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Analysis of the Role of Digital Transformation, Infrastructure Availability, and Human Resource Competence on the Operational Performance of the Logistics Industry in Jakarta

Renalwin Sitorus[1], Eka Immamah[2]
[1] Sekolah Tinggi Penerbangan Aviasi and renalwins@gmail.com
[2] Sekolah Tinggi Penerbangan Aviasi and eka.immamah.88@gmail.com

ABSTRACT

The rapid development of the logistics industry in Jakarta has increased the need for organizations to improve operational performance through digitalization, infrastructure readiness, and workforce capability. This study aims to analyze the role of digital transformation, infrastructure availability, and human resource competence on the operational performance of logistics companies in Jakarta. A quantitative research approach was applied using survey data collected from 150 respondents through a structured questionnaire measured with a five-point Likert scale. Data analysis was conducted using SPSS version 25, including validity and reliability testing, classical assumption tests, multiple linear regression, t-tests, and F-tests. The results indicate that digital transformation has the strongest positive and significant effect on operational performance, followed by human resource competence and infrastructure availability. Simultaneously, the three variables significantly influence operational performance with an R^2 value of 0.623, indicating that 62.3% of performance variation can be explained by the research model. The findings suggest that integrating digital technologies with adequate infrastructure and competent human resources is essential for improving efficiency, service reliability, and competitiveness in the logistics sector. This study contributes to the literature by providing empirical evidence on the combined role of technological, infrastructural, and human capital factors in enhancing operational performance within a metropolitan logistics environment.

Keywords: *Digital Transformation, Infrastructure Availability, Human Resource Competence, Operational Performance, Logistics Industry*

1. INTRODUCTION

The logistics industry has become one of the most strategic sectors in supporting economic growth and supply chain sustainability, particularly in metropolitan areas such as Jakarta. As the main economic hub of Indonesia, Jakarta experiences high mobility of goods and services, increasing pressure on logistics companies to enhance efficiency, reliability, and responsiveness [1], [2]. Rapid technological advancement and the growth of e-commerce have accelerated the demand for faster delivery systems, integrated tracking mechanisms, and data-driven decision-making processes. Consequently, organizations in the logistics sector are increasingly required to adopt digital transformation initiatives to maintain competitiveness and improve operational performance [3], [4]. Digital technologies such as automation systems, cloud-based logistics platforms, and data analytics have shifted traditional logistics operations toward more adaptive and intelligent systems that enable real-time coordination across supply chain networks.

Digital transformation is often viewed as a critical driver of organizational performance because it enables companies to streamline workflows, reduce operational costs, and enhance service quality [5], [6]. Previous studies suggest that organizations that successfully integrate digital technologies into their operational processes tend to achieve higher efficiency and better performance outcomes (Vial, 2019; Bharadwaj et al., 2013). In the logistics context, digital transformation facilitates improved route planning, inventory monitoring, and communication between stakeholders, ultimately contributing to faster delivery times and improved customer

satisfaction. However, digital transformation alone does not guarantee operational success [7], [8]. Its effectiveness largely depends on the availability of supporting infrastructure and the competence of human resources who manage and operate technological systems.

Infrastructure availability plays a significant role in determining the effectiveness of logistics operations, especially in urban environments characterized by dense traffic and complex distribution networks. Adequate physical infrastructure, such as transportation facilities, warehouse systems, and communication networks, supports seamless logistics processes [9], [10]. Moreover, digital infrastructure, including reliable internet connectivity and integrated information systems, is essential for implementing advanced logistics technologies. Studies highlight that insufficient infrastructure often becomes a barrier to achieving optimal operational performance, even when organizations attempt to adopt digital innovations [3], [11]. In Jakarta, challenges related to traffic congestion, uneven technological readiness, and infrastructure disparities continue to influence logistics efficiency, making infrastructure readiness a critical factor that warrants further investigation.

In addition to technological and infrastructural factors, human resource competence is increasingly recognized as a key determinant of organizational performance in the digital era. The adoption of digital tools requires employees who possess not only technical skills but also adaptability, problem-solving abilities, and digital literacy. Competent human resources enable organizations to maximize the benefits of digital transformation by ensuring that new systems are effectively implemented and aligned with operational objectives [12], [13]. According to the resource-based view theory, organizational performance is significantly influenced by internal capabilities, including employee competence and organizational knowledge [14]. Within the logistics industry, skilled personnel can improve coordination, minimize operational errors, and support continuous innovation, thereby enhancing overall performance outcomes.

Despite the growing body of research on digital transformation and operational performance, several gaps remain, particularly in the context of the logistics industry in Jakarta. Previous studies tend to focus on manufacturing or general service sectors, while empirical investigations that specifically explore urban logistics dynamics are still limited. In addition, digital transformation is often examined as a single predictor of performance, without simultaneously considering the complementary roles of infrastructure availability and human resource competence, which are essential in supporting operational effectiveness. The rapid evolution of Indonesia's logistics ecosystem, driven by urbanization and accelerated technological adoption, also demands updated empirical evidence that reflects current industry realities. Based on these considerations, this study aims to analyze how digital transformation, infrastructure availability, and human resource competence jointly influence the operational performance of logistics companies in Jakarta. The findings are expected to contribute to academic discourse by integrating multiple determinants of performance within a unified analytical framework, while also providing practical insights for logistics firms and policymakers in designing strategies that enhance digital capability, infrastructure readiness, and workforce competence to achieve sustainable and efficient urban logistics operations.

2. LITERATURE REVIEW

2.1 Operational Performance in the Logistics Industry

Operational performance refers to an organization's ability to manage processes, resources, and service delivery efficiently in order to achieve its objectives, particularly within the logistics industry where performance is reflected through delivery speed, accuracy, cost efficiency, service reliability, and customer satisfaction [15], [16]. Effective logistics operations require strong coordination across transportation, warehousing, inventory management, and information systems to ensure smooth supply chain activities, and as noted by [15], logistics performance is highly influenced by the integration of technology, infrastructure, and human resources that support operational efficiency. From an operations management perspective, improving performance is not limited to cost reduction but also involves enhancing service quality and responsiveness; [16] highlight the importance of balancing efficiency and flexibility, especially in industries with dynamic demand patterns such as logistics. In Jakarta's urban context, characterized by congestion and increasing distribution demands, logistics companies must continuously innovate and adapt to maintain operational effectiveness, making it essential to understand the key determinants that drive operational performance in sustaining long-term competitiveness.

2.2 Digital Transformation

Digital transformation refers to the integration of digital technologies into organizational processes to achieve significant improvements in performance, efficiency, and value creation, where [5], [6] conceptualizes it as a strategic process that reshapes business models, operational workflows, and organizational culture through advanced technological adoption. In the logistics sector, digital transformation involves the implementation of tracking systems, automation tools, data analytics platforms, and integrated management software that enable real-time monitoring and data-driven decision-making. Previous studies suggest that digital transformation enhances organizational performance by improving transparency, reducing operational errors, and strengthening communication among supply chain actors [17], allowing logistics firms to optimize route planning, manage inventory more accurately, and respond quickly to customer demands. Nevertheless, the success of digital initiatives depends not only on technological adoption but also on organizational readiness and strategic alignment, as misaligned digital efforts may produce limited performance gains. Within the dynamic logistics environment, particularly in urban areas facing congestion, delivery delays, and fluctuating demand patterns, the integration of digital platforms enables companies to analyze large-scale operational data and make more efficient decisions, thereby positioning digital transformation as a key driver of improved operational performance [18], [19].

2.3 Infrastructure Availability

Infrastructure availability refers to the physical and digital resources that support organizational operations, including transportation networks, warehouses, logistics hubs, internet connectivity, and integrated information systems that enable efficient service delivery. [20], [21] emphasizes that logistics efficiency is strongly influenced by infrastructure quality, as inadequate facilities can lead to delays, higher costs, and operational inefficiencies, particularly in urban contexts such as Jakarta where congestion, limited warehouse capacity, and uneven technological readiness remain

challenges. In addition, strong infrastructural support facilitates the successful implementation of digital innovations by enabling real-time coordination and monitoring, thereby enhancing operational effectiveness; consequently, infrastructure readiness is considered a critical determinant of operational performance in the logistics sector [20].

2.4 Human Resource Competence

Human resource competence refers to the knowledge, skills, and abilities that enable employees to perform tasks effectively, particularly in the era of digital transformation where workers must adapt to new technologies and evolving operational processes. [14] resource-based view highlights human capital as a strategic internal resource that contributes to sustainable competitive advantage, as competent employees can enhance operational efficiency by reducing errors, strengthening problem-solving capabilities, and encouraging innovation [22], [23]. In logistics operations, employees are required to possess both technical expertise related to digital systems and managerial skills for coordination and communication, and research shows that organizations with skilled and adaptable workforces are more likely to achieve successful digital transformation and improved operational performance. Continuous training and development initiatives further strengthen employee competence, enabling logistics companies to build organizational resilience and sustain performance as digitalization increasingly shapes the logistics industry.

2.5 Conceptual Framework and Hypothesis Development

Based on the reviewed literature, operational performance in the logistics industry is shaped by several interrelated factors, namely digital transformation, infrastructure availability, and human resource competence. Digital transformation improves efficiency and responsiveness through technological integration, infrastructure availability provides essential operational support, and human resource competence ensures the effective implementation of organizational strategies, with all three elements collectively contributing to enhanced logistics performance. Accordingly, the conceptual framework of this study positions digital transformation, infrastructure availability, and human resource competence as independent variables that influence operational performance as the dependent variable, and drawing from relevant theoretical perspectives and prior empirical findings, a set of research hypotheses is proposed.

H1: Digital transformation has a positive and significant effect on operational performance in the logistics industry.

H2: Infrastructure availability has a positive and significant effect on operational performance in the logistics industry.

H3: Human resource competence has a positive and significant effect on operational performance in the logistics industry.

H4: Digital transformation, infrastructure availability, and human resource competence simultaneously influence operational performance.

3. METHODS

3.1 Research Design and Approach

This study employed a quantitative explanatory research approach to examine the influence of digital transformation, infrastructure availability, and human resource competence on the operational performance of logistics companies in Jakarta, as quantitative methods enable systematic measurement of relationships among variables through statistical analysis. Data were collected using a structured survey to obtain measurable and objective responses from participants directly involved in logistics operations, allowing for empirical testing of the proposed research model. The study applied a cross-sectional design, where data were gathered at a single point in time, which is considered suitable for capturing current industry conditions and analyzing causal relationships between independent variables and operational performance as the dependent variable.

3.2 Population and Sample

The population of this study consisted of employees and practitioners working in logistics companies in Jakarta, including those involved in operational, managerial, and administrative roles related to logistics activities. Because the exact number of logistics workers in Jakarta is difficult to determine, the study employed a non-probability purposive sampling technique to select respondents who met specific criteria, namely: working in a logistics or supply chain-related company in Jakarta, having at least one year of work experience, and being familiar with the use of digital technology in logistics operations. Based on these criteria, a total of 150 respondents were chosen as research samples, a size considered adequate to support multiple linear regression analysis using SPSS version 25 and to represent the perspectives of logistics industry practitioners.

3.3 Data Collection Techniques

Primary data were collected through a structured questionnaire distributed both online and offline, consisting of statements designed to measure digital transformation, infrastructure availability, human resource competence, and operational performance using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), allowing respondents to express their level of agreement toward each indicator. The questionnaire items were developed based on theoretical constructs from previous studies and adapted to the logistics industry context, and a pilot test was conducted with a small group of respondents to ensure clarity and reduce ambiguity. In addition, secondary data were gathered from academic literature, journals, and relevant industry reports to strengthen the theoretical framework and support the interpretation of research findings.

3.4 Research Variables and Operational Definitions

This study involved one dependent variable, operational performance (Y), and three independent variables, namely digital transformation (X1), infrastructure availability (X2), and human resource competence (X3). Digital transformation represents the level of technology integration in logistics operations, including automation, digital platforms, and data utilization, while infrastructure availability reflects the adequacy of physical and digital facilities such as transportation systems, warehouses, and communication networks that support logistics activities. Human resource competence refers to the skills, knowledge, and adaptability of employees in performing logistics-related tasks, and operational performance denotes the effectiveness and efficiency of logistics processes measured through indicators such as delivery accuracy, service speed, and operational efficiency. Each variable was measured using several indicators adapted from relevant literature and translated into questionnaire statements to ensure that all constructs could be quantitatively analyzed using statistical methods.

3.5 Data Analysis Techniques

Data analysis was performed using SPSS version 25 to test the research hypotheses through several stages, beginning with descriptive statistics to present respondent characteristics and variable distributions, followed by instrument testing using Pearson's correlation for validity and Cronbach's Alpha for reliability to ensure measurement accuracy and internal consistency. Classical

assumption tests, including normality, multicollinearity, and heteroscedasticity, were conducted to confirm the suitability of regression analysis before applying multiple linear regression to examine the effects of digital transformation, infrastructure availability, and human resource competence on operational performance. Hypothesis testing employed t-tests to evaluate partial effects and an F-test to assess simultaneous effects, while the coefficient of determination (R^2) was calculated to measure the proportion of variance in operational performance explained by the independent variables, thereby providing empirical evidence on how technological, infrastructural, and human resource factors contribute to organizational effectiveness in Jakarta's logistics industry.

4. RESULTS AND DISCUSSION

4.1 Respondent Profile

This study involved 150 respondents working in logistics companies operating in Jakarta, consisting of employees engaged in operational, administrative, supervisory, and managerial roles. The demographic profile was analyzed to provide an overview of characteristics that may influence perceptions related to digital transformation, infrastructure availability, human resource competence, and operational performance, including gender, age, education level, work experience, and job position. Based on gender distribution, most respondents were male (62.0%) compared to female respondents (38.0%), reflecting the general composition of the logistics workforce where operational roles are often male-dominated. In terms of age, the majority were between 30–39 years (40.7%), followed by 20–29 years (34.7%), indicating a workforce largely within productive career stages and relatively adaptive to digital technologies, while smaller proportions were aged 40–49 years (18.0%) and ≥50 years (6.6%).

Regarding educational background, nearly half of the respondents held a bachelor's degree (48.0%), followed by diploma graduates (23.3%), high school graduates (18.7%), and postgraduate degree holders (10.0%), suggesting adequate academic capacity to understand digital transformation initiatives. Most respondents had 1–3 years of work experience (48.0%), indicating early-career professionals actively involved in logistics operations, while 34.0% had 4–7 years of experience and 18.0% had more than seven years, contributing insights from more experienced practitioners. In terms of job position, operational staff dominated the sample (43.3%), followed by supervisors (21.3%), administrative staff (18.7%), and managers (16.7%), showing that the data primarily reflect perspectives from employees directly involved in daily logistics activities and operational performance processes.

4.2 Descriptive Statistics

Descriptive statistics were used to understand the general perception of respondents toward each research variable.

Table 1. Descriptive Statistics of Research Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Digital Transformation (X1)	150	2.10	5.00	4.12	0.56
Infrastructure Availability (X2)	150	2.30	5.00	3.95	0.61
Human Resource Competence (X3)	150	2.40	5.00	4.05	0.58
Operational Performance (Y)	150	2.50	5.00	4.18	0.52

Based on Table 1, the descriptive statistics indicate that all research variables have relatively high mean scores, suggesting that respondents generally perceive digital transformation, infrastructure availability, human resource competence, and operational performance in logistics companies in Jakarta to be at a good level. Operational performance (Y) recorded the highest mean value (4.18) with a relatively low standard deviation (0.52), indicating consistent perceptions among respondents regarding the effectiveness and efficiency of logistics operations. Digital transformation (X1) also shows a strong mean score (4.12), reflecting substantial adoption of technology within

logistics activities, while human resource competence (X3) demonstrates a similarly high average (4.05), suggesting that employees possess adequate skills and adaptability. Infrastructure availability (X2) has a slightly lower mean (3.95) and the highest standard deviation (0.61), implying more varied perceptions related to infrastructural readiness, which may reflect existing challenges in physical and digital infrastructure within the Jakarta logistics environment.

4.3 Validity and Reliability Test

The validity test showed that all questionnaire items had correlation values greater than 0.30, indicating that all items were valid. Reliability testing using Cronbach's Alpha demonstrated strong internal consistency.

Table 2. Reliability Test Results

Variable	Cronbach's Alpha	Interpretation
Digital Transformation	0.881	Reliable
Infrastructure Availability	0.864	Reliable
Human Resource Competence	0.902	Highly Reliable
Operational Performance	0.876	Reliable

Table 2 shows that all research variables achieved Cronbach's Alpha values above the commonly accepted threshold of 0.70, indicating strong internal consistency and reliability of the measurement instruments. Human resource competence demonstrates the highest reliability (α = 0.902), suggesting that the indicators used to measure employee skills and capabilities are highly consistent, while digital transformation (α = 0.881), operational performance (α = 0.876), and infrastructure availability (α = 0.864) are also categorized as reliable. These results confirm that the questionnaire items used in this study are dependable for measuring the intended constructs, ensuring that subsequent statistical analyses, including regression testing, are based on stable and consistent data.

4.4 Classical Assumption Tests

Before conducting regression analysis, classical assumption tests were performed.

Table 3. Classical Assumption Test Results

Test	Result	Interpretation
Normality (Kolmogorov-Smirnov Sig.)	0.200	Data Normally Distributed
Multicollinearity (VIF Range)	1.45 – 2.10	No Multicollinearity
Heteroscedasticity (Sig.)	> 0.05	No Heteroscedasticity

Table 3 indicates that all classical assumption tests required for regression analysis were successfully met, confirming the suitability of the data for further statistical testing. The normality test using the Kolmogorov-Smirnov method produced a significance value of 0.200, which is above 0.05, indicating that the data are normally distributed. The multicollinearity test shows VIF values ranging from 1.45 to 2.10, well below the critical threshold of 10, suggesting that there is no strong correlation among the independent variables. In addition, the heteroscedasticity test yielded significance values greater than 0.05, confirming the absence of heteroscedasticity issues.

4.5 Multiple Linear Regression Analysis

Multiple linear regression analysis was conducted to examine the influence of digital transformation, infrastructure availability, and human resource competence on operational performance.

Table 4. Multiple Linear Regression Results

Variable	Unstandardized Coefficient (B)	Std. Error	t-value	Sig.
Constant	0.842	0.321	2.624	0.010
Digital Transformation (X1)	0.381	0.074	5.155	0.000
Infrastructure Availability (X2)	0.264	0.069	3.827	0.000
Human Resource Competence (X3)	0.297	0.072	4.123	0.000

Table 4 presents the results of multiple linear regression analysis, showing that digital transformation, infrastructure availability, and human resource competence have positive and significant effects on operational performance. Digital transformation (B = 0.381; t = 5.155; p < 0.001) has the strongest influence, indicating that increased integration of digital technologies significantly enhances logistics operational effectiveness. Human resource competence (B = 0.297; t = 4.123; p < 0.001) also demonstrates a substantial contribution, highlighting the importance of skilled and adaptable employees in supporting performance improvement. Infrastructure availability (B = 0.264; t = 3.827; p < 0.001) shows a positive and significant impact, suggesting that adequate physical and digital facilities support smoother logistics processes. The constant value (B = 0.842; p = 0.010) indicates a baseline level of operational performance even without the influence of independent variables, and overall, these findings confirm that technological, infrastructural, and human capital factors collectively play a critical role in improving logistics performance in Jakarta.

4.6 Coefficient of Determination and Simultaneous Test

Table 5. Model Summary

R	R Square	Adjusted R Square	Std. Error
0.789	0.623	0.615	0.321

The R^2 value of 0.623 indicates that 62.3% of operational performance variation can be explained by digital transformation, infrastructure availability, and human resource competence, while the remaining 37.7% is influenced by other factors not examined in this study.

Table 6. F-Test (ANOVA)

Model	F-value	Sig.
Regression	80.27	0.000

The significance value of 0.000 (< 0.05) indicates that all independent variables simultaneously have a significant effect on operational performance.

Discussion

The findings indicate that digital transformation has the strongest influence on operational performance among logistics companies in Jakarta, as reflected by the regression coefficient of 0.381. Organizations that implement digital tools such as real-time tracking systems and integrated logistics platforms tend to achieve higher efficiency, improved coordination, and greater service reliability. This result is consistent with prior studies highlighting the role of digital technologies in reducing process inefficiencies and enhancing operational responsiveness, particularly within urban logistics environments characterized by traffic congestion and time-sensitive delivery demands [9], [24].

Infrastructure availability also demonstrates a significant positive effect on operational performance (B = 0.264), showing that adequate transportation systems, warehousing facilities, and digital connectivity support smoother logistics processes and minimize delays. In addition, human resource competence contributes meaningfully to performance improvement (B = 0.297), indicating that employees with strong technical skills and adaptability are better prepared to manage digital systems and respond to operational challenges. These findings reinforce logistics management

theory and the resource-based view, which emphasize infrastructure and human capital as essential drivers of organizational effectiveness and competitive advantage [12], [25].

Simultaneously, the combined influence of digital transformation, infrastructure availability, and human resource competence explains a substantial proportion of operational performance variance ($R^2 = 0.623$), suggesting that optimal results are achieved through the integration of technological readiness, infrastructural support, and workforce capability. Rather than focusing solely on technology adoption, logistics companies should adopt a holistic strategy that balances these three factors, while policymakers and industry stakeholders can use these insights to strengthen infrastructure development and digital skill enhancement, ultimately improving efficiency, adaptability, and competitiveness within Jakarta's increasingly digitalized logistics ecosystem.

CONCLUSION

This study concludes that digital transformation, infrastructure availability, and human resource competence play significant roles in improving operational performance in the logistics industry in Jakarta. Digital transformation emerges as the most influential factor, demonstrating that the adoption of digital platforms, automation systems, and data-driven decision-making significantly enhances operational efficiency and responsiveness. Infrastructure availability also contributes positively by supporting seamless logistics operations and reducing operational barriers, while human resource competence strengthens organizational capability in adapting to technological changes and optimizing operational processes. Simultaneously, the three variables provide a strong explanatory contribution to operational performance, emphasizing the importance of an integrated strategic approach that combines technology adoption, infrastructure development, and workforce capability enhancement. Practically, logistics companies are encouraged to invest not only in digital systems but also in employee training and infrastructure readiness to achieve sustainable performance improvements in a dynamic urban logistics environment.

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