

THE MEDIATING ROLE OF THIRD PARTY LOGISTICS IN THE RELATIONSHIP BETWEEN TRUCK OPERATOR PERFORMANCE AND CRANE RENTAL COSTS ON INTEGRATED LOGISTICS REVENUE

Lisnawati¹ *.Maniah²

^{1,2}University Of Logistics And International Business, Indonesia

*Correspondence email: lisnawati_1010@yahoo.com

ABSTRACT

This study analyzes the mediating role of Third Party Logistics (3PL) in the relationship between Truck Operator Performance and Crane Rental Costs on Integrated Logistics Revenue at PT Nulin Sarana Jaya. The study was motivated by declining logistics revenue, delivery delays, damaged goods, and increasing crane rental costs. The objective was to examine the direct and indirect effects among Truck Operator Performance, Crane Rental Costs, Third Party Logistics, and Integrated Logistics Revenue.

This research employed a quantitative explanatory approach with a cross-sectional design. Data were collected from 117 respondents selected from 165 logistics customers using stratified random sampling. Data analysis was conducted using Structural Equation Modeling–Partial Least Square (SEM-PLS) with SmartPLS 3. The validity test showed outer loading values ranging from 0.700–0.873, exceeding the required standard of 0.700. Reliability testing indicated that Cronbach's Alpha and Composite Reliability values were above 0.700, while Average Variance Extracted (AVE) values exceeded 0.500, confirming valid and reliable instruments.

The regression results showed that Third Party Logistics was influenced by Truck Operator Performance and Crane Rental Costs through the equation $Y = 0.411X_1 + 0.453X_2$, while Integrated Logistics Revenue was influenced by Third Party Logistics through the equation $Z = 0.627Y$. The adjusted R-square values were 0.439 for Third Party Logistics and 0.669 for Integrated Logistics Revenue. Hypothesis testing showed that all T-statistics values exceeded 1.96 and all p-values were below 0.05, indicating significant positive relationships among variables. The findings confirm that Third Party Logistics significantly mediates operational efficiency and revenue improvement.

Keywords: Crane Rental Costs, Integrated Logistics Revenue, Third Party Logistics, Truck Operator Performance, Supply Chain Management

1. INTRODUCTION

hereinafter referred to as Nulin) is a company engaged in integrated logistics services, including the procurement of goods and services, land, sea, and air transportation, distribution, as well as delivery services to end customers throughout Indonesia. In its operations, Nulin does not own transportation fleets but instead collaborates with 23 Third Party Logistics (3PL) companies located in Balikpapan and several other cities across Indonesia.

The primary issue addressed in this study is the decline in Integrated Logistics Revenue. Data indicate that in 2025, Nulin's revenue amounted to IDR 72,510,000,000, which decreased compared to IDR 81,480,000,000 in 2024, representing a decline of IDR 8,970,000,000 or 11.01%. This decline indicates inefficiencies in the company's integrated logistics performance. Operationally, throughout 2025, a total of 884 integrated logistics transactions were recorded, of which 93 transactions (10.50%) experienced delays, 25 transactions (2.8%) involved damaged goods, and 61 transactions (6.9%) incurred additional crane rental costs. These conditions indicate operational problems related to the performance of Third Party Logistics (3PL) providers serving as Nulin's logistics partners.

Theoretically, the involvement of Third Party Logistics (3PL) in distribution systems is believed to improve logistics performance and revenue through enhanced efficiency and distribution process integration (Darmiono, 2023). However, other studies suggest that improvements in integrated logistics revenue are not influenced by 3PL performance but are instead determined by the volume of transported goods (Marina Mayer, 2024). These differing findings indicate the presence of empirical inconsistencies that warrant further investigation.

Furthermore, the high rate of delivery delays (10.50%) and damaged goods (2.8%) indicates issues related to Truck Operator Performance managed by 3PL providers. Research conducted by Narantaka, N., Maulani, S. F., and Larasati, W. A. (2025), as well as Rahman and Hossain (2024), demonstrated that Truck Operator Performance significantly affects 3PL performance. In contrast, Karahan Kara and Emre İpekçi (2022) found that Truck Operator Performance does not have a significant effect on 3PL performance. This inconsistency provides an opportunity for further research within the context of Nulin Balikpapan.

Another identified issue is the increase in crane rental costs in 61 transactions (6.9%), indicating operational cost inefficiency. Hakim (2024) stated that Crane Rental Cost affects 3PL performance, whereas Jean (2022) reported contrasting findings, indicating no significant effect. This discrepancy highlights a research gap that requires empirical examination.

In relation to Integrated Logistics Performance, Zai (2022) argued that Truck Operator Performance significantly affects integrated logistics performance. However, Qatrun Nada Mutiah Gusfi, Nofrisel, and Dinar Dewi Kania (2024) found that the effect was not significant. Similarly, regarding the Crane Rental Cost variable, Amran, Diawati, and Lubis (2025) identified a significant effect on integrated logistics performance, while Vildayanti et al. (2024) reported insignificant findings.

From a mediation perspective, Darmiono (2023) stated that Truck Operator Performance affects integrated logistics performance through the mediating role of Third Party Logistics. However, Setyawan and Rizkyah (2024) found no mediating effect. Regarding the Crane Rental Cost variable, Zulkarnain (2025) demonstrated an effect through 3PL mediation, whereas Syafranita and Purnomo (2025) reported no mediating effect.

Based on these inconsistencies in previous research findings, it can be concluded that a significant research gap exists regarding the relationships among Truck Operator Performance, Crane Rental Cost, Third Party Logistics (3PL), and Integrated Logistics Revenue. Therefore, this study is important to conduct, focusing on analyzing the mediating role of Third Party Logistics in the relationship between Truck Operator Performance and Crane Rental

2. LITERATURE REVIEW

2.1. Grand Theory

The Grand Theory in this study is the Supply Chain Management Theory. Grand Theory refers to a broad and fundamental theory that serves as the primary foundation for explaining general phenomena in a research context. In this study, which focuses on logistics, Third Party Logistics (3PL), and operational performance, Supply Chain Management Theory is considered the most relevant theoretical foundation.

According to Supply Chain Management: Strategy, Planning, and Operation by Sunil Chopra and Peter Meindl (2022), Supply Chain Management Theory explains that logistics system performance is the result of integration among functions within the supply chain, including suppliers, transportation systems, and distribution activities to end customers. The theory primarily emphasizes: The relationships among actors within the supply chain, The integration of goods, information, and cost flows, and The efficiency and effectiveness of the logistics system as a whole. The core contribution of this Grand Theory is its explanation that integrated logistics performance is influenced by the coordination of various supply chain elements, including operators, operational costs, and Third Party Logistics (3PL) providers (Chopra & Meindl, 2022).

The reason for using Supply Chain Management Theory as the Grand Theory in this study is that the theory comprehensively explains the integration and coordination mechanisms among operational components in logistics systems. Furthermore, the theory is capable of explaining how operational performance, cost efficiency, and Third Party Logistics (3PL) collectively influence integrated logistics performance.

2.2. Middle Theory

Middle Theory in this study refers to operational theories that bridge the Grand Theory of Supply Chain Management with the empirical research variables examined in this study. Unlike Grand Theory, which is broad and general, Middle Theory is more specific and applicable in explaining the relationships among operational variables within the research model.

According to Chopra and Meindl (2022), Middle Range Theory functions as the theoretical basis for explaining the mechanisms linking operational inputs, logistics processes, and organizational outputs in supply chain systems. In this study, Middle Theory is used to explain how operational factors such as truck operator performance and crane rental costs influence Third Party Logistics (3PL) and ultimately affect integrated logistics performance. The Middle Theories employed in this study are as follows:

2.2.1. Third Party Logistics (3PL) Theory

Third Party Logistics Theory explains the role of third-party service providers in logistics activities, including transportation outsourcing, distribution management, and operational handling aimed at improving efficiency and flexibility within supply chain systems. According to Chopra and Meindl (2022), Third Party Logistics (3PL) is positioned as an outsourcing strategy designed to improve supply chain efficiency and logistics performance. The theory explains that companies can achieve better logistics effectiveness by collaborating with specialized logistics providers possessing operational expertise and distribution capabilities. The reason for using 3PL Theory as a Middle Theory in this study is that the theory directly explains the mediating role of Third Party Logistics in the relationship between operational performance, operational costs, and integrated logistics performance.

2.2.2. Operational Performance / Logistics Performance Theory

Logistics Performance Theory explains that logistics performance is influenced by operational factors such as workforce quality, operational costs, technology utilization, and coordination within distribution processes.

According to Logistics and Supply Chain Management by Martin Christopher (2022), logistics performance is the result of efficiency and effectiveness in operational processes throughout the supply chain. Effective operational performance contributes significantly to improving logistics integration, delivery reliability, and service quality.

The reason for applying this theory as a Middle Theory is that it provides an operational explanation of how Truck Operator Performance influences integrated logistics performance and Third Party Logistics effectiveness.

2.2.3. Cost Efficiency Theory (Cost Management in Logistics)

Cost Management in Logistics Theory explains that operational costs, including crane rental costs and transportation expenses, significantly influence the efficiency and performance of logistics systems.

According to Chopra and Meindl (2022), cost control is an essential factor in achieving logistics efficiency and operational optimization. Efficient cost management enables companies to improve logistics effectiveness, reduce operational inefficiencies, and strengthen supply chain competitiveness.

The reason for using this theory as a Middle Theory is that it explains the relationship between Crane Rental Cost efficiency and the improvement of Third Party Logistics performance as well as integrated logistics performance within the company's logistics operations.

2.3 Applied Theory

Applied theory in this study consists of exogenous variables, mediating variables, and endogenous variables. The exogenous variables are Truck Operator Performance and Crane Rental Costs. The mediating variable is Third Party Logistics, while the endogenous variable is Integrated Logistics Revenue.

2.3.1 Truck Operator Performance

Truck Operator Performance refers to the level of operational achievement of truck operators in conducting transportation activities measured through indicators such as discipline, productivity, occupational safety, punctuality, and equipment maintenance. According to Wijaya, Dahda, and Priyana (2025), Truck Operator Performance consists of two dimensions: Operational Performance and Occupational Safety Performance.

The Operational Performance dimension includes indicators such as increasing transportation frequency, punctual arrival at customer locations, and compliance with transportation Standard Operating Procedures (SOPs). Meanwhile, the Occupational Safety dimension includes punctual departure, punctual arrival at departure locations, and the absence of cargo damage during transportation activities.

2.3.2 Crane Rental Costs

Crane Rental Costs refer to all expenses arising from the use of external lifting equipment in logistics and operational activities, including hourly or daily rental fees, crane operator expenses, fuel consumption, mobilization expenses, installation costs, and maintenance costs. According to Carter (2023), crane rental expenses are classified into direct costs and indirect costs.

Direct cost indicators include crane rental tariffs, crane operator expenses, and fuel or energy costs. Indirect cost indicators include mobilization expenses, installation and setup expenses, and maintenance expenses incurred during the rental period.

2.3.3 Third Party Logistics

Third Party Logistics refers to external logistics partners supporting companies in optimizing supply chain performance through specialized logistics services. According to Akhter et al. (2024), Third Party Logistics functions as a strategic partner in supply chain optimization.

Third Party Logistics consists of two dimensions: Operational Logistics Services and Value-Added Services. Operational Logistics Services include transportation reliability, cargo

storage security, and punctual delivery performance. Value-Added Services include document management accuracy, packaging reliability, readable labeling systems, and integrated logistics services from sender to final customer.

2.3.4 Integrated Logistics Revenue

Integrated Logistics Revenue represents organizational performance reflecting the company's capability to manage and integrate logistics activities effectively. According to Paul Schönsleben (2023), integrated logistics revenue reflects transaction value, service utilization intensity, and customer participation within integrated supply chain systems.

Integrated Logistics Revenue consists of four dimensions: Transaction Volume, Financial Value, Service Coverage, and Relationship Sustainability. Transaction Volume includes increasing logistics service utilization and shipment frequency. Financial Value includes increased customer logistics expenditure and transaction growth. Service Coverage includes the use of integrated end-to-end logistics services. Relationship Sustainability includes long-term collaboration, customer loyalty, and future transaction potential.

2.4. Previous Studies and Hypothesis Development

2.4.1. The Effect of Truck Operator Performance on Third Party Logistics

The effect of Truck Operator Performance on Third Party Logistics (3PL) was proposed by Coyle et al. (2023) and Narantaka et al. (2025), who stated that transportation operational performance improves service quality, reliability, and supply chain integration. Conversely, Kara and İpekçi (2023) and Dumapias (2025) argued that Truck Operator Performance does not significantly affect 3PL performance, indicating that 3PL performance is more influenced by strategic factors such as innovation, collaboration, and outsourcing decisions.

These differing findings indicate the existence of a research gap regarding the direct role of transportation operational performance on 3PL performance, thereby requiring further empirical investigation.

H1: Truck Operator Performance has a positive and significant effect on Third Party Logistics.

2.4.2. The Effect of Truck Operator Performance on Integrated Logistics Performance

The effect of Truck Operator Performance on Integrated Logistics Performance was proposed by Zai et al. (2022), Li et al. (2024), and Siddique et al. (2024), who stated that transportation efficiency improves delivery timeliness and logistics integration. Conversely, Gusfi et al. (2024) found that Truck Operator Performance does not significantly affect Integrated Logistics Performance because the effect is mediated by logistics capability and system integration.

This inconsistency indicates the existence of a research gap regarding the direct role of operational performance on integrated logistics performance.

H2: Truck Operator Performance has a positive and significant effect on Integrated Logistics Performance.

2.4.3. The Effect of Crane Rental Cost on Third Party Logistics

The effect of Crane Rental Cost on Third Party Logistics was proposed by Syafranita et al. (2025) and Zulkarnain (2025), who stated that operational cost efficiency improves the effectiveness of 3PL services. Conversely, Abbasi et al. (2024) and Kara and İpekçi (2022) argued that Crane Rental Cost does not significantly affect 3PL performance because 3PL performance is more determined by system integration and supply chain strategy.

These differing findings indicate the existence of a research gap regarding the role of operational costs in 3PL performance.

H3: Crane Rental Cost has a positive and significant effect on Third Party Logistics.

2.4.4. The Effect of Crane Rental Cost on Integrated Logistics Performance

The effect of Crane Rental Cost on Integrated Logistics Performance was proposed by Vildayanti et al. (2024) and Hendra et al. (2024), who demonstrated that cost efficiency improves logistics operational performance.

Conversely, Syafranita (2025) found that Crane Rental Cost does not significantly affect Integrated Logistics Performance because the effect of cost is mediated by technology, system integration, and supply chain collaboration.

This inconsistency indicates the existence of a research gap regarding the direct effect of cost on integrated logistics performance.

H4: Crane Rental Cost has a positive and significant effect on Integrated Logistics Performance.

2.4.5. The Effect of Third Party Logistics on Integrated Logistics Performance

The effect of Third Party Logistics on Integrated Logistics Performance was proposed by Zulkarnain (2025) and Darmiono (2023), who stated that 3PL improves logistics efficiency, coordination, and integration. Conversely, Nguyen N.A.T., Wang et al. (2025), Mayer (2024), Armstrong (2024), and Festus (2021) found that Third Party Logistics does not significantly affect Integrated Logistics Performance because the effectiveness of 3PL is influenced by market conditions and the level of integration.

These differing findings indicate the existence of a research gap regarding the effectiveness of 3PL implementation on logistics performance.

H5: Third Party Logistics has a positive and significant effect on Integrated Logistics Performance.

2.4.6. The Effect of Truck Operator Performance on Integrated Logistics Performance through Third Party Logistics

The effect of Truck Operator Performance on Integrated Logistics Performance through the mediation of Third Party Logistics was proposed by Darmiono (2023) and Zulkarnain (2025), who stated that 3PL strengthens distribution integration and coordination.

Conversely, Abbasi et al. (2024) and Setyawan and Rizkyah (2024) found that the relationship is not significant because it is influenced by outsourcing factors, coordination issues, and suboptimal system integration.

This inconsistency indicates the existence of a research gap regarding the mediating role of 3PL in the relationship between operational performance and logistics performance.

H6: Truck Operator Performance has a positive and significant effect on Integrated Logistics Performance through Third Party Logistics as a mediating variable.

2.4.7. The Effect of Crane Rental Cost on Integrated Logistics Performance through Third Party Logistics

The effect of Crane Rental Cost on Integrated Logistics Performance through the mediation of Third Party Logistics was proposed by Abbasi et al. (2024), Zulkarnain (2025), and Setyawan and Rizkyah (2024), who stated that cost efficiency through 3PL improves logistics performance.

Conversely, Syafrianita and Purnomo (2025), Syafrianita et al. (2025), and Hakim (2024) found that Crane Rental Cost does not significantly affect Integrated Logistics Performance through 3PL because cost is not the primary determinant compared to system integration and logistics strategy.

These differing findings indicate the existence of a research gap regarding the effectiveness of 3PL mediation in the relationship between operational cost and logistics performance.

H7: Crane Rental Cost has a positive and significant effect on Integrated Logistics Performance through Third Party Logistics as a mediating variable.

2.5. Research Model

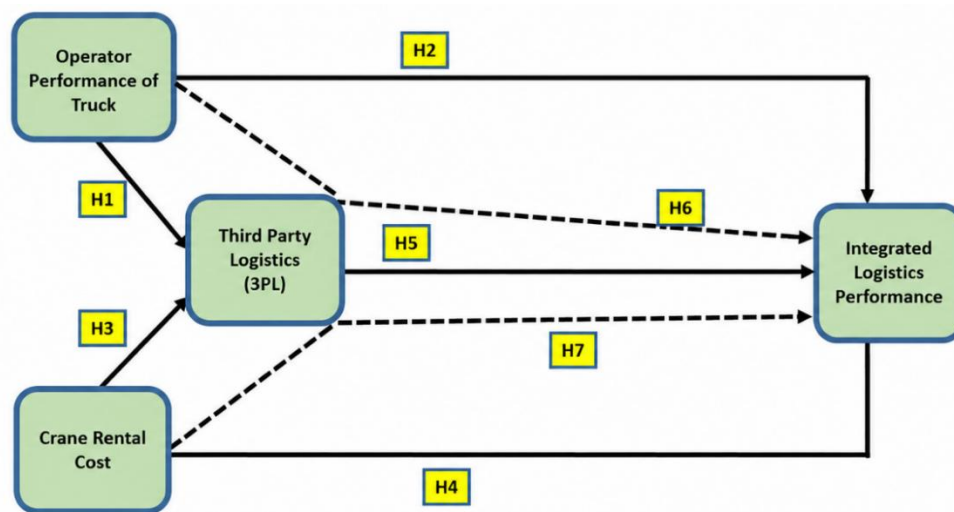


Figure 1. Research Model

The research model is developed based on the assumption that Integrated Logistics Revenue is influenced not only directly by operational and cost factors but also indirectly through the mediating role of Third Party Logistics. In this study, Truck Operator Performance and Crane Rental Costs are positioned as independent variables influencing Integrated Logistics Revenue both directly and indirectly through Third Party Logistics as an intervening variable.

3. METHODS

This study applied a quantitative research method with an explanatory approach to examine the causal relationships among variables. The research was descriptive and verificative in nature and employed a cross-sectional design, where data were collected at a single point in time (Sugiyono, 2021). The study aimed to analyze the mediating role of Third Party Logistics (3PL) in the relationship between Truck Operator Performance and Crane Rental Costs on Integrated Logistics Revenue at PT Nulin Sarana Jaya. The research variables consisted of exogenous variables, namely Truck Operator Performance (X1) and Crane Rental Costs (X2), a mediating variable represented by Third Party Logistics (Y), and an endogenous variable, namely Integrated Logistics Revenue (Z). The research instrument was developed in the form of a structured questionnaire using a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree (Sugiyono, 2023). The population consisted of 165 customers of PT Nulin Sarana Jaya, while the sample size was determined using the Slovin formula with a 5% significance level, resulting in 117 respondents selected through stratified random sampling to ensure proportional representation. Data collection techniques included literature studies, observations, and questionnaires distributed both directly and indirectly to respondents, while interviews were not utilized in this study. The collected data were analyzed using Structural Equation Modeling–Partial Least Square (SEM-PLS) with SmartPLS 3 software because this method is suitable for analyzing complex relationships among variables and non-normally distributed data (Iman Supriadi, 2025). The analysis consisted of outer model and inner model evaluations. The outer model tested validity and reliability through convergent validity,

discriminant validity, Cronbach's Alpha, rho_A, Composite Reliability, and Average Variance Extracted (AVE). Meanwhile, the inner model examined the direct and indirect effects among variables, including the mediating role of Third Party Logistics. Hypothesis testing was conducted using t-statistics and p-values, where hypotheses were accepted if the t-statistic exceeded 1.96 and the p-value was below 0.05. Mediation testing was performed using the bootstrapping procedure in PLS-SEM to determine the significance of indirect effects. Finally, the results of the statistical analysis were interpreted to answer the research objectives, evaluate the hypotheses, and formulate theoretical and practical recommendations related to integrated logistics management and Third Party Logistics optimization.

4. RESULTS AND DISCUSSION

4.1. Respondent Characteristics

The respondent characteristics indicate that the majority of participants were male, accounting for 66.67% (78 respondents), while female respondents represented 33.33% (39 respondents). Based on the type of business, most respondents were engaged in the mining and energy sector (29.91%), followed by construction and infrastructure (24.79%), trading or distributor companies (15.38%), manufacturing (11.11%), state-owned enterprises (10.26%), and local SMEs (8.55%). In terms of position, the respondents were relatively balanced across organizational levels, with staff members dominating at 29.06%, followed by managers (25.64%), supervisors (23.93%), and business owners (21.37%). Regarding educational background, most respondents held a bachelor's degree (38.46%), while others had senior high school/vocational education (27.35%), diploma degrees (21.37%), and postgraduate degrees (12.82%). The logistics expenditure profile shows that most companies allocated IDR 10,000,001–50,000,000 per month for logistics activities, representing 34.19% of respondents. Meanwhile, 25.64% spent IDR 50,000,001–100,000,000, 23.08% spent above IDR 100,000,000, and 17.09% spent up to IDR 10,000,000. Specifically, for logistics spending at PT Nulin Sarana Jaya, the largest proportion of respondents spent IDR 5,000,001–20,000,000 per month (35.90%), followed by expenditures up to IDR 5,000,000 (23.93%), IDR 20,000,001–50,000,000 (23.08%), and above IDR 50,000,000 (17.09%). These findings indicate that the respondents mainly represent medium-to-large business sectors with moderate to high logistics spending intensity.

4.2. Descriptive Analysis Results

The descriptive analysis results indicate that all research variables were assessed within the “fairly good” category and were considered worthy of further investigation. PT Nulin Sarana Jaya showed an average score of 2.95 for Truck Operator Performance (KOT), 2.96 for Crane Rental Costs (CRC), 3.01 for Third Party Logistics (3PL), and 3.09 for Integrated Logistics Revenue (ILR).

4.3. Validity Test Results

The validity test results indicate that all indicators for each research variable have outer loading values above the validity threshold of 0.700; therefore, all indicators are considered valid and appropriate for use in this study. The Truck Operator Performance variable has outer loading values ranging from 0.700 to 0.833, the Crane Rental Costs variable ranges from 0.805 to 0.870, the Third Party Logistics variable ranges from 0.801 to 0.873, and the Integrated Logistics Revenue variable ranges from 0.734 to 0.812. Thus, all indicators within each variable are capable of adequately representing the research constructs.

4.4. Reliability Test Results

The reliability and convergent validity test results demonstrate that all research variables met the recommended measurement standards. The Cronbach's Alpha values ranged from 0.887 to 0.931, indicating a high level of internal consistency among the indicators for each construct. Similarly, the rho_A values, which ranged from 0.898 to 0.934, further confirmed the reliability of the measurement model. The Composite Reliability values for all variables were above 0.900, specifically 0.936 for Crane Rental Costs, 0.913 for Truck Operator Performance, 0.937 for Integrated Logistics Revenue, and 0.944 for Third Party Logistics, showing strong construct reliability. In addition, the Average Variance Extracted (AVE) values ranged from 0.622 to 0.708, exceeding the minimum threshold of 0.500, which indicates that all constructs possessed adequate convergent validity. Overall, these findings confirm that the measurement model used in the study is reliable and valid for further structural analysis.

4.5. Hypothesis Testing Results

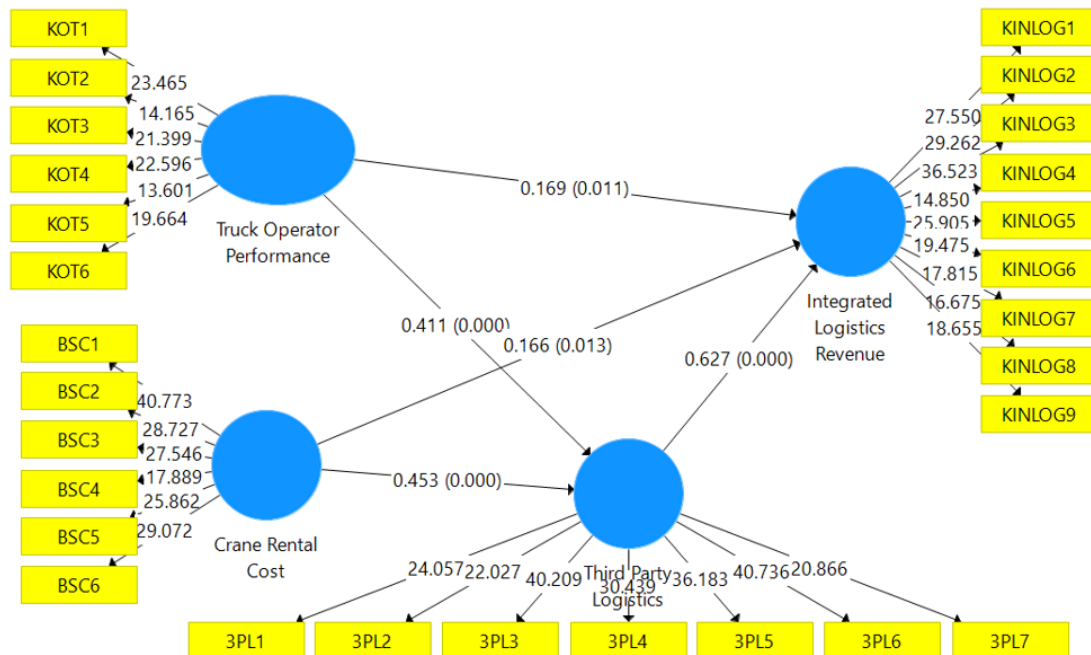


Figure 2. Research Result

The hypothesis testing results indicate that all proposed relationships in the research model were positive and statistically significant. The effect of Truck Operator Performance on Third Party Logistics showed a t-statistic value of 5.962, which exceeded the t-table value of 1.96, with a p-value of 0.000 (< 0.05), indicating a significant positive effect. Similarly, Truck Operator Performance had a significant positive effect on Integrated Logistics Revenue with a t-statistic of 2.546 and a p-value of 0.011. Furthermore, Crane Rental Costs significantly influenced Third Party Logistics, as reflected by a t-statistic value of 6.887 and a p-value of 0.000, while its effect on Integrated Logistics Revenue was also significant with a t-statistic of 2.460 and a p-value of 0.014.

In addition, Third Party Logistics demonstrated a strong positive effect on Integrated Logistics Revenue, with the highest t-statistic value of 8.875 and a p-value of 0.000, indicating that Third Party Logistics plays an important role in improving integrated logistics revenue at PT Nulin Sarana Jaya. The mediation analysis also confirmed that Third Party Logistics significantly mediated the relationship between Truck Operator Performance and Integrated Logistics Revenue, with a t-statistic value of 5.078 and a p-value below 0.05. Likewise, Third Party Logistics significantly mediated the relationship between Crane Rental Costs and Integrated Logistics Revenue, as indicated by a t-statistic value of 5.045 and a p-value of 0.000. Overall, these findings confirm that all hypotheses proposed in the study were accepted.

4.6. Regression Equation Analysis

4.6.1. Multiple Linear Regression Equation

The multiple linear regression equation examining the influence of Truck Operator Performance and Crane Rental Costs on Third Party Logistics is expressed as follows:

$$Y = 0.411X_1 + 0.453X_2$$

Where:

- Y = Third Party Logistics
- X_1 = Truck Operator Performance
- X_2 = Crane Rental Costs

The equation indicates that simultaneous improvements in Truck Operator Performance and Crane Rental Costs management increase the effectiveness of Third Party Logistics services.

4.6.2. Simple Linear Regression Equation

The simple regression equation examining the effect of Third Party Logistics on Integrated Logistics Revenue is expressed as follows:

$$Z = 0.627Y$$

Where:

- ZZZ = Integrated Logistics Revenue
- YYY = Third Party Logistics

The equation demonstrates that improvements in Third Party Logistics performance significantly increase Integrated Logistics Revenue.

4.7. Coefficient of Determination

Table1. R-Square Adjusted Results

Causality	R-Square	R-Square Adjusted
Integrated Logistics Revenue	0.677	0.669
Third Party Logistics	0.448	0.439

Source: Questionnaire Data Processed Using SmartPLS (2026)

The adjusted R-square value for Third Party Logistics was 0.439, indicating that Truck Operator Performance and Crane Rental Costs contributed 43.90% to explaining variations in Third Party Logistics. The remaining 56.10% was influenced by other variables not examined in this study, such as logistics service quality, information technology utilization, fleet capacity, and distribution networks.

Meanwhile, the adjusted R-square value for Integrated Logistics Revenue was 0.669, indicating that Third Party Logistics contributed 66.90% to explaining variations in Integrated Logistics Revenue. The remaining 33.10% was influenced by other factors outside the research model.

4.8. Discussion

4.8.1. The Effect of Truck Operator Performance on Third Party Logistics (3PL)

The results showed that Truck Operator Performance has a positive and significant effect on Third Party Logistics (3PL), with a T-statistic of $5.962 > 1.96$ and a P-value of $0.000 < 0.05$. Better truck operator performance improves delivery timeliness, distribution effectiveness, logistics service quality, and supply chain operations. These findings support the studies of John J. Coyle et al. (2023) and Narantaka et al. (2025), which state that transportation operational performance plays an important role in improving service quality, distribution reliability, and supply chain integration in 3PL companies.

4.8.2. The Effect of Truck Operator Performance on Integrated Logistics Performance

The results indicate that Truck Operator Performance has a positive and significant effect on Integrated Logistics Performance, with a T-statistic of $2.546 > 1.96$ and a P-value of $0.011 < 0.05$. Improved truck operator performance enhances distribution timeliness, delivery

efficiency, and logistics coordination. These findings are consistent with the studies of Zai et al. (2022), Li et al. (2024), and Siddique et al. (2024).

4.8.3. The Effect of Crane Rental Costs on Third Party Logistics (3PL)

The findings show that Crane Rental Costs have a positive and significant effect on Third Party Logistics (3PL), with a T-statistic of $6.887 > 1.96$ and a P-value of $0.000 < 0.05$. Efficient crane rental cost management improves operational effectiveness, distribution processes, and logistics cost control. These results support the studies of Syafrianita et al. (2025) and Zulkarnain (2025).

4.8.4 The Effect of Crane Rental Costs on Integrated Logistics Performance

The results reveal that Crane Rental Costs positively and significantly affect Integrated Logistics Performance, with a T-statistic of $2.460 > 1.96$ and a P-value of $0.014 < 0.05$. Efficient crane rental costs improve logistics operational effectiveness and distribution integration. These findings are in line with the studies of Vildayanti et al. (2024) and Hendra et al. (2024).

4.8.5. The Effect of Third Party Logistics (3PL) on Integrated Logistics Performance

The results indicate that Third Party Logistics (3PL) has a positive and significant effect on Integrated Logistics Performance, with a T-statistic of $8.875 > 1.96$ and a P-value of $0.000 < 0.05$. The implementation of 3PL improves distribution efficiency, logistics coordination, and supply chain integration. These findings support the studies of Zulkarnain (2025) and Darmiono (2023).

4.8.6. The Effect of Truck Operator Performance on Integrated Logistics Performance through Third Party Logistics (3PL)

The findings show that Truck Operator Performance positively and significantly affects Integrated Logistics Performance through Third Party Logistics (3PL) as a mediating variable, with a T-statistic of $5.078 > 1.96$ and a P-value of $0.000 < 0.05$. 3PL strengthens the relationship between truck operator performance and integrated logistics performance. These results are consistent with the studies of Darmiono (2023) and Zulkarnain (2025).

4.8.3. The Effect of Crane Rental Costs on Integrated Logistics Performance through Third Party Logistics (3PL)

The results show that Crane Rental Costs positively and significantly affect Integrated Logistics Performance through Third Party Logistics (3PL) as a mediating variable, with a T-statistic of $5.045 > 1.96$ and a P-value of $0.000 < 0.05$. 3PL mediates the relationship between crane rental cost efficiency and integrated logistics performance improvement. These findings support the studies of Abbasi et al. (2024), Zulkarnain (2025), and Setyawan & Rizkyah (2024).

5. CONCLUSION AND LIMITATION

This study concluded that Truck Operator Performance and Crane Rental Costs significantly influence Third Party Logistics and Integrated Logistics Revenue both directly and indirectly. Third Party Logistics was proven to play a strategic mediating role in strengthening the relationship between operational performance and integrated logistics revenue. The findings confirmed that operational efficiency, cost management, and logistics integration are critical determinants of logistics performance and revenue improvement in project-based logistics industries. The study also strengthened the theoretical development of supply chain management and Third Party Logistics by empirically demonstrating the mediating role of 3PL within integrated logistics systems.

This study has several limitations. First, the research was limited to customers of PT Nulin Sarana Jaya, which may limit the generalizability of the findings to other logistics sectors or regions. Second, the study used a cross-sectional design, which only captured conditions at a single point in time. Third, several external variables such as logistics technology, service quality, information system integration, and market dynamics were not included in the research model. Therefore, future research is recommended to incorporate additional variables, apply longitudinal approaches, and conduct comparative studies across industries or regions to enrich the understanding of integrated logistics performance and Third Party Logistics management.

6. REFERENCES

- Abbasi, S., Sıcakyüz, Ç., Santibanez Gonzalez, E. D. R., & Ghasemi, P. (2024). A systematic literature review of logistics services outsourcing. *Heliyon*, 10(13), e33374. <https://doi.org/10.1016/j.heliyon.2024.e33374>
- Amran, K. M., Diawati, P., & Lubis, N. I. P. (2025). Pengaruh biaya transportasi dan biaya pemasaran terhadap laba bersih pada PT. Sinar Andesto Mandiri Logistik. *Land Journal*, 6(1), 242–252. <https://doi.org/10.47491/landjournal.v6i1.4031>
- Armstrong. (2024). *Efektivitas third party logistics dalam kondisi pasar dinamis*.
- Carter. (2023). *Cost management in logistics operations*. McGraw-Hill.
- Chopra, S., & Meindl, P. (2022). *Supply chain management: Strategy, planning, and operation* (8th ed.). Pearson Education.
- Christopher, M. (2022). *Logistics and supply chain management* (6th ed.). Pearson Education.
- Coyle, J. J., Langley, C. J., Novack, R. A., & Gibson, B. J. (2023). *Supply chain management: A logistics perspective* (12th ed.). Cengage Learning.

- Darmiono, D. (2023). Analysing the impact of third-party involvement on smooth distribution in supply chain in Indonesia. *Sinergi International Journal of Logistics*, 1(2), 96–107. <https://doi.org/10.61194/sijl.v1i2.146>
- Dumapias, D. A. (2025). Strategic drivers for outsourcing third-party logistics (3PL) in local foodservice establishments: Its impact to the financial and operational performance. *BCP Business & Management*, 9(14), 553–567. <https://ideas.repec.org/a/bcp/journal/v9y2025issue-14p553-567.html>
- Festus, E. E. (2021). Logistics and trade flows in selected ECOWAS countries: An empirical verification. *arXiv*. <https://arxiv.org/abs/2108.06441>
- Gusfi, Q. N. M., Nofrisel, N., & Kania, D. D. (2024). Pengaruh kolaborasi strategi dan information sharing terhadap logistics performance yang dimediasi logistics capability pada PT. Myglobal Logistik Internasional. *AKUNTANSI '45*, 5(2). <https://doi.org/10.30640/akuntansi45.v5i2.3440>
- Hakim, A. N. (2024). *Analisis dan usulan perbaikan kinerja supply chain menggunakan SCOR digital standard pada proses procurement PT Kereta Api Indonesia (Persero) UPT Balai Yasa Yogyakarta* [Skripsi].
- Hendra.Fachrudin, R. D. H. (2022). *Pengaruh strategi fleksibilitas dan inovasi model bisnis terhadap kinerja rantai pasokan pada penyedia jasa logistik nasional* (Disertasi doktor, Universitas Pendidikan Indonesia). UPI Repository. <https://repository.upi.edu/87057/>
- Jean.Rodrigue, J.-P., Comtois, C., & Slack, B. (2022). *The geography of transport systems* (5th ed.). Routledge. <https://doi.org/10.4324/9780429346323>
- Kara, K., & İpekçi, E. (2023). The effect of logistics innovativeness on the relationship between logistics capabilities and logistics performance: An empirical analysis of 3PL firms. *Journal of Transportation and Logistics*, 7(2), 557–577. <https://doi.org/10.26650/JTL.2022.1047478>
- Liu, C. L., Shang, K. C., Lirn, T. C., Lai, K. H., & Lun, Y. H. V. (2023). Supply chain resilience, firm performance, and management policies in the shipping industry. *Transportation Research Part A: Policy and Practice*, 170, 103–118. <https://doi.org/10.1016/j.tra.2023.02.012>
- Mayer, M. (2024). 3PLs to see decline as supply chain market corrects itself. *Food Logistics*. <https://www.foodlogistics.com/transportation/3pl-4pl/news/22911893>
- Nanda, F., Mukti, E. T., & Sumiyattinah. (2023). Analisis kinerja jalan trans Kalimantan akibat antrian kendaraan truk. *JeLAST: Jurnal Teknik Sipil dan Transportasi*, 10(3), 45–55.

- Narantaka, N., Maulani, S. F., & Larasati, W. A. (2026). Pengaruh reward dan punishment terhadap kinerja pengemudi truk wingbox pada bidang third party logistic di PT Exytos Mitra Aditama. *RIGGS: Journal of Artificial Intelligence and Digital Business*, 5(1), 3940–3950. <https://doi.org/10.31004/riggs.v5i1.6755>
- Rahman, M. S., Islam, S., Khan, S. I., Ashik, A. A. M., Hossain, E., & Rahman, M. M. (2024). Redefining marketing and management strategies in digital age: Adapting to consumer behavior and technological disruption. *Journal of Information Systems Engineering and Management*, 9(4), 1–16. <https://doi.org/10.52783/jisem.v9i4.32>
- Schönsleben, P. (2023). *Handbook integral logistics management*. Springer.
- Setyawan, I., & Rizkyah, A. E. (2024). Criteria for selecting third-party logistics service providers: Systematic literature review. *Operations Excellence: Journal of Applied Industrial Engineering*, 16(2), 112–123. <https://doi.org/10.22441/oe.v16i2.27443>
- Siddique, I. M., Molla, S., Hasan, M. R., & Siddique, A. A. (2024). *Deployment of advanced and intelligent logistics vehicles with enhanced tracking and security features*. arXiv. <https://arxiv.org/abs/2402.11829>
- Syafrianita, S., Agus Purnomo, & Diar Fachmi Rachmat Chaidar. (2025). MENGEKSPLORASI DAMPAK KEPEMIMPINAN AGILE DAN LOGISTIK BERBASIS AGEN TERHADAP EFISIENSI BIAYA PENGIRIMAN LAST-MILE: WAWASAN DARI J&T EXPRESS. *LAND JOURNAL*, 6(2), 275–286. <https://doi.org/10.47491/landjournal.v6i2.4226>
- Syafrianita, S., Purnomo, A., & Faisal Nasrudin, M. (2025). Investigasi hubungan antara advanced technology, logistics service cost, dan logistics performance di Shopee Express Bandung Raya. *LAND Journal*, 6(1), 253–265. <https://doi.org/10.47491/landjournal.v6i1.4038>
- Vildayanti, R. A., Hidayat, R. S., Jusmansyah, M., Setyarko, Y., & Sriyanto, A. (2024). Pengaruh faktor biaya, faktor pelayanan dan efektifitas operasional terhadap performa manajemen logistik perusahaan. *Jurnal Publikasi Ekonomi dan Akuntansi*, 4(1), 141–153. <https://doi.org/10.51903/jupea.v4i1.2286>
- Nguyen, N.-A.-T., Wang, C.-N., & Dang, T.-T. (2025). Advanced process optimization in logistics and supply chain management. *Processes*, 13(6), 1864. MDPI. <https://doi.org/10.3390/pr13061864>
- Wijaya, M. K. D., Dahda, S. S., & Priyana, E. D. (2025). Pengukuran kinerja operator dump truck dengan pendekatan analytical hierarchy process dan rating scale. *INTECOMS: Journal of Information Technology and Computer Science*, 8(1), 112–120. <https://journal.ipm2kpe.or.id/index.php/INTECOM/article/view/17300>

Zai, et al. (2022). Analisis pengaruh peningkatan kinerja, incoterms, transportasi, distribusi, keterlibatan TPL dan manajemen risiko terhadap aktivitas logistik. *Jurnal Logistik Indonesia*, 6(2), 145–156.

Zulkarnain, A. (2025). *Unlocking logistics efficiency: The strategic role of third-party logistics (3PL) in Indonesia's manufacturing sector*. *Sinergi International Journal of Logistics*, 3(3), 135–144. <https://doi.org/10.61194/sijl.v3i3.885>