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

The Effect of Internet of Things (IoT) and CEISA 4.0 System Reliability on Logistics Company Performance: The Mediating Role of Service Quality in Freight Forwarding Companies in Jakarta

Jusuf Roni Siahaan[1], Siti Maemunah[2], Sofwan Farisyi[3], Eduard Alfian Syamsya[4], Rohana Sitanggang[5]
[1]Institut Transportasi dan Logistik Trisakti, Jakarta, Indonesia, ronidaen@gmail.com
[2]Institut Transportasi dan Logistik Trisakti, Jakarta, Indonesia, unacsy2015@gmail.com
[3]Institut Transportasi dan Logistik Trisakti, Jakarta, Indonesia, sofwan.farisyi@lecturer.itltrisakti.ac.id
[4]Institut Transportasi dan Logistik Trisakti, Jakarta, Indonesia, eduard.a.s.sijabat@gmail.com
[5]Institut Transportasi dan Logistik Trisakti, Jakarta,Indonesia, rohanadems@gmail.com

Corresponding Author: unacsy2015@gmail.com[2]

Abstract: This study analyzes the effect of Internet of Things (IoT) and CEISA 4.0 system reliability on logistics company performance, with service quality as a mediating variable in freight forwarding companies in Jakarta. A quantitative approach was applied using data from 288 CEISA 4.0 users, analyzed through SEM-PLS. The results show that IoT has a significant positive effect on both service quality and company performance. Meanwhile, CEISA 4.0 reliability has no significant direct effect on company performance but positively affects service quality. Furthermore, service quality mediates the relationship between IoT and company performance but does not mediate the effect of CEISA 4.0 reliability. These findings indicate that IoT plays a more critical role in improving logistics performance, while the effectiveness of CEISA 4.0 is still limited. Therefore, improving system reliability and service quality is essential to enhance company performance in the logistics sector.

Keywords: IoT, CEISA 4.0, Reliability, Service Quality, Company Performance

INTRODUCTION

The rapid advancement of digital technology in the era of Industry 4.0 has significantly transformed the logistics and supply chain sector. One of the key technologies driving this transformation is the Internet of Things (IoT), which enables real-time data exchange, visibility, and integration across logistics operations (Ben-Daya et al., 2019; Birkel & Hartmann, 2020). In parallel, the Indonesian government has introduced the Customs-Excise Information System and Automation (CEISA) 4.0 as a digital platform to improve customs processes, enhance transparency, and accelerate export-import activities (Mulyadi, 2021).

Despite these developments, the implementation of digital systems in logistics operations does not automatically lead to improved company performance. In practice, freight forwarding companies in Jakarta still face various operational challenges related to system instability, data inaccuracies, and technical disruptions within CEISA 4.0. These issues potentially reduce service effectiveness and hinder operational efficiency, indicating that system reliability remains a critical concern in digital logistics environments (Ghobakhloo & Fathi, 2020).

Previous studies have highlighted the importance of technology adoption and system reliability in improving operational performance. System reliability has been found to significantly influence service quality and operational efficiency, particularly in digital-based logistics and public service systems (Alalwan et al., 2021; Rane et al., 2023). However, empirical research examining the combined effect of IoT and CEISA 4.0 reliability on company performance, particularly with service quality as a mediating variable, remains limited. Most prior studies focus on direct relationships, without considering how service quality bridges the impact of digital technology on organizational outcomes.

Service quality plays a crucial role in the logistics sector, as it reflects a company's ability to deliver reliable, timely, and accurate services to customers (Zeithaml et al., 2018). High service quality not only enhances customer satisfaction but also contributes to improved organizational performance (Mulyono, 2021). Therefore, understanding the mediating role of service quality is essential to explain how digital technology influences logistics performance more comprehensively.

Based on these gaps, this study aims to analyze the effect of IoT and CEISA 4.0 system reliability on logistics company performance, with service quality as a mediating variable in freight forwarding companies in Jakarta. This research is expected to contribute to the development of digital logistics management theory and provide practical insights for improving technology utilization and service performance in the logistics industry.

METHOD

This study adopts a quantitative research approach using primary data collected through a structured questionnaire. The research focuses on freight forwarding companies in Jakarta that actively utilize the CEISA 4.0 system in their operational processes, particularly in customs documentation and logistics services. This approach is considered appropriate as it allows for empirical testing of relationships among variables within a real operational context.

The population of this study consists of CEISA 4.0 users who are members of the regional association of logistics and freight forwarding companies (ALFI Jakarta). A total of 288 respondents were selected using a purposive sampling technique, with the main criterion being individuals who have direct experience in operating or interacting with the CEISA 4.0 system. This sampling method ensures that the data collected reflects relevant insights from practitioners involved in logistics operations. Data collection was carried out through the distribution of questionnaires using a Likert scale, ranging from strongly disagree to strongly agree, to measure respondents' perceptions of each research variable.

The variables examined in this study include Internet of Things (IoT) and CEISA 4.0 system reliability as independent variables, company performance as the dependent variable, and service quality as a mediating variable. Each construct was operationalized based on established theoretical indicators adapted to the logistics and freight forwarding context. IoT reflects the level of digital integration and real-time data utilization, while system reliability represents system stability, consistency, and accuracy. Service quality captures responsiveness, reliability, and accuracy of logistics services, whereas company performance reflects operational effectiveness and efficiency outcomes.

Data analysis was conducted using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with the assistance of SmartPLS software. The analysis procedure consists of two main stages. First, the measurement model (outer model) was evaluated to assess the validity and reliability of the constructs, including convergent validity (outer loading and AVE), discriminant validity (Fornell-Larcker criterion), and internal consistency reliability (Composite Reliability and Cronbach's Alpha). Second, the structural model (inner model) was evaluated to test the research hypotheses, including path coefficient analysis, coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2).

This analytical approach enables the simultaneous examination of both direct and indirect relationships among variables, making it particularly suitable for assessing the mediating role of service quality in the relationship between digital technology adoption and company performance. By applying SEM-PLS, this study provides a comprehensive and robust evaluation of the proposed research model within the logistics industry context.

RESULTS AND DISCUSSION

The data analysis was conducted using SEM-PLS to evaluate both the measurement model and the structural model. The results confirm that all constructs meet the required validity and reliability criteria, indicating that the research model is statistically robust and suitable for hypothesis testing.

Table 1. Convergent Validity Results

Variable	Dimension	*Outer Loading*	Signification (> 0,7)
Internet of Things (IoT)	PEN-1	0.971	Valid
	ANA-1	0.965	Valid
	KEA-1	0.971	Valid
	EFI-1	0.979	Valid
CEISA 4.0 System Reliability	KKS-2	0.979	Valid
	SOP-2	0.982	Valid
Company Performance	PRO-4	0.973	Valid
	KUA-4	0.975	Valid
	EFI-4	0.966	Valid
	PRO-4	0.969	Valid
Service Quality	REL-3	0.952	Valid
	TAN-3	0.967	Valid
	RES-3	0.963	Valid
	ASR-3	0.961	Valid
	EMP-3	0.954	Valid

The outer loading values for all indicators exceed the threshold of 0.70, indicating strong convergent validity. Each indicator across the variables of Internet of Things (IoT), CEISA 4.0 reliability, service quality, and company performance demonstrates high loading values ranging from 0.952 to 0.982, confirming that all measurement items are valid.

Table 2. Average Variance Extracted (AVE) Results

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
CEISA 4.0 System Reliability	0.960	0.963	0.980	0.961
Internet of Things (IoT)	0.980	0.981	0.985	0.944
Company Performance	0.980	0.980	0.985	0.942
Service Quality	0.979	0.979	0.983	0.921

Furthermore, the reliability test results show that all constructs have Cronbach's Alpha and Composite Reliability values above 0.70, while the Average Variance Extracted (AVE) values exceed 0.50. Specifically, IoT (AVE = 0.944), CEISA reliability (AVE = 0.961), service quality (AVE = 0.921), and company performance (AVE = 0.942) indicate excellent construct reliability and validity. These findings suggest that the measurement model is reliable and suitable for further structural analysis.

The hypothesis testing results reveal several important relationships among variables.

Table 3. Path Coefficients and Hypothesis Testing (Direct Effect)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Description
CEISA 4.0 System Reliability → Company Performance	0.040	0.040	0.024	1.640	0.101	Not Supported
CEISA 4.0 System Reliability → Service Quality	0.105	0.105	0.028	3.791	0.000	Supported
Internet Of Things (Iot) → Company Performance	0.370	0.370	0.053	6.938	0.000	Supported
Internet Of Things (Iot) → Service Quality	0.886	0.886	0.012	72.881	0.000	Supported
Service Quality → Company Performance	0.585	0.585	0.056	10.524	0.000	Supported

First, IoT has a significant positive effect on company performance ($\beta = 0.370$; $t = 6.938$; $p < 0.001$) and service quality ($\beta = 0.886$; $t = 72.881$; $p < 0.001$). These results indicate that IoT plays a critical role in enhancing logistics operations by improving data integration, real-time monitoring, and decision-making processes. This finding is consistent

with previous studies that highlight IoT as a key driver of operational efficiency and service quality in logistics systems (Ben-Daya et al., 2019; Birkel & Hartmann, 2020).

Second, CEISA 4.0 reliability has a significant positive effect on service quality (β = 0.105; t = 3.791; p < 0.001), but does not have a significant effect on company performance (β = 0.040; t = 1.640; p = 0.101). This suggests that although system reliability improves service delivery, it is not sufficient to directly enhance overall company performance. This finding aligns with previous research stating that system reliability primarily influences service quality through improved system stability and reduced operational errors (Alalwan et al., 2021; Ghobakhloo & Fathi, 2020).

Third, service quality has a significant positive effect on company performance (β = 0.585; t = 10.524; p < 0.001), indicating that better service delivery leads to improved operational outcomes. This result supports the SERVQUAL framework, which emphasizes the importance of service quality in determining organizational performance (Zeithaml et al., 2018; Mulyono, 2021).

Table 4. Path Coefficients and Hypothesis Testing (Indirect Effect)

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Description
CEISA 4.0 System Reliability → Service Quality → Company Performance	0.061	0.061	0.017	3.674	0.000	Supported
Internet of Things (IoT) → Service Quality → Company Performance	0.519	0.519	0.050	10.301	0.000	Supported

The mediation test results show that service quality significantly mediates the relationship between IoT and company performance (β = 0.519; t = 10.301; p < 0.001). This indicates that IoT not only directly improves performance but also enhances it indirectly through improved service quality.

In contrast, service quality does not significantly mediate the relationship between CEISA 4.0 reliability and company performance, even though the indirect effect is statistically significant (β = 0.061; t = 3.674; p < 0.001). This suggests that the contribution of CEISA reliability to performance is relatively weak and mostly indirect.

These findings support previous research indicating that technology adoption contributes to performance when it is effectively translated into service improvements (Farooq & Zhu, 2019). However, the limited impact of CEISA 4.0 reliability suggests that technical issues such as system instability, downtime, and data inconsistencies may reduce its effectiveness in improving overall performance.

Overall, the results indicate that IoT has a more dominant and consistent impact on logistics company performance compared to CEISA 4.0 reliability. IoT significantly influences both service quality and performance, while CEISA 4.0 reliability mainly affects service quality without a direct impact on performance.

This finding highlights that digital transformation in the logistics sector depends not only on system implementation but also on the level of integration, usability, and operational effectiveness of the technology. While CEISA 4.0 provides a necessary digital infrastructure, its current limitations prevent it from fully supporting performance improvement.

From a theoretical perspective, this study strengthens the role of service quality as a mediating variable in the relationship between digital technology and organizational performance. From a practical perspective, the findings suggest that logistics companies and policymakers should prioritize improving system stability, enhancing user capabilities, and optimizing digital infrastructure to maximize the benefits of CEISA 4.0.

CONCLUSION

This study aims to examine the effect of Internet of Things (IoT) and CEISA 4.0 system reliability on logistics company performance, with service quality as a mediating variable in freight forwarding companies in Jakarta. The findings reveal that IoT has a significant positive effect on both service quality and company performance, indicating its critical role in enhancing operational efficiency and real-time data integration within logistics activities. In contrast, CEISA 4.0 system reliability is found to significantly influence service quality but does not have a direct effect on company performance.

Furthermore, service quality is proven to have a significant positive effect on company performance and acts as a partial mediating variable in the relationship between IoT and performance. However, service quality does not significantly mediate the relationship between CEISA 4.0 reliability and company performance, suggesting that the current implementation of CEISA 4.0 has not been fully optimized to support overall organizational performance.

These findings imply that digital transformation in the logistics sector is not solely determined by the availability of technology but also by how effectively the technology is integrated into operational processes and service delivery. IoT demonstrates a more comprehensive impact on performance, while CEISA 4.0 still functions primarily as a supporting system with limited direct contribution to performance outcomes.

From a theoretical perspective, this study contributes to the development of digital logistics and service management literature by confirming the mediating role of service quality in linking technology adoption and company performance. From a practical perspective, the results suggest that logistics companies and policymakers should focus on improving system reliability, enhancing user competencies, and optimizing digital infrastructure to maximize the benefits of CEISA 4.0 and improve service quality and organizational performance.

REFERENCES

Alalwan, A. A., Dwivedi, Y. K., Rana, N. P., & Williams, M. D. (2021). Examining factors influencing Jordanian customers' intentions and adoption of internet banking: Extending UTAUT2 with trust. *International Journal of Information Management*, 40, 125–138.

Acar, A. Z. (2019). Organizational culture, leadership styles and organizational performance in Turkish logistics industry. *Procedia - Social and Behavioral Sciences*, 235, 1–10.

Adenigbo, J. A., Ojo, O. S., & Nwachukwu, C. C. (2023). Logistics management and organizational efficiency in supply chain operations. *Journal of Logistics Management*, 12(1), 45–58.

Adiatma, A. (2019). Manajemen logistik dalam meningkatkan efisiensi operasional perusahaan. *Jurnal Manajemen Logistik Indonesia*, 5(2), 67–75.

Al-Rfou, A. N. (2022). The impact of service quality on organizational performance in service industries. *International Journal of Business Research*, 10(2), 89–101.

Arief, M., Rahman, A., & Setiawan, B. (2017). Perencanaan logistik dalam mendukung efektivitas operasional perusahaan. *Jurnal Ekonomi dan Bisnis*, 8(1), 23–34.

Ben-Daya, M., Hassini, E., & Bahroun, Z. (2019). Internet of Things and supply chain management: A literature review. *International Journal of Production Research*,

57(15–16), 4719–4742.
Birkel, H. S., & Hartmann, E. (2020). Impact of IoT challenges and risks for SCM. *International Journal of Physical Distribution & Logistics Management*, 50(3), 263–286.
Bowersox, D. J., Closs, D. J., & Cooper, M. B. (2020). *Supply chain logistics management*(5thed.). McGraw-Hill.
Chopra, S., & Meindl, P. (2020). *Supply chain management: Strategy, planning, and operation* (7th ed.). Pearson.
DeLone, W. H., & McLean, E. R. (2014). Information systems success: The quest for the dependent variable. *Information Systems Research*, 3(1), 60–95.
Dožić, S. (2019). Logistics systems and efficiency in modern supply chains. *Transport Research Procedia*, 37, 45–52.
Farooq, M. S., & Zhu, X. (2019). The impact of digital transformation on service quality and firm performance. *Journal of Business Research*, 98, 123–133.
Ghobakhloo, M., & Fathi, M. (2020). Industry 4.0 and opportunities for logistics: Asystematic review. *International Journal of Production Economics*, 221, 107–114.
Hari, S. (2021). Analisis penggunaan aplikasi CEISA 4.0 dalam meningkatkan kinerja pelayanan kepabeanan. *Jurnal Logistik Indonesia*, 6(2), 101–110.
Lubis, A. (2019). Kualitas pelayanan dalam meningkatkan kepuasan pelanggan. *Jurnal Manajemen Pelayanan Publik*, 3(1), 15–27.
Mentzer, J. T. (2019). Logistics service quality as a competitive advantage. *Journal of Business Logistics*, 20(1), 1–15.
Merliana Putri, D., et al. (2021). Analisis penggunaan CEISA dalam pelayanan kepabeanan.
Jurnal Administrasi Bisnis, 9(2), 55–63. Mulyadi, D. (2021). Implementasi sistem CEISA 4.0 dalam meningkatkan pelayanan kepabeanan. *Jurnal Kebijakan Publik*, 12(3), 210–220.
Mulyono, S. (2021). Pengaruh kualitas pelayanan terhadap kinerja perusahaan logistik. *Jurnal Manajemen Transportasi*, 14(2), 77–89.
Na-Nan, K. (2019). The influence of organizational performance on business sustainability. *Sustainability Journal*, 11(3), 1–15.
Peter, R., & McCormack, K. (2019). Supply chain performance measurement and management. *Supply Chain Management Review*, 23(2), 45–52.
Pratiwi, D. (2019). Evaluasi sistem informasi menggunakan model DeLone & McLean. *Jurnal Sistem Informasi*, 8(1), 12–20.
Radanliev, P., et al. (2019). Future developments in IoT and supply chain systems. *IEEE Access*, 7, 1–12.
Rane, N., et al. (2023). Digital supply chain transformation and system reliability. *Journal of Supply Chain Management*, 59(2), 34–48.
Robbins, S. P., & Coulter, M. (2018). *Management* (14th ed.). Pearson.
Sholihin, M. (2021). Pengembangan sistem CEISA 4.0 dalam pelayanan kepabeanan. *Jurnal Teknologi Informasi*, 10(2), 89–98.
Soewarno, N. (2019). Transformasi digital dalam manajemen logistik. *Jurnal Manajemen Indonesia*, 19(1), 55–66.
Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2018). *Services marketing: Integrating customer focus across the firm* (7th ed.). McGraw-Hill.