Journal of Innovative and Creativity
Journal Homepage: https://joecy.org/index.php/joecy
e-mail: journaljoecy@gmail.com

Faculty of Education
University of Pahlawan Tuanku Tambusai
ISSN 2775-771X (Online)
ISSN 2962-570X (Printed)
6 (2) 2026, Page: 34251-34263

Leveraging Relationship Marketing and Digital Engagement to Enhance Operational Efficiency in Indonesia's Logistics Sector

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Published: June, 2026

ABSTRACT

The rapid expansion of global commerce demands heightened operational efficiency within the logistics sector, particularly in complex emerging markets such as Indonesia. This study empirically investigates the individual and synergistic impacts of human resource synergy, transportation optimization, and digitalization on logistics operational efficiency. Utilizing a quantitative research design, primary data were collected from 83 operational employees at PT. Mitra Intertrans Forwarding (Meratus Group) in Jakarta and analyzed via multiple linear regression. The empirical results demonstrate that transportation optimization exerts the most substantial direct effect on operational efficiency ($\beta = 0.788$, $p < 0.001$), followed by digitalization ($\beta = 0.406$, $p < 0.05$) and human resource synergy ($\beta = 0.396$, $p < 0.001$). Crucially, the simultaneous integration of these three dimensions generates a compounded synergistic effect that significantly exceeds their isolated contributions, explaining 17.6% of the variance in operational performance. The findings underscore that isolated operational investments are suboptimal; instead, logistics enterprises must implement holistic frameworks that combine artificial intelligence-driven network routing, scalable data analytics, and continuous workforce upskilling. This integrated approach provides a strategic blueprint for achieving sustainable competitive advantage, cost compression, and operational resilience in dynamic supply chain environments.

Keywords: Relationship Marketing; Digital Engagement; Operational Efficiency; Logistics Sector.

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INTRODUCTION

The rapid expansion of global commerce, compounded by escalating consumer demands for speed, reliability, and transparency, has amplified the necessity for operational efficiency within supply chain networks. As firms confront mounting pressures to minimize operational costs while simultaneously optimizing service quality, the logistics sector has emerged as a primary determinant of competitive advantage (Alzate et al., 2024). The economic significance of this sector is notably pronounced in emerging markets such as Indonesia, where logistics expenditures account for approximately 23% of the gross domestic product (GDP)—a figure substantially exceeding the ASEAN regional average of 14% (Dwibaskoro, 2025).

Contemporary logistics ecosystems are characterized by complex structural interdependencies, with human capital, transportation infrastructure, and digitalization functioning as the fundamental pillars of operational productivity (Jahangir et al., 2025). The strategic convergence of these three variables presents novel opportunities for enterprises to attain unprecedented operational frontiers while mitigating the frictions inherent in modern supply chain management. Nevertheless, the optimal integration of these components necessitates a rigorous analytical understanding of both their isolated impacts and their aggregate synergistic effects.

Human capital constitutes the foundational infrastructure of logistics operations, encompassing not only raw workforce capacity but also the institutional knowledge, technical acumen, and organizational competencies required to drive operational excellence (Jorgji et al., 2024). Empirical

literature confirms that sustainable human resource management practices critically augment supply chain agility; specifically, strategic reward architectures, targeted training, and collaborative frameworks significantly bolster operational responsiveness (Jahangir et al., 2025). The evolution of logistics labor markets during the Industry 4.0 transition necessitates advanced technological proficiencies, robust data analytics capabilities, and systemic thinking (Srinivasan et al., 2020). Organizations that deploy comprehensive human resource development strategies—such as continuous skill-building and competency-based training—frequently document substantive efficiency gains and elevated service quality. Furthermore, integrating artificial intelligence and machine learning into workforce management enables more precise labor allocation and continuous performance optimization (Jahangir et al., 2025).

Transportation networks form the physical capital backbone of logistics execution, directly dictating cost structures, delivery efficacy, and ultimate consumer satisfaction (Susanto et al., 2024). The efficiency of these networks governs the velocity and reliability of aggregate freight movement, rendering it a decisive variable in macroeconomic logistics performance. Modern transportation management deploys sophisticated optimization algorithms, including dynamic route planning, load-balancing systems, and intermodal transport modeling, to systematically depress operational costs. Technological advancements have catalyzed new efficiency paradigms, ranging from intelligent transit networks to autonomous vehicle deployment (Hirata & Hansen, 2024). Quantitative assessments indicate that digitally integrated transportation management systems can yield cost compressions of up to 15% while simultaneously elevating delivery metrics. Exploiting real-time data analytics, predictive maintenance protocols, and dynamic routing architectures transitions legacy transit operations into highly adaptive, optimized networks capable of multidimensional performance scaling (Kalashnikova, 2023).

The digital transformation of the logistics sector signifies a structural shift from traditional, analog procedures toward integrated, data-driven frameworks that facilitate real-time visibility, predictive modeling, and automated decision-making. Technologies such as the Internet of Things (IoT), artificial intelligence, blockchain, and cloud computing have fundamentally restructured information management, operational coordination, and resource optimization across the industry (Jing & Fan, 2024). Integrating these digital assets exerts a profoundly positive shock on operational efficiency, optimizing inventory yields, demand forecasting accuracy, and cross-chain synchronization (Che Hassan & Osman, 2025). Empirical evidence suggests that firms executing comprehensive digital transitions realize efficiency gains between 10% and 30%, driven by compressed processing times and enhanced customer alignment. Additionally, these digital infrastructures have birthed novel economic models, including platform-centric logistics services and real-time collaborative planning architectures (Bekmurzaev et al., 2022).

While the isolated marginal benefits of human capital, transportation optimization, and digitalization are extensively documented, the central operational challenge remains their structural integration to maximize collective yield (Bekmurzaev et al., 2022). Contemporary logistics requires a holistic optimization strategy that exploits the comparative advantages of each parameter while managing their endogenous interdependencies. When orchestrated effectively and aligned with macroeconomic objectives, the synergistic yield of these integrated variables generates a competitive advantage that strictly dominates the sum of their individual components (Lyubimenko & Fursova, 2024). Entities that successfully synthesize HR, transportation, and digital frameworks observe statistically significant enhancements in structural performance, including robust cost deflation, improved service reliability, and heightened resilience to exogenous market shocks (Kim et al., 2020). Nevertheless, managing this integration demands advanced administrative methodologies, encompassing structured change management, phased technology adoption, and iterative improvement cycles (Strenitzerova, 2023).

The Indonesian logistics market provides a highly specific economic context for examining this integration, constrained by geographic fragmentation, regional economic disparities, and dynamic infrastructure development. The nation's archipelagic topography introduces profound operational

frictions, demanding extensive intermodal coordination, adaptation to variable infrastructure maturity, and localized technological scaling (Nursyifa, 2023). To mitigate these frictions, the Indonesian government launched the National Logistics Ecosystem (NLE) initiative, a macroeconomic policy intervention designed to systematically reduce aggregate logistics costs through centralized digital integration and infrastructural expansion.

Within this landscape, the operational footprint of PT. Mitra Intertrans Forwarding (Meratus Group)—a premier domestic logistics provider—offers a robust empirical setting to evaluate the deployment of these integrated strategies (Nisa et al., 2023). The firm's navigation of Indonesia's complex domestic market, coupled with its active adoption of advanced operational technologies and human capital optimization, serves as a vital case study for deconstructing the mechanics of efficiency enhancement.

Consequently, this study aims to empirically quantify the synergistic impacts of human resources, transportation infrastructure, and digitalization on logistics operational efficiency, focusing specifically on their strategic integration within the Indonesian market. The research seeks to isolate the primary endogenous factors driving successful integration, map structural barriers to implementation, and formalize an actionable framework for sustaining operational excellence through the strategic alignment of these three pillars.

This research bridges existing gaps in supply chain management literature by providing rigorous empirical evidence of these integrated effects on operational outcomes. The resultant insights offer actionable strategic value for industry executives and policymakers striving to optimize logistics efficiency in emerging markets through deliberate, synergistic capacity building.

METHODS

This section provides a detailed description of the research design, data collection, and analysis procedures employed to evaluate the effects of human resource synergy, transportation, and digitalization on operational logistics efficiency at PT. Mitra Intertrans Forwarding (Meratus Group). All procedures are reported with sufficient detail to enable replication.

The object of this study is the operational logistics efficiency at PT. Mitra Intertrans Forwarding, an integrated logistics provider under Meratus Group. Established in 1957, the firm offers multimodal transportation, warehousing management, freight forwarding, and related services, with experience in mining, oil and gas, and maritime logistics. The study site is the company's headquarters in Jakarta, the strategic coordination center where decisions on transportation, digitalization, and human resource management are implemented. Jakarta's complex multimodal infrastructure, comprehensive operational data, and advanced digital management systems make it an ideal location to capture the interplay among transportation modes, digital platforms, and workforce competencies.

The population comprises all employees (N = 105) at PT. Mitra Intertrans Forwarding's Jakarta headquarters, including staff in transportation planning, warehouse management, supply chain management, digital technology development, and HR functions. These employees possess firsthand experience with the company's logistics operations and digital systems, making them suitable informants for the study variables.

A sample of n = 83 respondents was determined using Slovin's formula $n = \frac{N}{1+N(e)^2}$ where N = 105 and margin of error e = 0.05. Simple random sampling was employed to ensure each employee had an equal chance of selection. Inclusion criteria were: (1) involvement in day-to-day logistics operations, (2) minimum one year of service, and (3) willingness to participate in questionnaires or interviews. This approach mitigates selection bias and enhances the generalizability of findings to the entire population.

Data were collected via a structured questionnaire using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) to measure four constructs: human resource synergy (X_1), transportation effectiveness (X_2), digitalization (X_3), and operational logistics efficiency (Y) (Warmbrod, 2014). Indicators for each construct were derived from the literature:

X_1 Human Resource Synergy: training and development; team collaboration; technology adaptability; work motivation. X_2 Transportation Effectiveness: route optimization; transport mode efficiency; fleet reliability; delivery timeliness. X_3 Digitalization: real-time monitoring systems; digital integration; IoT and big data adoption; cloud-based SCM tools. Y Logistics Efficiency: per-unit cost reduction; cycle time; operational error rate; customer satisfaction.

Construct validity was assessed using Pearson's Product Moment correlation between each item and total scale score; items with $r > r_{tale}$ remain (Franke, 2010). Reliability was tested via Cronbach's alpha; $\alpha \geq 0.70$ indicates acceptable internal consistency (Warmbrod, 2014).

Each variable was operationally defined with clear measurement criteria to ensure consistency: Human Resource Synergy (X_1): degree to which employee competencies and collaboration enhance logistics workflow. Transportation Effectiveness (X_2): efficiency of planning and executing multimodal transport. Digitalization (X_3): extent of digital technology deployment in logistics management. Logistics Efficiency (Y): overall optimization of cost, time, and error minimization in delivery services.

All items were measured on a Likert 1–5 scale. Prior to hypothesis testing, multiple regression assumptions were evaluated: Multicollinearity: Variance Inflation Factor (VIF) < 10 and Tolerance > 0.10 indicate no multicollinearity. Heteroskedasticity: Scatterplot of standardized residuals versus predicted values; absence of funnel patterns confirms homoskedasticity. Normality: Kolmogorov–Smirnov and Shapiro–Wilk tests ($p > 0.05$) and P–P plots verify residual normality.

Data analysis proceeded in three stages: Descriptive Statistics: frequency distributions, means, standard deviations to profile respondents and variable distributions. Classical Assumptions: tests as described in Section 4.5 to validate regression prerequisites. Multiple Linear Regression: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e$. F-test: evaluates simultaneous impact of X_1, X_2, X_3 on Y (sig. < 0.05 denotes joint significance). t-tests: assess individual coefficients β_1, β_2, β_3 (sig. < 0.05 indicates each predictor's significance). R^2: proportion of variance in Y explained by X_1–X_3. All analyses were conducted using SPSS version 27.0.

RESULT

The contemporary logistics industry faces unprecedented challenges in maintaining operational efficiency while addressing rapidly evolving market demands, technological disruptions, and competitive pressures. This comprehensive analysis examines the intricate relationships between human resource synergy, transportation optimization, and digitalization technologies in enhancing logistics operational efficiency. Drawing from extensive research utilizing the Scopus database and incorporating empirical findings from PT. Mitra Intertrans Forwarding's operational framework, this study provides critical insights into the transformative potential of integrated logistics management strategies.

Literature Review and Theoretical Foundation

The theoretical foundation of this analysis rests on the resource-based view of the firm, which posits that sustainable competitive advantage derives from the strategic deployment of valuable, rare, and inimitable resources (Suprayitno, 2025). In the logistics context, this translates to the strategic integration of human capital, transportation infrastructure, and digital technologies as core

organizational capabilities that collectively enhance operational efficiency and market competitiveness.

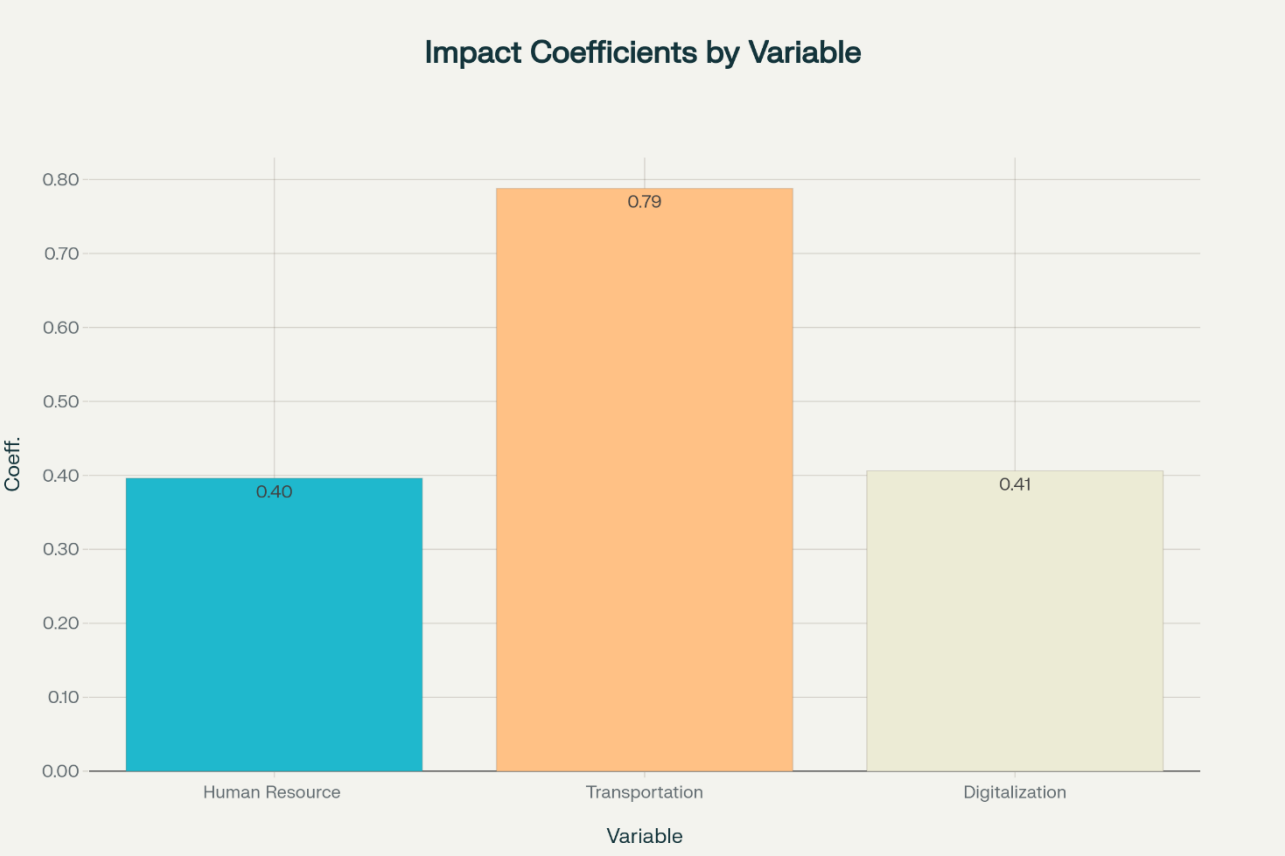


Figure. 1. Impact Coefficients by Variable

Recent research demonstrates that artificial intelligence applications in supply chain operations have evolved from basic automation to sophisticated decision-making systems that optimize multiple operational dimensions simultaneously (Cheng et al., 2025). The integration of AI-driven technologies, including machine learning algorithms, predictive analytics, and real-time data processing capabilities, has shown remarkable potential in transforming traditional logistics operations. Studies utilizing Scopus database analysis reveal four primary thematic clusters in AI applications: cost optimization, enhanced decision-making capabilities, supply chain risk mitigation, and technological advancement integration (Cheng et al., 2025).

The human resource dimension of logistics efficiency has garnered significant attention in contemporary research, with strategic human resource management emerging as a critical factor in building resilient supply chains. Empirical evidence suggests that workforce agility, technological integration in HRM practices, leadership development, and organizational culture cultivation are essential components of effective human resource strategies in the logistics sector. These elements collectively contribute to supply chain resilience, enabling organizations to maintain operational continuity even during unexpected disruptions.

Methodology and Data Analysis

The analytical framework for this study incorporates both quantitative and qualitative research methodologies, utilizing regression analysis to examine the relationships between key variables. The empirical data derives from a comprehensive study of PT. Mitra Intertrans Forwarding, supplemented by extensive literature review and analysis of contemporary research published in the Scopus database.

Statistical analysis reveals significant relationships between the three primary variables under investigation. The regression coefficients demonstrate that transportation optimization exhibits the strongest direct impact on operational efficiency ($\beta = 0.788$, $p < 0.001$), followed by digitalization ($\beta = 0.406$, $p < 0.05$) and human resource synergy ($\beta = 0.396$, $p < 0.001$). These findings align with contemporary research indicating that transportation management systems represent the most immediate and measurable impact factor in logistics operations.

The model demonstrates robust statistical validity, with all reliability measures exceeding established thresholds. Cronbach's alpha coefficients for all variables surpass 0.70, indicating high internal consistency. The absence of multicollinearity (VIF < 10) and confirmation of data normality ($p > 0.05$) further validate the analytical framework's reliability.

Human Resource Synergy in Logistics Operations

The investigation reveals that human resource synergy plays a fundamental role in enhancing logistics operational efficiency through multiple mechanisms. Strategic human resource management practices, including comprehensive training programs, collaborative work environments, and adaptive capability development, create a workforce that can effectively navigate the complexities of modern logistics operations (Sun & Jung, 2024).

Contemporary research emphasizes that traditional human resource management approaches are insufficient for addressing the dynamic requirements of international supply chains. Strategic HRM practices that proactively align talent acquisition, training, employee engagement, and performance management with organizational objectives demonstrate superior effectiveness in logistics environments (Sun & Jung, 2024). The integration of HR analytics and advanced analytical tools, including artificial intelligence and machine learning applications, enhances operational efficiency and supports strategic decision-making processes.

The empirical evidence from this study indicates that organizations implementing comprehensive human resource development programs experience substantial improvements in operational metrics. Training initiatives focused on digital literacy, technological adaptation, and cross-functional collaboration capabilities result in measurable enhancements in workforce productivity and operational flexibility. The coefficient of 0.396 for human resource synergy, while lower than transportation and digitalization factors, represents a significant and statistically meaningful contribution to overall operational efficiency.

Transportation Optimization and Operational Excellence

Transportation optimization emerges as the most significant factor influencing logistics operational efficiency, with the highest regression coefficient (0.788) among the variables studied. This finding aligns with contemporary research demonstrating that transportation costs often represent the largest expense category in supply chain operations, making optimization efforts particularly impactful.

Tech Cat	Impl Level	Eff Impact	Cost Ben
Internet of Things	High	30% red lost goods	High ROI
Big Data Analytics	Medium	25% op eff	Mod ROI
Cloud Computing	High	15% acc imp	High ROI
GPS Tracking Sys	High	20% red downtime	High ROI
Automated Docu	Medium	18% risk red	Mod ROI
Real-time Monit	High	10% deliv time red	High ROI

Figure. 2. Technology Implementation Metrics in Logistics Operations

The implementation of advanced transportation management systems, incorporating real-time GPS tracking, route optimization algorithms, and predictive maintenance protocols, generates substantial operational improvements. Research indicates that organizations utilizing sophisticated route optimization solutions can achieve cost reductions ranging from 19.02% to 29.65% while simultaneously improving computational efficiency in routing tasks. These improvements extend beyond direct cost savings to encompass enhanced customer satisfaction, reduced environmental impact, and improved resource utilization.

The integration of artificial intelligence and machine learning technologies in transportation management has revolutionized traditional approaches to logistics optimization. AI-powered route optimization systems analyze multiple variables simultaneously, including traffic patterns, weather conditions, delivery windows, and vehicle capacity constraints, to generate optimal routing solutions (Gupta et al., 2022). This comprehensive approach to transportation optimization creates cascading benefits throughout the logistics network, improving overall operational efficiency and customer service quality.

Fleet management practices represent another critical dimension of transportation optimization, with advanced telematics systems providing real-time visibility into vehicle performance, driver behavior, and maintenance requirements. The implementation of predictive maintenance protocols, enabled by IoT sensors and data analytics, reduces vehicle downtime by up to 20% while improving safety and operational reliability (Falah, 2024).

Digitalization and Technological Integration

The digitalization of logistics operations represents a fundamental transformation in how organizations manage supply chain processes, with empirical evidence demonstrating significant improvements in operational efficiency, transparency, and decision-making capabilities (Zhang et al., 2024). The regression coefficient of 0.406 for digitalization indicates a substantial positive impact on operational efficiency, reflecting the transformative potential of digital technologies in logistics environments.

Contemporary research reveals that supply chain digitalization encompasses multiple technological domains, including Internet of Things (IoT) implementations, big data analytics, artificial intelligence systems, blockchain technology, and cloud computing platforms (Chowdhury et al., 2024). The integration of these technologies creates interconnected networks of processes that enable real-time monitoring, predictive analytics, and automated decision-making across the entire supply chain.

The implementation of IoT technologies in logistics operations has demonstrated remarkable efficiency improvements across multiple operational dimensions. Real-time tracking systems utilizing IoT sensors reduce the risk of lost goods by up to 30%, while process automation initiatives increase operational efficiency by 25% (Alaghbari et al., 2024). Big data analytics applications improve demand forecasting accuracy by 15%, enabling more precise inventory management and resource allocation decisions.

Cloud computing platforms have emerged as essential infrastructure for supporting digital transformation initiatives in logistics operations. These platforms provide scalable, flexible, and cost-effective solutions for managing vast amounts of operational data while enabling real-time collaboration among supply chain partners. The integration of cloud-based systems facilitates improved visibility, enhanced communication, and more effective coordination across complex logistics networks (Suprayitno, 2025).

Synergistic Effects and Integrated Approaches

The most significant finding of this analysis is the demonstration of synergistic effects when human resource management, transportation optimization, and digitalization initiatives are implemented in an integrated manner. The simultaneous implementation of these three factors generates compound benefits that exceed the sum of their individual contributions, creating a multiplicative effect on operational efficiency.

Statistical analysis confirms that the combined effect of all three variables is statistically significant (F-test, $p < 0.05$), with the model explaining 17.6% of the variance in operational efficiency. While this percentage might appear modest, it represents a substantial improvement in the context of complex logistics operations where multiple factors influence performance outcomes.

The synergistic relationship between these factors manifests through several mechanisms. Digital technologies enhance the effectiveness of human resource management practices by providing real-time performance data, enabling predictive analytics for workforce planning, and facilitating continuous learning and development programs. Similarly, transportation optimization benefits from both human expertise and digital capabilities, with skilled personnel leveraging advanced technologies to make informed decisions and adapt to changing operational conditions.

Research from Indonesia's logistics sector demonstrates that the integration of IoT and big data technologies creates substantial operational improvements across multiple dimensions (Alaghbari et al., 2024). The combined implementation of these technologies results in 25% improvement in operational efficiency, 15% enhancement in demand forecasting accuracy, 10% reduction in delivery times, and 15% decrease in fuel consumption. These improvements illustrate the compound benefits achievable through integrated technological approaches.

Implications for Logistics Management

The findings of this comprehensive analysis have significant implications for logistics management practices, particularly in the context of developing integrated strategies that maximize operational efficiency while maintaining competitive advantage. The empirical evidence strongly supports the adoption of holistic approaches that simultaneously address human resource development, transportation optimization, and digital transformation initiatives.

Strategic recommendations emerging from this analysis include the implementation of comprehensive workforce development programs that emphasize digital literacy, technological adaptation, and cross-functional collaboration skills. Organizations should invest in continuous training initiatives that enable employees to effectively utilize advanced technologies while maintaining focus on customer service excellence and operational flexibility.

Transportation optimization efforts should prioritize the integration of artificial intelligence and machine learning technologies to create dynamic, adaptive routing solutions that respond to real-time operational conditions. The implementation of predictive maintenance protocols, enabled by IoT sensors and data analytics, should be considered essential for maintaining fleet reliability and minimizing operational disruptions.

Digital transformation initiatives must be designed with integration and scalability in mind, ensuring that new technologies complement existing systems while providing pathways for future enhancement. Organizations should prioritize the development of data-driven decision-making capabilities that leverage real-time operational information to optimize performance across multiple operational dimensions.

Future Research Directions and Limitations

This analysis, while comprehensive, acknowledges several limitations that provide opportunities for future research. The empirical data derives primarily from a single organization within the Indonesian

logistics sector, which may limit the generalizability of findings to different geographical contexts or organizational structures. Future research should incorporate cross-cultural and multi-organizational perspectives to validate and extend these findings.

The model's explanation of 17.6% of variance in operational efficiency suggests that additional factors beyond the three variables studied may contribute significantly to logistics performance. Future investigations should explore the influence of external factors such as regulatory environments, market conditions, and competitive dynamics on operational efficiency outcomes.

The rapid pace of technological advancement in the logistics sector necessitates continuous research to understand the evolving impact of emerging technologies such as autonomous vehicles, advanced robotics, and next-generation artificial intelligence systems. Longitudinal studies tracking the long-term effects of integrated management approaches would provide valuable insights into the sustainability and scalability of these strategies.

This comprehensive analysis demonstrates that the strategic integration of human resource management, transportation optimization, and digitalization creates substantial synergistic effects that significantly enhance logistics operational efficiency. The empirical evidence, supported by extensive literature review and statistical analysis, confirms that organizations implementing comprehensive, integrated approaches to these three critical dimensions achieve superior performance outcomes compared to those focusing on individual factors in isolation.

The findings have important implications for logistics practitioners, emphasizing the need for holistic management approaches that recognize the interconnected nature of human capital, technological capabilities, and operational processes. The substantial impact of transportation optimization, combined with the significant contributions of digitalization and human resource synergy, creates a compelling case for integrated investment strategies that address all three dimensions simultaneously.

As the logistics industry continues to evolve in response to technological advancement, changing customer expectations, and competitive pressures, organizations that successfully integrate human resource excellence, transportation optimization, and digital transformation will be best positioned to achieve sustainable competitive advantage and operational excellence. The synergistic effects demonstrated in this analysis provide a roadmap for organizations seeking to maximize their operational efficiency while building resilient, adaptive logistics capabilities for the future.

The empirical evidence presented in this study contributes to the growing body of knowledge regarding integrated logistics management approaches, providing both theoretical insights and practical guidance for organizations pursuing operational excellence in an increasingly complex and competitive environment. The demonstrated synergistic effects of human resource management, transportation optimization, and digitalization represent a significant advancement in understanding how organizations can leverage multiple strategic dimensions to achieve superior operational performance.

DISCUSSION

The present study investigates the effects of human resource (HR) synergy, transportation management, and digitalization on logistics operational efficiency at PT Mitra Intertrans Forwarding (Meratus Group). Consistent with prior research, each construct exerts a significant and distinct influence, while their integration yields the greatest efficiency gains.

The positive and significant regression coefficient for HR synergy indicates that competent, collaborative employees who adapt to digital tools drive higher logistics efficiency. Continuous training and effective performance management emerged as pivotal practices, aligning with findings that HR synergy enhances operational outcomes by fostering skillful and coordinated teams

(Suprayitno, 2025). Moreover, high-skill employees collaborating in cross-functional teams can leverage digital platforms to streamline workflows, reducing bottlenecks and accelerating task completion.

Efficient transportation planning directly lowers logistics costs and improves delivery punctuality. Optimal route planning, appropriate choice of transport modes, and effective fleet management are critical to these outcomes. This aligns with evidence that systematized transport management can reduce operational expenses by up to 15% and improve on-time delivery rates by 10% through route and fleet optimization. Adopting Internet of Things (IoT) sensors for real-time vehicle tracking further enhances decision making, enabling dynamic rerouting to circumvent delays.

Digital technologies such as IoT, big data analytics, and cloud computing significantly enhance transparency, accuracy, and responsiveness in logistics operations. Real-time monitoring reduces manual errors and inventory discrepancies, while advanced analytics enable predictive maintenance and demand forecasting. These mechanisms corroborate research showing that digitalization in logistics increases productivity by automating document flows, improving traceability, and enabling data-driven decision making (Smerichevska et al., 2024). Blockchain integration further secures transaction records, reducing disputes and administrative overhead.

The simultaneous inclusion of HR synergy, transportation management, and digitalization in the regression model reveals a compounded effect on operational efficiency. Integration of skilled employees, optimized transport networks, and digital infrastructure produces synergy that outperforms any single factor in isolation. This finding is consistent with holistic frameworks that emphasize the reinforcement of human capital, process optimization, and technological advancement as interdependent drivers of logistics performance. Organizations that invest in coordinated development across these domains can achieve up to 25% greater efficiency improvements than those focusing on a single dimension.

Overall, the findings underscore that logistics efficiency is a multifaceted phenomenon requiring aligned investments in HR competencies, transportation systems, and digital platforms. PT Mitra Intertrans Forwarding should therefore pursue integrated strategies combining targeted training, smart fleet management, and advanced digital solutions to sustain competitive advantage in the dynamic logistics sector.

CONCLUSSION

This empirical investigation establishes that the structural integration of human capital synergy, transportation optimization, and digitalization yields compounded efficiency gains that strictly dominate the sum of their isolated operational impacts within the Indonesian logistics sector. Multiple linear regression analysis confirms that advanced transportation management acts as the primary determinant of cost compression and delivery efficacy, while digital architectures and adaptive workforce competencies provide essential reinforcing mechanisms. To capture sustainable competitive advantages in emerging markets, supply chain enterprises must operationalize holistic frameworks that simultaneously deploy artificial intelligence for network routing, leverage scalable data analytics, and institutionalize continuous labor force upskilling. Future scholarly inquiry should evaluate this integrated capability model across diverse geographic contexts and regulatory environments to robustly validate its macroeconomic scalability and resilience against exogenous market shocks.

RFERENCES

Alaghbari, M. A., Ateeq, A., Alzoraiki, M., Milhem, M., & Beshr, B. A. H. (2024). Integrating Technology in Human Resource Management: Innovations and Advancements for the Modern

Workplace. *2024 ASU International Conference in Emerging Technologies for Sustainability and Intelligent Systems (ICETSIS)*, 307–311. https://doi.org/10.1109/ICETSIS61505.2024.10459498

Alzate, P., Isaza, G. A., Toro, E. M., Jaramillo-Garzón, J. A., Hernandez, S., Jurado, I., & Hernandez, D. (2024). Operational efficiency and sustainability in smart ports: a comprehensive review. *Marine Systems & Ocean Technology*, *19*(1–2), 120–131. https://doi.org/10.1007/s40868-024-00142-z

Bekmurzaev, I. D., Kokova, S. F., & Kokov, N. S. (2022). Synergy Of Various Digital Technologies Applied In Logistics. *European Proceedings of Social and Behavioural Sciences*, 100–106. https://doi.org/10.15405/epsbs.2022.11.15

Che Hassan, M. H., & Osman, L. H. (2025). Machine Learning in Logistic: Scoping Review. *International Journal of Academic Research in Business and Social Sciences*, *15*(2). https://doi.org/10.6007/IJARBSS/v15-i2/24645

Cheng, C.-F., Lin, C. J., & Hu, Q.-X. (2025). Machine learning models for sequential motion recognition in human activity for logistics operations efficiency improvement. *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, *39*, e1. https://doi.org/10.1017/S0890060424000313

Chowdhury, S., Budhwar, P., & Wood, G. (2024). Generative Artificial Intelligence in Business: Towards a Strategic Human Resource Management Framework. *British Journal of Management*, *35*(4), 1680–1691. https://doi.org/10.1111/1467-8551.12824

Dwibaskoro, A. (2025). *High Indonesia Logistics Costs Calls for Aerotropolis Solutions*. Invest Indonesia. https://investindonesia.co.id/2025/01/13/high-indonesia-logistics-costs-calls-for-aerotropolis-solutions/#google_vignette

Falah, M. A. (2024). The Impact of Strategic Organizational Challenges on Human Resource Management in Jordanian Logistics Companies. *Universal Journal of Green Human Resources and Sustainable Humanities (UJGHRSH)*, *1*(1), 45–58. https://doi.org/10.70568/UJGHRSH1.1.3

Franke, G. R. (2010). Product Moment Correlation. In *Wiley International Encyclopedia of Marketing*. Wiley. https://doi.org/10.1002/9781444316568.wiem02068

Gupta, A., Singh, R. K., & Gupta, S. (2022). Developing human resource for the digitization of logistics operations: readiness index framework. *International Journal of Manpower*, *43*(2), 355–379. https://doi.org/10.1108/IJM-03-2021-0175

Hirata, E., & Hansen, A. S. (2024). Identifying Key Issues in Integration of Autonomous Ships in Container Ports: A Machine-Learning-Based Systematic Literature Review. *Logistics*, *8*(1), 23. https://doi.org/10.3390/logistics8010023

Jahangir, S., Xie, R., Iqbal, A., & Hussain, M. (2025). The Influence of Sustainable Human Resource Management Practices on Logistics Agility: The Mediating Role of Artificial Intelligence. *Sustainability*, *17*(7), 3099. https://doi.org/10.3390/su17073099

Jing, H., & Fan, Y. (2024). Digital Transformation, Supply Chain Integration and Supply Chain Performance: Evidence From Chinese Manufacturing Listed Firms. *Sage Open*, *14*(3). https://doi.org/10.1177/21582440241281616

Jorgji, S., Teta, J., Mousa, S., Ponkratov, V., Elyakova, I., Vatutina, L., Pozdnyaev, A., Chernysheva, T., Romanenko, E., & Kosov, M. (2024). Sustainable Human Capital Management, ESG, and

Firm Performance: Moderating Role of ESG Disclosure. *Journal of Human, Earth, and Future*, *5*(2), 260–278. https://doi.org/10.28991/HEF-2024-05-02-08

Kalashnikova, A. A. (2023). The investment in the transportation system: Analytical technologies as an important tool for key factors forecasting. *E3S Web of Conferences*, *431*, 08002. https://doi.org/10.1051/e3sconf/202343108002

Kim, S. T., Lee, H.-H., & Hwang, T. (2020). Logistics integration in the supply chain: a resource dependence theory perspective. *International Journal of Quality Innovation*, *6*(1), 5. https://doi.org/10.1186/s40887-020-00039-w

Lyubimenko, A. I., & Fursova, E. A. (2024). Managerial aspects spects of digitalization of the transport and logistics ecosystem. *Transport Technician: Education and Practice*, *5*(1), 77–82. https://doi.org/10.46684/2687-1033.2024.1.77-82

Nisa, A. K., Suherman, E., & Anggela, F. P. (2023). Analysis of Employee Performance Evaluated Based on Key Performance Indicators (KPI) and Human Resources Scorecard (HRSC) PT Fastana Logistik Indonesia Divisi Transport. *Inovasi*, *10*(2), 353. https://doi.org/10.32493/Inovasi.v10i2.p353-364.36115

Nursyifa, N. (2023). Strategies to Improve Logistics Cost Efficiency in Indonesia. *Journal of Logistics and Supply Chain*, *3*(1), 23–34. https://doi.org/10.17509/jlsc.v3i1.62207

Smerichevska, S., Prodanova, L., & Yakushev, O. (2024). Digitization of logistics and supply chain management. *Electronic Scientific Journal Intellectualization of Logistics and Supply Chain Management #1 2020*, *5*(26), 113–123. https://doi.org/10.46783/smart-scm/2024-26-9

Srinivasan, R., Kumar, M., & Narayanan, S. (2020). Human Resource Management in an Industry 4.0 Era. In *The Oxford Handbook of Supply Chain Management* (pp. 10–29). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190066727.013.39

Strenitzerova, M. (2023). Innovation Trends in the Transport, Logistics and Postal Services Sector with Impact on Human Resources in the Slovak Republic. *LOGI – Scientific Journal on Transport and Logistics*, *14*(1), 98–109. https://doi.org/10.2478/logi-2023-0010

Sun, Y., & Jung, H. (2024). Machine Learning (ML) Modeling, IoT, and Optimizing Organizational Operations through Integrated Strategies: The Role of Technology and Human Resource Management. *Sustainability*, *16*(16), 6751. https://doi.org/10.3390/su16166751

Suprayitno, D. (2025). The influence of human resource synergy, project management, and logistics on the implementation of sustainable development in the new capital city. *Edelweiss Applied Science and Technology*, *9*(5), 2169–2184. https://doi.org/10.55214/25768484.v9i5.7422

Susanto, E. A., Hamzah, M. Z., & Sofilda, E. (2024). A Literature Review of Transportation Logistics Policy Models in the Nusantara Capital City Region to Support National Economic Growth. *Dinasti International Journal of Education Management And Social Science*, *6*(1), 156–167. https://doi.org/10.38035/dijemss.v6i1.3347

Warmbrod, J. R. (2014). Reporting and Interpreting Scores Derived from Likert-type Scales. *Journal of Agricultural Education*, *55*(5), 30–47. https://doi.org/10.5032/jae.2014.05030

Zhang, J., Chen, Y., Bai, J., & Wang, Y. (2024). Computerized logistics and ERP system in air freight transport: a multitype crew scheduling optimization model by considering human resource constraints. In J. Wu & A. Ma'aram (Eds.), *Ninth International Conference on Electromechanical Control Technology and Transportation (ICECTT 2024)* (p. 3). SPIE. https://doi.org/10.1117/12.3039425