of digital culture. Practically, the findings suggest that MSMEs should complement technology adoption with capability development and cultural readiness, for example, through structured digital training and leadership support for experimentation, to achieve superior operational outcomes.

Keywords: *Digital Technology Capability, Digital Transformation Capability, Digital Culture, Operational Performance*

1. Introduction

Micro, small and medium-sized enterprises (MSMEs) operating across various sectors are increasingly confronted with rapid market changes, short product life cycles, and highly volatile customer preferences (Costa et al., 2023; Epede & Wang, 2022; Kindström et al., 2024). In such environments, digital technologies are widely viewed explaining as critical enablers for improving operational efficiency, responsiveness, and competitiveness (Omrani et al., 2024; Shahadat et al., 2023). The diffusion of digital tools such as social media and e-commerce platforms to basic enterprise systems and data-driven application, has lowered entry barriers and expanded market access for SMEs (Omrani et al., 2024; Vrontis et al., 2022). However, despite substantial investments in digital technologies, many SMEs still struggle to translate these technological resources into tangible improvements in operational performance (Epede & Wang, 2022; Faiz et al., 2024; Shahadat et al., 2023). This gap between digital adoption and operational outcomes suggests that technology alone is insufficient to guarantee superior performance.

Prior studies in operations management and information systems have emphasized the strategic value of digital technologies for enhancing organizational processes and performance (Chatterjee et al., 2023; Chaudhuri et al., 2024; Odebode & Ogunbayo, 2025). Yet, empirical evidence increasingly shows that the mere possession of digital technologies does not automatically lead to better operational results. Firms often face difficulties in embedding digital tools into their daily workflows, aligning them with business objectives, and mobilizing organizational members to use them effectively (Islam Bhuiyan et al., 2024; Omrani et al., 2024;

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Shahadat et al., 2023). This is particularly salient for MSMEs, where operations are characterized by high levels of customization, frequent changes in product designs, and strong dependence on fast responses to shifting market trends. In such contexts, the challenge is not only to acquire digital technologies, but also to develop the organizational capability to transform existing processes, structures, and ways of working.

However, prior research has largely examined digital technology adoption and performance outcomes in isolation, without systematically investigating how digital capabilities translate into operational improvements or under what conditions they are most effective (Bag et al., 2025; Dubey et al., 2023). Specifically, the mediating role of transformation capability and the moderating role of digital culture remain underexplored in the MSME context.

Building on the dynamic capability perspective (Teece, 2018; Teece et al., 1997), this study argues that digital transformation capability plays a crucial mediating role in converting digital technology capability into operational performance. Digital technology capability reflects a firm's ability to deploy and use digital tools in its operations (Bag et al., 2025; Heredia et al., 2022; Li et al., 2022; Vilkas et al., 2024), whereas digital transformation capability captures the firm's ability to sense opportunities for digital-driven change, organize and coordinate resources, and reconfigure processes and workflows accordingly (Aguiar et al., 2019; Gökalp & Martinez, 2022; Yu et al., 2022). In other words, digital transformation capability represents the mechanism through which technological resources are translated into actual changes in operational practices (Cranney et al., 2025; Leso et al., 2024). Without such a capability, digital technologies risk remaining underutilized or misaligned with operational needs, thereby limiting their performance impact.

Moreover, the effectiveness of digital capabilities is likely to depend on the organizational context in which they are embedded. In this regard, digital culture has emerged as a critical but still underexplored factor, especially in the SME context. Digital culture reflects shared values, attitudes, and norms that support the use of digital technologies, experimentation with new ways of working, and continuous learning related to digitalization (Blatz et al., 2018; Leal-Rodríguez et al., 2023; Shin et al., 2023). A supportive digital culture can encourage employees to embrace digital tools, reduce resistance to change, and facilitate the implementation of digital transformation initiatives (El-Sayed et al., 2025; Hautala-Kankaanpää, 2022; Özkan Alakaş, 2024). Conversely, in the absence of such a culture, even well-developed digital technology capabilities may fail to generate meaningful operational improvements. This suggests that digital culture may not only strengthen the link between digital technology capability and digital transformation capability, but also shape how technological resources directly contribute to operational performance.

Despite growing interest in digital transformation and digital capabilities, existing research still offers limited insights into how these elements interact to influence operational performance in SMEs (Bag et al., 2025; Shahadat et al., 2023; Yu et al., 2022), particularly in creative and dynamic business environments. Many studies focus either on the technological aspects of digitalization or on performance outcomes, without sufficiently unpacking the organizational mechanisms and contextual conditions that connect the two (Bag et al., 2025; Dubey et al., 2023; Hautala-Kankaanpää, 2022). To address this gap, this study develops and tests a model proposing that (1) digital technology capability positively affects operational performance, (2) digital transformation capability mediates this relationship, and (3) digital culture moderates the effects of digital technology capability on both digital transformation capability and operational performance. In doing so, this study adopts a process-oriented view of digitalization by emphasizing that performance gains arise from both technology adoption and the organization's ability to transform and from the cultural context that supports such transformation.

This study makes several contributions to the literature on operations management and digital transformation. First, it advances understanding of how digital technology capability is

translated into operational performance by identifying digital transformation capability as a key mediating mechanism, which has been largely treated as a black box by prior studies. Second, it highlights the contingent role of digital culture by demonstrating that cultural support for digitalization strengthens the effectiveness of technological capabilities. Third, by focusing on a broad sample of MSMEs across multiple sectors, this study extends prior research that has largely concentrated on larger firms or more traditional industrial contexts. From a practical perspective, the findings offer insights for MSME owners and managers by showing that investments in digital technologies need to be complemented by transformation capabilities and a supportive digital culture to achieve meaningful operational benefits.

The remainder of this paper is structured as follows. The next section develops the hypotheses and conceptual framework. The subsequent sections describe the research methodology, present the empirical results, and discuss the theoretical and managerial implications of the findings. Finally, the paper concludes with limitations and directions for future research.

2. Research Method

Research Design

This study adopts a quantitative, cross-sectional survey design to examine the relationships among digital technology capability, digital transformation capability, digital culture, and operational performance in micro, small, and medium-sized enterprises (MSMEs). The empirical context of this study focuses on MSMEs operating in West Java, which is a region with a high concentration of digital adoption and diverse business sectors. This setting provides an appropriate context to investigate how digital capabilities and organizational culture shape operational outcomes.

Sampling and Data Collection

A purposive sampling technique was employed to select respondents who met specific inclusion criteria. The criteria were: (1) the business had been established for at least five years to ensure operational stability; (2) the firm actively used at least one digital technology in its daily operations, such as WhatsApp Business for customer communication, e-commerce platforms (Shopee, Tokopedia) for sales, digital payment systems (QRIS, GoPay, OVO), or basic accounting software; (3) the respondent was the owner or manager with direct knowledge of the firm's operations and digital initiatives. These criteria ensured that only MSMEs with sufficient digital exposure and organizational maturity were included.

Respondents were identified through multiple sources: (1) lists from cooperative and MSME offices in West Java regencies/cities, (2) membership directories of local business associations, and (3) referrals from prior participants. The geographic coverage included major urban and peri-urban areas in West Java, specifically Bandung Raya (Bandung City, Bandung Regency, Cimahi City), Bekasi, Depok, Bogor, and Sukabumi. Sectoral diversity was pursued intentionally, with respondents representing retail and wholesale, food and beverage, services, creative industry, small-scale manufacturing, and agribusiness.

A structured questionnaire was distributed using both online and offline channels. Online distribution used Google Forms shared via WhatsApp and email to business association contacts. Offline distribution involved direct visits to MSME clusters and markets, where enumerators administered paper-based questionnaires. To minimize response bias, several steps were taken: (1) the same questionnaire format and wording were used across both modes, (2) participation was voluntary and anonymous, and (3) no incentives were offered to avoid self-selection bias. Non-response bias was assessed by comparing early and late respondents (Armstrong & Overton, 1977) on key demographic variables, no significant differences were

found, indicating that non-response bias is unlikely to be a serious concern. After excluding incomplete and invalid responses (those with missing data >10% or straight-lining patterns), a total of 300 usable questionnaires were retained for further analysis. This sample size exceeds the minimum recommended for PLS-SEM given the model complexity (Hair et al., 2019).

Measurement

All constructs in this study were measured using multi-item scales adapted from prior studies and modified to fit the context of MSMEs. All items were assessed using a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Digital technology capability was measured using ten items capturing three aspects: digital adaptability, digital agility, and digital alignment. The items were adapted from prior studies (Bag et al., 2025; Dubey et al., 2023) and refined to reflect the context of MSMEs. Digital transformation capability was measured using five items adapted from Yu et al. (2022). The scale captures the firm's overall ability to identify opportunities for digital-driven change, coordinate and implement digital transformation initiatives, and reconfigure resources and workflows using digital technologies.

Digital culture was measured using five items adapted from Blatz et al. (2018) and Hautala-Kankaanpää (2022). These items capture employees' and the organization's general attitudes toward digital technologies, openness to new digital ways of working, and support for digital training and digitalization initiatives. Operational performance was measured using five items adapted from Yu et al. (2022), capturing improvements in product and service quality, process improvement, cost reduction, customer attraction, and the ability to customize products or services to specific customer needs.

The original questionnaire items were developed in English. Following best practices for cross-cultural research, a translation and back-translation procedure was conducted. Two bilingual researchers independently translated the English items into Bahasa Indonesia. A third researcher then back-translated the Indonesian version into English without reference to the original. Discrepancies were discussed and reconciled to ensure conceptual equivalence. The Indonesian version was then pilot-tested with 30 MSME owners and managers who were not included in the final sample. Based on pilot feedback, minor wording adjustments were made to improve clarity and relevance to the Indonesian MSME context. Expert validation was also performed by three academic researchers specializing in operations management and digital transformation to assess content validity. The final questionnaire items are provided in Table 2.

Data Analysis

The data were analyzed using partial least squares structural equation modeling (PLS-SEM) with SmartPLS. This approach was chosen because the research model involves a mediation and moderation structure, and focuses on explaining variance in operational performance. In addition, PLS-SEM is suitable for complex models and does not require multivariate normal data distribution. The analysis employs two stages, namely assessing the measurement model and the structural model.

Because data were collected from a single source (owner/managers) using a cross-sectional survey, common method bias (CMB) could pose a threat to validity. Procedural remedies were implemented during the design phase, including ensuring respondent anonymity, reducing item ambiguity, and separating predictor and criterion items in the questionnaire. Statistically, Harmon's single-factor test was conducted: the unrotated factor solution explained less than 40% of the total variance, suggesting that CMB is not a major concern in this study. However, the cross-sectional design limits causal inference, and this limitation is acknowledged in the concluding section.

3. Results and Discussion

Respondent Profile

The demographic profile indicates that the sample represents diverse MSMEs in terms of business sector, firm size, and decision-maker background (Table 1). Most respondents operate in the trade (26.0%) and food and beverage sectors (24.0%), followed by services (20.0%) and creative industries (15.0%), while small-scale manufacturing and agribusiness account for a smaller proportion. In terms of firm age, the majority have been operating for 3–5 years (30.0%) and 6–10 years (28.3%). Regarding firm size, the sample is dominated by micro and small enterprises, with 36.7% employing 1–4 employees and 41.7% employing 5–19 employees. Most firms report annual revenues between IDR 100–300 million (40.0%) and below IDR 100 million (31.7%). The respondents are primarily business owners (61.7%), followed by operational managers (26.7%) and supervisors (11.6%). In terms of education, most respondents hold a bachelor's degree (38.3%) or high school diploma (35.0%). Overall, the sample is considered appropriate for examining the relationship between digital capabilities and operational performance in MSMEs.

Table 1. Respondent Profile

Characteristics	Category	Frequency	Percentage (%)
Business Type	Retail & Wholesale	78	26.0
	Food & Beverages	72	24.0
	Service	60	20.0
	Creative Industry	45	15.0
	Small Scale Manufacture	30	10.0
	Agribusiness	15	5.0
Duration of Business Operations	< 3 years	75	25.0
	3–5 years	90	30.0
	6–10 years	85	28.3
	> 10 years	50	16.7
Number of Employees	1–4 (micro)	110	36.7
	5–19 (small)	125	41.7
	20–50 (medium)	65	21.6
Annual Revenue	< Rp100 million	95	31.7
	Rp100 – 300 million	120	40.0
	Rp301 – 500 million	60	20.0
	> Rp500 million	25	8.3
Respondents' Education	Senior High School	105	35.0
	Diploma	60	20.0
	S1 (Bachelor)	115	38.3
	S2 (Magister)	20	6.7
Respondents' Position	Owner	185	61.7
	Operational Manager	80	26.7
	Supervisor	35	11.6

Convergent Validity

The convergent validity assessment shows that all constructs meet the recommended criteria (Table 2). All indicator loadings exceed 0.70, ranging from 0.914 to 0.954, indicating strong indicator reliability. The Average Variance Extracted (AVE) values are also above the threshold of 0.50, with values of 0.893 for Digital Culture, 0.866 for Digital Technology Capability, 0.840 for Digital Transformation Capability, and 0.875 for Operational Performance. These

results confirm that each construct explains more than half of the variance of its indicators, demonstrating satisfactory convergent validity.

A note on the high loadings and reliability values (all >0.91, Cronbach's α >0.95): While these values exceed conventional thresholds, they reflect the focused conceptual scope of each construct and the use of well-validated scales adapted from prior studies (Bag et al., 2025; Yu et al., 2022; Blatz et al., 2018). High loadings are not inherently problematic as long as discriminant validity is established, which is demonstrated in Table 2.

Table 2. Convergent Validity Test

Variable	Indicator	Loading Factor	AVE
Digital Culture (DC)	There is a positive attitude to digital technologies	0.944	0.893
	Employees are ready to take advantage of new digital operations models	0.941	
	Employees see opportunities in digitalization	0.940	
	There is a positive attitude in a firm to remote working with digital technologies	0.954	
	There is a positive attitude to the training on digitalization	0.948	
Digital Technology Capability (DTC)	Use digital technology to reconfigure processes when markets change.	0.927	0.866
	Modify workflows digitally to respond to customer demand.	0.931	
	Adjust products/services quickly using digital technologies.	0.936	
	Reorganize operations digitally to handle unexpected changes.	0.934	
	Use digital tools to detect changes in customer needs.	0.937	
	Digital systems enable rapid response to demand changes.	0.935	
	Digital technologies support fast operational decisions.	0.929	
	Digital technologies align with business objectives.	0.933	
	Digital tools integrate with daily work processes.	0.932	
	Digital systems support employees' tasks effectively.	0.930	
Digital Transformation Capability (DTrC)	Identify opportunities for digital-driven process changes	0.915	0.840
	Formulate and implement digital transformation aligned with goals	0.922	
	Coordinate functions to execute digital transformation	0.918	
	Reconfigure resources and workflows digitally when needed	0.914	
	Successfully implement digital changes to improve operations	0.917	
Operational Performance (OP)	Raise the quality of products and services	0.935	0.875
	Increase process improvements	0.938	
	Reduce total costs	0.936	
	Attract more customers	0.932	
	Easily modify products to a specific customer need	0.934	

Construct Reliability

Construct reliability results indicate a high level of internal consistency (Table 3). Cronbach's alpha values range from 0.953 to 0.983, while composite reliability values range from 0.963 to 0.985, both exceeding the recommended minimum of 0.70. These findings confirm that all constructs are reliable and suitable for structural model analysis.

Table 3. Construct Reliability Test

Construct	Cronbach's Alpha	Composite Reliability
Digital Culture (DC)	0.970	0.977
Digital Technology Capability (DTC)	0.983	0.985
Digital Transformation Capability (DTrC)	0.953	0.963
Operational Performance (OP)	0.964	0.972

Discriminant Validity and Common Method Variance

Discriminant validity was assessed using the Fornell–Larcker criterion and HTMT ratio (Table 4). The square root of AVE for each construct is higher than its correlations with other constructs, indicating adequate discriminant validity. This result is further supported by HTMT values below the conservative threshold of 0.85, with the highest value being 0.815. In addition, the variance inflation factor (VIF) values range from 1.014 to 3.211, which are below the critical threshold of 3.3. This indicates that multicollinearity is not a concern and that common method bias is unlikely to affect the model estimation.

To further assess common method bias, Harmon's single-factor test was conducted. The unrotated factor solution explained 38.7% of the total variance, below the 50% threshold, indicating that common method bias is not a major threat.

Table 4. Discriminant Validity and Common Method Variance

Fornell-Larcker Criterion	DC	DTC	DTrC	OP
Digital Culture (DC)	0.945			
Digital Technology Capability (DTC)	-0.116	0.930		
Digital Transformation Capability (DTrC)	0.432	0.571	0.917	
Operational Performance (OP)	0.423	0.615	0.838	0.935
HTMT Ratio				
Digital Technology Capability (DTC)	0.120			
Digital Transformation Capability (DTrC)	0.449	0.590		
Operational Performance (OP)	0.437	0.630	0.815	
Multicollinearity and Common Method Variance				
Digital Culture (DC)			1.021	1.749
Digital Technology Capability (DTC)			1.014	2.295
Digital Transformation Capability (DTrC)				3.211

Explanatory Power of the Structural Model

The structural model demonstrates substantial explanatory power (Table 5). Digital Transformation Capability has an R^2 value of 0.689 (Adjusted R^2 = 0.685), indicating that 68.9% of its variance is explained by the predictor variables. Operational Performance shows an R^2 value of 0.799 (Adjusted R^2 = 0.796), suggesting that nearly 80% of its variance is explained by Digital Technology Capability, Digital Transformation Capability, and the moderating mechanism. The minimal difference between R^2 and adjusted R^2 indicates that the model does not suffer from overfitting and has good estimation stability.

Effect sizes (f^2) were calculated to assess the practical significance of each predictor. Following Cohen's (1988) guidelines ($f^2 \geq 0.02$ small, ≥ 0.15 medium, ≥ 0.35 large), the results show that Digital Technology Capability has a large effect on Digital Transformation Capability

(f^2 = 1.482). For Operational Performance, Digital Technology Capability exhibits a large effect (f^2 = 0.876), while Digital Transformation Capability shows a moderate-to-large effect (f^2 = 0.324). The interaction terms demonstrate moderate effect sizes (f^2 = 0.189 for DTC×DC → DTrC; f^2 = 0.112 for DTC×DC → OP). These values confirm that the significant path coefficients also represent practically meaningful relationships.

Table 5. Model Explanatory Power Assessment

	R Square	R Square Adjusted
Digital Transformation Capability	0.689	0.685
Operational Performance	0.799	0.796

Predictive Relevance (Q^2)

The Stone–Geisser's Q^2 values are 0.572 for Digital Transformation Capability and 0.692 for Operational Performance (Table 6), both well above zero and exceeding the threshold for large predictive relevance. This indicates that the model has strong predictive capability and is able to accurately predict data points not used in the estimation process.

Table 6. Predictive Relevance (Q^2)

	SSO	SSE	Q2 (=1-SSE/SSO)
Digital Transformation Capability	0.689	0.685	0.572
Operational Performance	0.799	0.796	0.692

Importance-Performance Map Analysis (IPMA)

The IPMA results (Figure 1) show that Digital Technology Capability has the highest importance (total effect ≈ 0.70) in explaining Operational Performance, although its performance score is around the mid-range. This suggests that improving this capability would generate the greatest impact on operational performance. Digital Transformation Capability and Digital Culture show moderate importance (≈ 0.43–0.45) with similar performance levels, indicating their complementary strategic role in strengthening the effectiveness of digital technology utilization. From a managerial perspective, these findings highlight Digital Technology Capability as the primary intervention priority, supported by the development of digital transformation capability and digital culture to maximize operational performance.

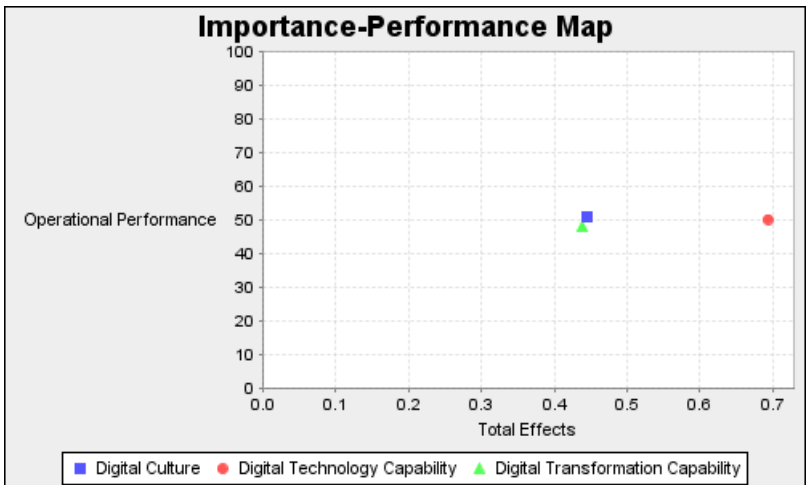

Figure 1. Importance-Performance Map for Operational Performance

Model Fit

The model fit assessment indicates that the estimated structural model demonstrates an excellent level of goodness-of-fit. As shown in Table 7, the Standardized Root Mean Square Residual (SRMR) value for the saturated model is 0.024 and for the estimated model is 0.025.

Both values are well below the conservative threshold of 0.08 and even the stricter cut-off value of 0.05, indicating a very small discrepancy between the observed and predicted correlation matrices. However, it should be noted that global fit indices in PLS-SEM remain a subject of ongoing debate, and SRMR should be interpreted as a descriptive measure rather than a definitive test of model fit. The minimal difference between the saturated and estimated models further suggests that the specified structural relationships are well aligned with the empirical data and do not suffer from substantial model misspecification. Therefore, the model can be considered to have a very good fit and is appropriate for subsequent hypothesis testing.

Table 7. Model Fit

	Saturated Model	Estimated Model
SRMR	0.024	0.025

Direct and Interaction Effects

The results of the structural model analysis reveal that digital technology capability has the strongest effect on digital transformation capability (β = 0.632, p < 0.001). All reported p-values and confidence intervals are based on 5,000 bootstrap resamples with 95% bias-corrected confidence intervals. This finding indicates that firms with higher levels of technological capability are more capable of developing and implementing digital transformation initiatives. Digital technology capability also has a significant direct effect on operational performance (β = 0.435, p < 0.001). In addition, digital transformation capability significantly improves operational performance (β = 0.381, p < 0.001). The significance of both the direct and indirect paths indicates a complementary relationship between technological capability and transformation capability in enhancing performance.

The interaction analysis shows that digital culture significantly moderates the relationship between digital technology capability and digital transformation capability (β = 0.350, p < 0.001). This result suggests that the positive effect of technological capability on transformation becomes stronger when the organization has a higher level of digital culture. Similarly, digital culture strengthens the relationship between digital technology capability and operational performance (β = 0.243, p < 0.001). This finding highlights the role of digital culture as an enabling mechanism that allows firms to better convert technological capability into performance outcomes. These results are consistent with the Importance–Performance Map Analysis, which identifies digital technology capability as the most important construct in driving operational performance. This indicates that the construct with the largest structural effect also represents the highest managerial priority.

Table 8. Direct and Interaction Effect

Hypothesis	β	Std Dev	T Statistics	P Values
Digital Technology Capability → Digital Transformation Capability	0.632	0.037	17.120	0.000
Digital Transformation Capability → Operational Performance	0.381	0.048	7.858	0.000
Digital Technology Capability → Operational Performance	0.435	0.047	9.197	0.000
Digital Technology Capability x Digital Culture → Digital Transformation Capability	0.350	0.036	9.870	0.000
Digital Technology Capability x Digital Culture → Operational Performance	0.243	0.037	6.617	0.000

The interaction plot between digital technology capability and digital culture on digital transformation capability shows a clear strengthening pattern. At low levels of digital culture (–1 SD), the slope is relatively flat, indicating that technological capability produces only limited

transformation outcomes. At the mean level of digital culture, the slope becomes steeper, suggesting a stronger effect. At high levels of digital culture (+1 SD), the slope is the steepest, meaning that increases in technological capability lead to substantially higher transformation capability.

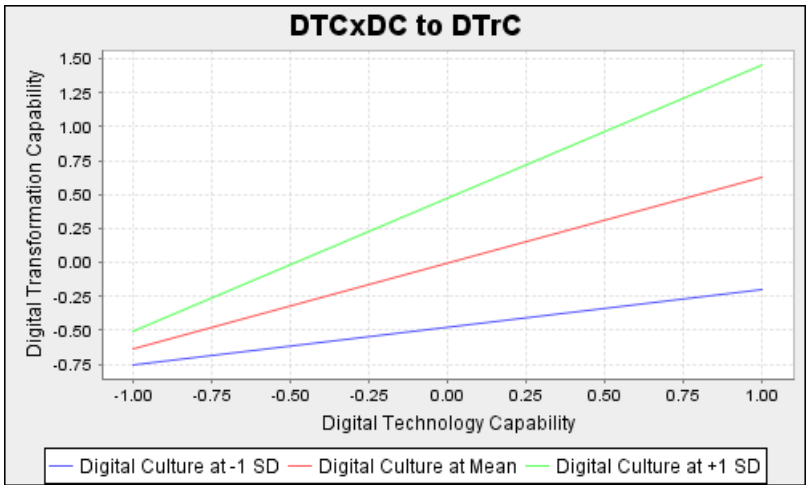

Figure 2. Interaction between Digital Technology Capability and Digital Culture towards Digital Transformation Capability

A similar pattern is observed in the interaction effect on operational performance. When digital culture is low, improvements in technological capability result in only modest performance gains. However, when digital culture is high, the impact of technological capability on performance becomes much stronger. This confirms that digital culture acts as a strategic catalyst that maximizes the value of technological investments.

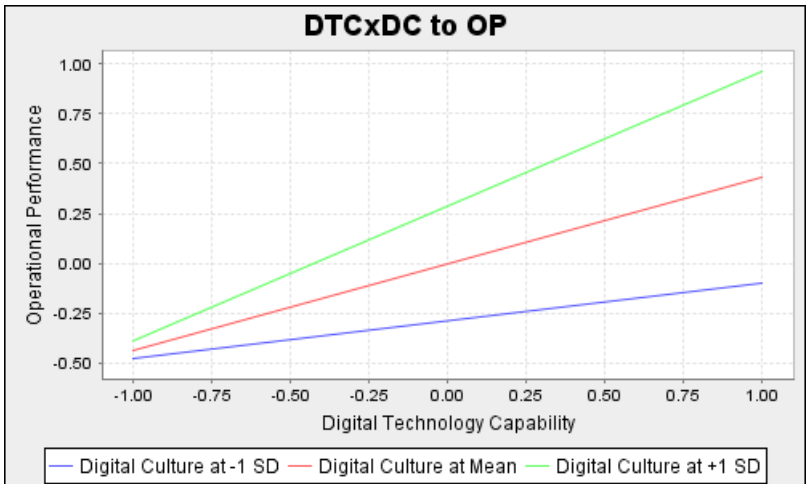

Figure 3. Interaction between Digital Technology Capability and Digital Culture towards Operational Performance

Mediation Analysis

The mediation test shows that digital transformation capability significantly mediates the relationship between digital technology capability and operational performance ($\beta = 0.240$, $t = 7.466$, $p < 0.001$). The 95% bias-corrected confidence interval [0.180, 0.305] does not include zero, confirming the significance of the indirect effect. This result indicates that part of the effect of technological capability on operational performance is transmitted through the firm's ability to transform its processes, structures, and practices digitally. Since the direct effect of digital

technology capability on operational performance remains significant, the mediation can be classified as partial mediation. This means that technological capability improves operational performance both directly and indirectly through digital transformation capability. Substantively, this finding suggests that technological resources alone are not sufficient. Firms must also possess the capability to transform and embed those technologies into their operations in order to fully realize performance benefits.

Table 9. Mediation Analysis

Hypothesis	β	Std Dev	T Statistics	P Values
Digital Technology Capability → Digital Transformation Capability → Operational Performance	0.240	0.032	7.466	0.000

Discussion

This study examines how digital technology capability drives operational performance through digital transformation capability and how digital culture strengthens these relationships in Indonesian MSMEs. The findings provide several important theoretical and managerial insights. First, the results demonstrate that digital technology capability has a strong positive effect on digital transformation capability. This confirms that the mere adoption of digital tools is not the endpoint; rather, it forms the foundational capability that enables firms to sense opportunities, organize resources, and reconfigure processes for transformation. This finding aligns with prior studies (Bag et al., 2025; Yu et al., 2022), but the effect size observed in our Indonesian MSME sample is notably larger than those reported in similar studies of larger firms (Heredia et al., 2022). One possible explanation is that Indonesian MSMEs operate from a lower baseline of digital maturity, meaning that initial improvements in digital technology capability produce steeper gains in transformation capability, or a "catch-up effect" common in emerging market contexts (Chatterjee et al., 2023; Epede & Wang, 2022). In the MSME context, this is particularly relevant because digital initiatives often begin with operational tools (e.g., platforms, mobile systems, cloud-based coordination) before evolving into broader organizational transformation. This finding reinforces the dynamic capability perspective, which posits that resource-based technological competence must be translated into higher-order transformation capability to generate strategic value.

Second, digital transformation capability significantly improves operational performance. This indicates that performance gains do not come directly from technology ownership, but from the firm's ability to embed digital technologies into workflows, decision-making processes, and product or service development. This finding is consistent with the process-oriented view of digitalization advanced by Vrontis et al. (2022) and Omrani et al. (2024), who argue that transformation capability is the primary mechanism linking technology investment to performance. However, our results extend prior research by demonstrating that this relationship holds even in resource-constrained MSME settings, where prior studies have been predominantly focused on large enterprises (Dubey et al., 2023; Shahadat et al., 2023). For MSMEs, transformation capability enables faster process improvement, greater customization, and better responsiveness to market changes. This explains why firms that actively restructure and innovate through digital initiatives achieve superior operational outcomes.

Third, digital technology capability also has a direct positive effect on operational performance, indicating partial mediation. This suggests that digital technologies in MSMEs play a dual role. On the one hand, they directly enhance efficiency, cost control, and customer reach. On the other hand, they indirectly improve performance by enabling broader organizational transformation. This dual-path mechanism is important because it shows that MSMEs can gain short-term operational benefits while simultaneously building long-term transformation capability. This partial mediation finding contrasts with some prior studies that reported full

mediation in larger firms (Leso et al., 2024; Cranney et al., 2025), suggesting that in MSMEs, where organizational structures are flatter and decision-making is less bureaucratic, digital technologies may have a more immediate direct effect on operational performance without requiring full-scale transformation (Islam Bhuiyan et al., 2024; Faiz et al., 2024).

Fourth, the mediating role of digital transformation capability confirms its position as a key conversion mechanism through which technological capability is translated into performance outcomes. This finding extends prior digital transformation literature by empirically showing that transformation capability is not merely an outcome of digital investment but a strategic bridge that connects technological resources to operational value. Specifically, our study contributes to the emerging stream of research on digital transformation in emerging economies (Costa et al., 2023; Epede & Wang, 2022; Shahadat et al., 2023) by demonstrating that the mediation effect is both statistically significant and practically meaningful, with the indirect effect accounting for approximately 36% of the total effect of digital technology capability on operational performance.

Fifth, digital culture strengthens the effect of digital technology capability on both digital transformation capability and operational performance. The interaction results and slope analysis show that when firms have a strong digital culture—characterized by positive attitudes toward digitalization, openness to new ways of working, and readiness to learn—technological capability becomes significantly more impactful. In contrast, in firms with weak digital culture, the same level of technological capability produces substantially lower transformation and performance outcomes. This moderating effect is consistent with recent findings by Hautala-Kankaanpää (2022) and Shin et al. (2023), but appears stronger in our Indonesian MSME context, possibly because digital culture in resource-constrained settings compensates for other structural and institutional limitations (Özkan Alakaş, 2024; El-Sayed et al., 2025). When formal digital strategies and dedicated IT budgets are absent, cultural readiness becomes the primary enabler of digital success. This highlights that technology investment alone is insufficient; cultural readiness determines whether digital initiatives succeed or stagnate.

Taken together, these findings suggest that digital culture acts as a catalytic mechanism that amplifies the value of technological capability. For MSMEs, where resources are constrained, culture becomes a low-cost but high-impact enabler of digital transformation success.

4. Conclusion

This study set out to explain how digital technology capability improves the operational performance of MSMEs by examining the mediating role of digital transformation capability and the moderating role of digital culture. The findings show that digital technology capability functions as a fundamental driver of performance both directly and indirectly through digital transformation capability, indicating that operational gains from digitalization are achieved not only through the adoption of technological tools but also through the firm's ability to reconfigure processes and practices around them. The results further demonstrate that digital culture strengthens this mechanism, as firms with stronger cultural readiness toward digitalization are better able to convert technological capability into transformation outcomes and superior operational performance.

This study makes three unique contributions to the literature. First, it advances the dynamic capability perspective by empirically demonstrating that digital transformation capability serves as a mediating mechanism between technological capability and operational performance, which is a hierarchical relationship that prior studies have largely treated as a black box. Second, it identifies digital culture as a boundary condition that amplifies the effectiveness of digital technology capability, with simple slope analysis showing that the effect of DTC on DTrC more than doubles when digital culture is high. Third, by focusing on Indonesian

MSMEs across six diverse sectors, this study extends prior research that has predominantly examined large firms or high-income country contexts, thus providing evidence that the proposed mechanisms hold even under resource-constrained conditions. In the context of MSMEs, this study highlights that transformation capability serves as the key mechanism through which limited technological investments can generate meaningful operational improvements. At the same time, the strong moderating effect of digital culture underscores that cultural support for digital initiatives is not a peripheral factor but a central condition that determines whether digital investments produce substantial results.

From a practical perspective, the results suggest that MSME managers should not focus solely on acquiring digital technologies but also on developing internal capabilities to integrate those technologies into business processes and on fostering a work environment that is open to digital experimentation, learning, and change. Strengthening digital culture through training, leadership support, and employee involvement can significantly enhance the effectiveness of digital initiatives without requiring substantial additional financial resources. Specifically, managers might consider low-cost interventions such as designating "digital champions" within the organization, encouraging peer-to-peer digital skills sharing, and publicly recognizing employees who experiment with new digital tools.

Despite these contributions, this study is limited by the use of cross-sectional design and focus on a single national context, which may restrict the ability to generalize the findings to different institutional environments.

Despite these contributions, this study has several limitations that should be acknowledged. First, the cross-sectional design precludes causal inference. As such, statements of association rather than causation are intended throughout this discussion. While our hypothesized model is grounded in dynamic capability theory, alternative directional relationships (e.g., high performance enabling greater digital investment) cannot be ruled out. Second, common method bias may be a concern given that all data were collected from single respondents (owners or managers). Although Harmon's single-factor test (38.7% variance) and procedural remedies were implemented, the risk of inflation in observed relationships cannot be entirely eliminated. Third, the study focused on a single national context which may limit generalizability to other emerging or developed economies with different institutional support structures, digital infrastructure, and cultural norms. Fourth, the sample includes MSMEs from six business sectors; while this diversity enhances external validity, it also means that sector-specific dynamics (e.g., regulatory differences, supply chain structures) were not separately modeled.

Future research may address these limitations by adopting longitudinal approaches to establish temporal precedence and causal direction, replicating this model across multiple countries to assess cross-cultural invariance, employing multi-level analysis that separates firm-level from individual-level effects, collecting data from multiple respondents per firm to reduce common method bias, incorporating objective performance measures (e.g., sales growth, profit margins) alongside perceptual measures, and examining whether the mediating role of digital transformation capability varies systematically across sectors or firm sizes. Additionally, future studies could explore potential reverse or reciprocal relationships, for instance, whether sustained operational performance subsequently reinforces digital culture or enables further digital capability development.

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