Siber Journal of Transportation and Logistic (SJTL)
E-ISSN: 2987-1050
P-ISSN: 2987-1026
+62 822 1012 3600 https://research.e-siber.org siberpublisher.info@gmail.com

DOI: https://doi.org/10.38035/sjtl.v4i1.795

The Influence of Digital Transformation Dimensions on Operational Efficiency and Logistics Service Performance at KCU Padang PT Pos Indonesia

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Abstract: This study examines the influence of three digital transformation dimensions, technology adoption, digital HR readiness, and top management support, on operational efficiency and logistics service performance at PT Pos Indonesia's Padang Main Branch Office. Using the TOE Framework and PLS-SEM with SmartPLS 4.0, data from 58 employees were analyzed. Five of six hypotheses were supported, revealing a previously undocumented cross dimensional pattern, digital HR readiness emerged as the strongest predictor of operational efficiency ($\beta = 0.553$, $f^2 = 0.485$), while technology adoption and top management support more strongly influenced service performance. The model explains 77.2% and 69.8% of variance respectively. These findings indicate that internal efficiency is primarily determined by human readiness, while customer facing service quality is driven by the combination of technology and leadership.

Keyword: Digital Transformation, Operational Efficiency, Logistics Service Performance, TOE Framework.

INTRODUCTION

Indonesia's logistics costs remain at approximately 23% of GDP, well above the ASEAN average of under 15% (World Bank, 2023). In an archipelagic nation spanning more than 17,000 islands, the logistics challenge extends beyond operational efficiency to the fundamental question of reaching geographically dispersed customers. The national digital roadmap transformation digital 2021-2024 (Kementerian Koordinator Bidang Perekonomian, 2023) has positioned state owned (Badan Usaha Milik Negara) logistics enterprises as key drivers of this transformation, including PT Pos Indonesia now undertaking a shift to digital transformation.

Since 2021, PT Pos Indonesia has implemented integrated digital systems under Directors' Decree No. KD.081/DIRUT/0821 (PT Pos Indonesia, 2021). At KCU Padang, this transformation has entered what may be characterized as a maturity phase, digital systems are available, deployed, and used on a daily basis. Yet the availability of technology has not

automatically produced uniform outcomes. As an active employee at KCU Padang, the researcher observed four phenomena that served as the departure point for this study.

First, technology utilization levels varied across departments despite uniform system availability, indicating that access alone does not guarantee effective use. Second, a gap existed between employees' ability to operate digital systems and their capacity to troubleshoot technical problems, they could use the systems, but could not resolve issues when disruptions occurred. Third, digital competency had not been incorporated into the performance evaluation system, creating no formal incentive for employees to develop deeper technological proficiency. Fourth, despite continued technology investment, customer perceived service quality had not improved proportionally.

These four phenomena converge on a single question, in an organization that has already passed the initial adoption stage, which dimension of digital transformation most determines performance, and does the answer differ depending on the type of performance being measured.

The theoretical framework employed is the TOE Framework (Tornatzky et al., 1990), which identifies three contextual determinants of innovation outcomes, technology, organization, and environment. While widely used to explain adoption decisions, its application to analyzing differential performance impacts, particularly the distinction between internal efficiency and customer facing service quality, remains limited. This study operationalizes the technological context as digital technology adoption (X1), the organizational context as digital HR readiness (X2) and top management support (X3), and measures two distinct performance outcomes, operational efficiency (Y1) and logistics service performance (Y2).

Several prior studies provide important foundations. Birkel & Wehrle (2024), found that digitalization without HR readiness becomes merely reactive-pragmatic, technology exists but its benefits remain unrealized. Cichosz et al. (2020) identified human factors as the primary critical success factor in European logistics firms' digital transformation. Ngo et al. (2023) confirmed technology competence as a significant driver within the TOE framework.

However, as Vial (2019) noted, digital transformation is a multidimensional phenomenon requiring differentiated analysis, and herein lies the unfilled research gap.Prabawa & Rizan (2015), who also studied PT Pos Indonesia, indicated that IT and leadership jointly influence performance, but did not separate their relative contributions. To date, no study has simultaneously examined how different transformation dimensions affect different types of performance, internal efficiency versus customer service, within a single organizational context.

This study tests six hypotheses positing that each transformation dimension positively and significantly affects each type of performance. Figure 1 presents the conceptual framework.

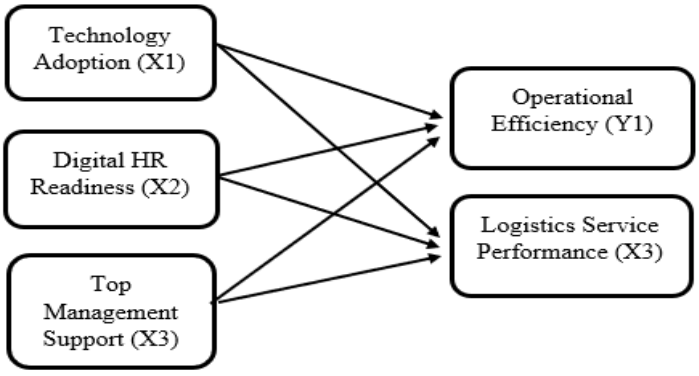


Figure 1. Conceptual Framework and Research Hypotheses

METHOD

This quantitative study employs a cross-sectional survey design targeting all active employees at KCU Padang and its 20 subordinate branch offices (N = 80). Four individuals were excluded prior to questionnaire distribution, the Executive General Manager and Deputy EGM as subjects of the top management support evaluation, to avoid self assessment bias, the researcher (an active employee, to avoid demand characteristics bias), and one employee who had not met the minimum six month tenure criterion. The effective population was 76. Given this small population size (N < 100), a census approach was adopted, distributing the questionnaire to the entire population rather than drawing a sample. This total sampling method is appropriate when the population is fully accessible and does not exceed 100 individuals. The final valid sample of 58 was subsequently verified against PLS-SEM minimum sample size requirements using the 10 times rule (Hair et al., 2019), the minimum sample equals 10 times the maximum number of structural paths directed at any single construct. In this model, both Y1 and Y2 receive three paths each (from X1, X2, and X3), yielding a minimum requirement of 10 × 3 = 30. The valid sample of 58 substantially exceeds this threshold, providing adequate statistical power for the analysis.

Data were collected via Google Form distributed personally and through official WhatsApp and Telegram groups over five working days in May 2026, yielding 73 responses (response rate: 96%). To mitigate Common Method Bias inherent in single source self report data, independent variables (Section B1: Digital Transformation Conditions) and dependent variables (Section B2: Perceived Impacts) were placed on separate pages with distinct instructions, full respondent anonymity was maintained, and confidentiality was explicitly guaranteed (Podsakoff et al., 2003).

Two reverse coded control items (X: 'I feel overwhelmed by digital systems', and X: 'Work processes have become slower after digitalization') were embedded for straight-lining detection. Fourteen respondents who scored ≥ 4 (Agree or Strongly Agree) on both control items while simultaneously scoring high on regular items stating the opposite were identified as logically inconsistent and excluded. One additional respondent who acknowledged misunderstanding the scale direction was also removed. The final valid sample comprised 58 respondents with 40 indicators, exceeding PLS-SEM minimum requirements (Hair et al., 2019).

The instrument uses a five point Likert scale with items adapted from established instruments, technology adoption from Davis (1989), service performance from Delone & McLean (2003), HR readiness from Parasuraman et al. (1988), management support from Tornatzky et al. (1990) Westerman et al. (2014), and operational efficiency from Mentzer et al. (2001). Content validity was established through expert judgment by the thesis supervisor. Analysis was conducted using PLS-SEM in SmartPLS 4.0 with 5,000 bootstrap subsamples (BCa, two-tailed, $\alpha = 0.05$) and PLSpredict with omission distance d = 7.

RESULTS AND DISCUSSION

Descriptive Findings

Respondents comprised 55.2% males and 44.8% females. The largest age group was 35–44 years (36.2%), with senior high school graduates forming the largest educational group (44.8%). The majority came from service departments (53.4%) with permanent employment status (65.5%). This profile reflects the typical mid-sized Indonesian post office, most employees are long tenured, 29.3% have served 11–20 years, individuals who began their careers in the different era and are now required to adapt to digital systems.

All variables recorded means above 4.0, indicating generally positive perceptions. Behind these averages, however, indicator level analysis revealed significant variation. The most striking finding was the gap between X2.1 (ability to operate digital systems, M =

4.224) and X2.2 (ability to troubleshoot technical problems, M = 3.397), a difference of 0.827 points. X2.2 also recorded the highest standard deviation in the entire dataset (0.935), indicating substantial disagreement among employees regarding their troubleshooting capacity. This gap is not merely a statistical artifact, it mirrors daily operational reality, employees use systems, but when the network drops or data fails to synchronize, most must wait for IT support.

Two infrastructure indicators recorded the lowest scores within the technology adoption variable, network reliability (X1.7, M = 3.862) and IT support responsiveness (X1.8, M = 3.948). On the management side, training time allocation (X3.4, M = 3.914) was the lowest rated indicator, and the connection between limited training time and low troubleshooting capability is readily apparent.

Measurement Model Assessment

All constructs met reliability and convergent validity criteria. Table 1 presents the results.

Table 1. Construct Reliability and Validity

Konstruk	α	rho_a	CR	AVE
Technology Adoption (X1)	0,908	0,927	0,928	0,623
Digital HR Readiness (X2)	0,863	0,882	0,893	0,517
Top Management Support (X3)	0,893	0,908	0,914	0,574
Operational Efficiency (Y1)	0,932	0,939	0,945	0,684
Logistics Service Performance (Y2)	0,929	0,941	0,943	0,678

Source: Output SmartPLS 4.0 (2026)

Cronbach's alpha ranged from 0.863 to 0.932, composite reliability from 0.893 to 0.945, and AVE from 0.517 to 0.684, all exceeding the thresholds recommended by Hair et al. (2019). The lowest AVE belonged to X2 (0.517), which, while just above the 0.50 threshold.

Table 2 presents the outer loadings for all indicators. Of the 40 indicators, 31 exceeded the ideal 0.708 threshold, the remaining nine fell within the 0.40–0.70 retention zone and were maintained as their removal did not improve CR or AVE (Hair et al., 2019).

Table 2. Outer Loadings

Var	Indikator	Loading	Status
X1	X1.1	0,735	Valid
	X1.2	0,918	Valid
	X1.3	0,912	Valid
	X1.4	0,900	Valid
	X1.5	0,842	Valid
	X1.6	0,755	Valid
	X1.7	0,630	Retention
	X1.8	0,529	Retention
X2	X2.1	0,612	Retention
	X2.2	0,587	Retention
	X2.3	0,734	Valid
	X2.4	0,791	Valid
	X2.5	0,861	Valid
	X2.6	0,839	Valid

Var	Indikator	Loading	Status
	X2.7	0,604	Retention
	X2.8	0,662	Retention
X3	X3.1	0,754	Valid
	X3.2	0,826	Valid
	X3.3	0,809	Valid
	X3.4	0,733	Valid
	X3.5	0,733	Valid
	X3.6	0,841	Valid
	X3.7	0,714	Valid
	X3.8	0,628	Retention
Y1	Y1.1	0,949	Valid
	Y1.2	0,866	Valid
	Y1.3	0,761	Valid
	Y1.4	0,705	Retention
	Y1.5	0,898	Valid
	Y1.6	0,742	Valid
	Y1.7	0,823	Valid
	Y1.8	0,844	Valid
Y2	Y2.1	0,727	Valid
	Y2.2	0,577	Retention
	Y2.3	0,912	Valid
	Y2.4	0,899	Valid
	Y2.5	0,907	Valid
	Y2.6	0,907	Valid
	Y2.7	0,750	Valid
	Y2.8	0,844	Valid

Source: Output SmartPLS 4.0 (2026)

Discriminant validity was assessed via Fornell-Larcker and HTMT criteria. Three HTMT pairs exceeded 0.85: X1-X2 (0.858), X2-Y1 (0.936), and Y1-Y2 (0.943). Table 3 presents the HTMT matrix.

Table 3. Heterotrait-Monotrait Ratio (HTMT)

	X1	X2	X3	Y1	Y2
X1	-				
X2	0,858	-			
X3	0,678	0,688	-		
Y1	0,833	0,936	0,702	-	
Y2	0,836	0,815	0,722	0,943	-

Source : Output SmartPLS 4.0 (2026)

These elevated HTMT values reflect conceptual proximity that is understandable within the logistics context. Technology adoption and HR readiness develop together, organizations with advanced technology tend to have better trained employees, and vice versa. The Y1-Y2

correlation (0.943) reflects the tight operational coupling between internal processing speed and delivery timeliness in logistics operations. What confirms that maintaining separate constructs retains analytical value is the divergent predictor pattern. X2 significantly predicts Y1 but not Y2, while X1 more strongly predicts Y2 than Y1. This pattern would remain hidden if both constructs were merged. Nevertheless, future research may consider testing Y1 and Y2 as a combined organizational performance construct.

Structural Model and Hypothesis Testing

The model demonstrated strong explanatory and predictive power. R^2 was 0.772 for operational efficiency, while R^2 of 0.698 for service performance falls in the moderate to strong range. Q^2predict values from the PLSpredict procedure (0.744 and 0.644) confirmed that the model not only explains existing data but can also predict new observations. Table 4 summarizes the model evaluation.

Table 4. Model Evaluation Summary

Variabel	R^2	R^2 Adjusted	Q^2 predict
Y1 Efficiency	0,772	0,759	0,744
Y2 Service Performance	0,698	0,682	0,644

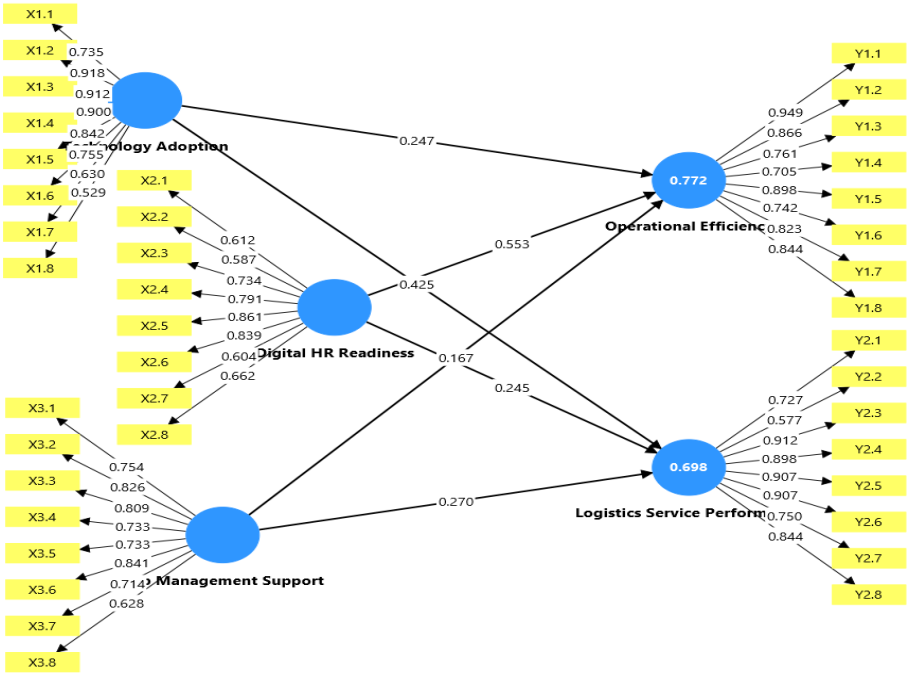
Source : Output SmartPLS 4.0 (2026)

Table 5 presents the hypothesis testing results, and Figure 2 displays the structural model from SmartPLS.

Table 5. Hypothesis Testing Results (Bootstrapping: 5,000 subsamples, BCa, two-tailed)

	Path	β	M	STDEV	t	p	Decision
H1	X1→Y1	0.247	0.225	0.124	1.996	0.046	Supported
H2	X1→Y2	0.425	0.392	0.142	3.001	0.003	Supported
H3	X2→Y1	0.553	0.569	0.124	4.464	0.000	Supported
H4	X2→Y2	0.245	0.258	0.179	1.373	0.170	Not Supported
H5	X3→Y1	0.167	0.172	0.074	2.259	0.024	Supported
H6	X3→Y2	0.270	0.289	0.103	2.624	0.009	Supported

Source : Output SmartPLS 4.0 (2026)



Source: Output SmartPLS 4.0

Figure 2. Structural Model Results

Table 6. Effect Sizes (f^2)

Path	f^2	Category
X1→Y1	0,097	Small
X1→Y2	0,216	Medium
X2→Y1	0,485	Large
X2→Y2	0,072	Small
X3→Y1	0,070	Small
X3→Y2	0,138	Medium

Source: Output SmartPLS 4.0

The Cross Dimensional Pattern

Five of six hypotheses were supported, but more informative than the count is the pattern that emerged. The three transformation dimensions did not exert uniform effects, each operated through distinct pathways depending on the type of performance being targeted.

For operational efficiency, the influence configuration was dominated by HR readiness (f^2 = 0.485), followed by technology adoption (f^2 = 0.097) and management support (f^2 = 0.070). For service performance, the configuration shifted, technology became the primary driver (f^2 = 0.216), supported by management (f^2 = 0.138), while HR readiness receded to non significance.

Within the TOE Framework, this pattern is interpretable. Operational efficiency experienced by employees through faster processing, shipment handling speed, data entry accuracy, and workflow fluidity, is at its core a human performance outcome. Whether an employee processes a shipment in five minutes or fifteen depends not on whether the technology exists, but on whether that employee has mastered it. Service performance, experienced by customers through delivery timeliness, tracking accuracy, and complaint responsiveness, is at its core a system and policy outcome. Customers do not perceive whether the employee behind the counter is digitally skilled, they perceive whether the package arrives on time and the tracking information is reliable.

The resource allocation implication is clear, organizations seeking to improve internal efficiency should invest in HR development, while those seeking to enhance customer service quality should prioritize technology infrastructure and management engagement. Applying a uniform strategy to both objectives means one target will inevitably be underserved.

Hypotheses 1 and 2: Digital Technology Adoption

At KCU Padang, technology adoption is already high and relatively uniform (X1 mean = 4.317). In this maturity phase context, where technology is no longer novel, it is expected that efficiency variation would be explained more by human capability than by technology availability. This accounts for why the X1-Y1 effect, while significant, is small ($\beta = 0.247$, $f^2 = 0.097$) technology contributes, but its contribution is compressed because everyone already has roughly equal access. Tiss & Orellano (2023) describe similar dynamics in their digital maturity framework, where the differentiating factor shifts from whether technology is available to how proficient its users are.

The picture differs markedly for service performance. Technology adoption's effect on Y2 ($\beta = 0.425$, $f^2 = 0.216$) is more than double its effect on efficiency. This is because the functions customers perceive, tracking accuracy, system performance, service reliability, notifications, complaint system responsiveness, are inherently system dependent rather than individual skill dependent. This finding aligns with (Rai et al., 2006) on digital integration's impact on delivery dependability, and with Ngo et al. (2023) who identified technology competence as a significant TOE driver.

The network reliability (X1.7, M = 3.862) and IT support responsiveness (X1.8, M = 3.948) indicators, which scored lowest within X1, deserve particular attention. Tracking systems and digital services are only as reliable as the infrastructure supporting them. The required investment is not in additional software, the organization already has adequate systems, but in strengthening the infrastructure that enables those systems to serve customers consistently.

Hypotheses 3 and 4: Digital HR Readiness

The finding that digital HR readiness is the single strongest predictor of operational efficiency ($\beta = 0.553$, $t = 4.464$, $f^2 = 0.485$) represents this study's central contribution. The X2-Y1 path produced the highest t-statistic in the model, by comparison, the X1-Y1 path ($t = 1.996$) is significant but approaches the threshold. This finding is consistent with Birkel & Wehrle (2024), who explicitly characterized digitalization without HR readiness as reactive-pragmatic, and with Cichosz et al. (2020), who ranked human factors as the primary success determinant. Building on the work of Prabawa & Rizan (2015), who explored PT. Pos Indonesia through a different methodological lens, this study extends their findings regarding the joint influence of IT and leadership on performance. It further advances this discourse by isolating human resource readiness as a distinct and dominant variable, analyzed via SEM-PLS.

The demographic context strengthens this interpretation. With 44.8% of respondents holding only senior high school diplomas and 29.3% having served 11–20 years, the KCU Padang employee profile reflects state owned (BUMN) enterprise workers who began their careers in the before transformation digital era and are now required to adapt to digital systems. The training provided appears sufficient for routine operations, operating tools, entering data into the system, but inadequate for building technical self sufficiency, diagnosing problems when systems fail to respond, verifying data discrepancies between platforms, or executing emergency procedures when networks go down.

An alternative interpretation must be acknowledged, The relationship between HR readiness and efficiency may partly reflect reverse causality, employees who are already

efficient may be more inclined to report high digital competence, not because competence causes efficiency but because confidence inflates both self assessments simultaneously. The cross-sectional design of this study cannot fully eliminate this possibility, and longitudinal research is needed to clarify the direction of causality.

Meanwhile, the direct effect of HR readiness on customer service performance proved non significant (H4: $\beta = 0.245$, $p = 0.170$), rendering this relationship statistically unreliable. This does not indicate that HR is irrelevant to service, but rather suggests that its influence operates indirectly, mediated by operational efficiency. More competent employees process shipments faster and more accurately (Y1), and that speed and accuracy is what customers subsequently experience as timely delivery and reliable tracking (Y2). The mediation pathway X2-Y1-Y2 was not tested in the current model and represents a promising direction for future research.

The plausibility of this mediation hypothesis is supported by the data, The service performance indicators most closely linked to efficiency, delivery timeliness (Y2.3, loading = 0.912), shipment accuracy (Y2.4, loading = 0.899), and tracking reliability (Y2.5, loading = 0.907) are precisely the outcomes that would logically improve when internal processing becomes faster and more accurate. The high HTMT between Y1 and Y2 (0.943), which on one hand constitutes a methodological caveat, on the other serves as substantive evidence of how tightly internal efficiency and service quality are operationally coupled in the logistics business.

Hypotheses 5 and 6: Top Management Support

One anomaly in the data is the loading of indicator X3.8 (integration of digital competency into performance evaluation), which at 0.628 was the lowest among X3 indicators and fell in the retention zone rather than the ideal zone. This is not merely a measurement issue, it reflects the reality that technology proficiency is not yet formally valued at KCU Padang. When digital competency carries no weight in performance evaluations, management's push for transformation lacks its institutional reinforcement, consistent with Mctaggart & Loonam (2024) finding that effective management support must be actively engaged rather than merely symbolic.

Despite this gap, both direct paths from X3 remained significant, toward efficiency ($\beta = 0.167$, $p = 0.024$) and toward service performance ($\beta = 0.270$, $p = 0.009$). The stronger effect on service performance suggests that management decisions, budget allocation for customer facing systems, infrastructure maintenance priorities, and direct involvement in resolving operational problems. translate more visibly into the service experience received by customers than into employees' internal work efficiency.

Novelty and Theoretical Contribution

This study extends the application of the TOE Framework in two directions. First, it moves beyond the framework's standard focus on adoption decisions toward differential performance outcomes, demonstrating that the same transformation dimensions produce non uniform effects on different types of organizational performance. Second, by separating internal efficiency from external service quality, a distinction rarely made in digital transformation research. It reveals that transformation dimensions possess specific influence pathways. The context of a state owned (BUMN) logistics enterprise in a mid-sized Indonesian city during its digital maturity phase offers a perspective distinct from the prevailing literature, which is dominated by studies of early stage adoption or digitally native firms.

CONCLUSION

This study demonstrates that digital transformation's impact on organizational performance is dimension specific rather than uniform. At KCU Padang, an organization in its digital maturity phase, operational efficiency is primarily determined by digital HR readiness ($\beta = 0.553$, $f^2 = 0.485$) large effec, while logistics service performance is driven by technology adoption ($\beta = 0.425$, $f^2 = 0.216$) and top management support ($\beta = 0.270$, $f^2 = 0.138$). The model explains 77.2% and 69.8% of variance respectively, with strong predictive relevance (Q^2predict = 0.744 and 0.644). All three TOE dimensions proved relevant, but each operates through a specific pathway determined by whether the outcome is internally or externally oriented.

Three practical recommendations follow directly from the findings. First, digital training programs must be redesigned from generic orientation to operational troubleshooting, the 0.827-point gap between operation ability and troubleshooting capacity makes this the highest impact intervention ($f^2 = 0.485$). Training should be differentiated by competency level, for sustained skill development. Second, infrastructure investment should prioritize customer facing components, real time tracking speed, automated shipment notifications, and responsive digital complaint portals. Network reliability and IT support responsiveness, the two lowest rated technology indicators should be addressed as immediate priorities. Third, digital competency must be formally integrated into annual performance evaluations, until technology proficiency is institutionally valued, management's support for transformation will remain symbolic rather than structural.

The study's limitations must be acknowledged. The cross-sectional design does not permit causal inference through experimental procedures, including the possibility of reverse causality on the X2-Y1 path. The sample of 58, while exceeding PLS-SEM minimum requirements, may produce slightly overestimated Hair et al. (2019), particularly for H1, which approaches the significance boundary ($p = 0.046$). All data derive from employee self-report at a single branch office, limiting generalizability.

Four directions for future research are recommended, specifically (1) testing the mediation pathway X2-Y1-Y2, (2) modeling Y1 and Y2 as a combined organizational performance construct given their high HTMT (0.943), (3) replicating across different organizational contexts, urban versus rural branches, or cross firm comparisons within Indonesia's logistics sector to test whether the dominance of HR readiness is universal or specific to the maturity phase, and (4) complementing employee perceptions with direct customer surveys to validate whether internal perceptions align with actual service experience (Schneider & Bowen, 1985).

Ultimately, this study demonstrates that digital transformation success is not about technology alon, it is about the long process of orchestrating technology, people, and leadership, where each plays a specific role in a specific domain of organizational performance. Understanding these specific roles, who needs to be developed, what needs to be strengthened, and how both connect, is the first step toward a digital transformation that does not merely adopt technology, but genuinely changes how an organization serves.

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