

FACTORS AFFECTING LAST MILE DELIVERY AT PT POS INDONESIA MAIN BRANCH OFFICE JAKARTA OCEANIA THROUGH DISTRIBUTION

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ABSTRACT

This study aims to analyze the effect of Mail Processing Centre, Line Haul Transportation, and Distribution on Last Mile Delivery at PT Pos Indonesia Jakarta Oceania Main Branch Office. The study employed a quantitative approach using descriptive and verificative methods, with data collected from 121 employees and analyzed using Partial Least Squares--Structural Equation Modeling (PLS-SEM). The results indicate that Mail Processing Centre has a positive and significant effect on Distribution ($\beta = 0.363$) and Last Mile Delivery ($\beta = 0.214$). Line Haul Transportation also has a positive and significant effect on Distribution ($\beta = 0.444$) as well as on Last Mile Delivery ($\beta = 0.163$). Distribution was found to be the most dominant variable influencing Last Mile Delivery ($\beta = 0.571$). In addition, Distribution was proven to mediate the effect of Mail Processing Centre and Line Haul Transportation on Last Mile Delivery, with indirect effects of 0.207 and 0.254, respectively. These findings highlight the importance of multi-echelon logistics system integration in improving final delivery performance. Practically, the results provide recommendations for the Executive General Manager Jakarta Oceania to prioritize the optimization of the Mail Processing Centre, line haul transportation, and Distribution in order to improve operational performance achievement and logistics revenue toward the minimum annual target of 95%.

Keywords: Mail Processing Centre, Line Haul Transportation, Distribution, Last Mile Delivery, PT Pos Indonesia Jakarta Oceania Main Branch Office

1. INTRODUCTION

PT Pos Indonesia is a state-owned enterprise that has been operating in the courier and logistics sector since its establishment. The Main Branch Office Jakarta Oceania (KCU Jakarta Oceania) is part of PT Pos Indonesia that provides logistics services to the community in West Jakarta, where the logistics business processes carried out include first mile, middle mile, and

last mile. The logistics courier revenue of KCU Jakarta Oceania in the previous year (2025) without the Telkomsel project can be seen as follows:

Table 1. Logistics Courier Service Revenue of KCU Jakarta Oceania

Tahun	Target	Realisasi	Ach	Growth
2024	31.000.000.000	26.145.487.058	84%	-8.305.766.453
2025	44.500.000.000	17.839.720.605	40%	atau -32%

Source: KCU Jakarta Oceania (2026)

The revenue achievement in 2025 is still far from the established target, and there was a revenue decline compared to 2024 of Rp 8,305,766,453 or a decrease of 32%. Based on the above data, it is known that the logistics revenue of KCU Jakarta Oceania has decreased, one of which is influenced by the last mile delivery process. Regarding the revenue performance above, operational/logistics performance when viewed from the number of logistics shipments that must be delivered to end customers from January 2025 to December 2025 at KCU Jakarta Oceania amounted to 990,000 items.

Table 2. Operational Performance of KCU Jakarta Oceania

 Operational Performance (990,000 Items)

Process	Achievement
Last Mile Delivery	88.20%
Distribution	87.75%
Line Haul Transportation	88.16%
Mail Processing Centre	88.14%

Source: KCU Jakarta Oceania (2026)

PT Pos Indonesia establishes that the minimum performance for Last Mile Delivery is 95%, Distribution is 95%, Line Haul Transportation is 95%, and Mail Processing Centre is 95% (Customer Complaint Handling of PT Pos Indonesia, 2024). The realization of Last Mile Delivery performance is only 88.20%, which is lower than the minimum target of 95%. The realization of Distribution performance is only 87.75%, which is lower than the minimum target of 95%. The realization of Line Haul Transportation performance is only 88.16%, which is lower than the minimum target of 95%. The realization of Mail Processing Centre performance is only 88.14%, which is lower than the minimum target of 95%, proving that there are problems in Last Mile Delivery, Distribution, Line Haul Transportation, and Mail Processing Centre.

The information regarding the realization of logistics activity performance at PT Pos Indonesia shows that several key operational indicators have not been able to achieve the company's established performance targets. Based on data from Customer Complaint Handling of PT Pos Indonesia (2024), the minimum target for Last Mile Delivery, Distribution, Mail Processing Centre, and Line Haul Transportation performance is set at 95%. However, the

realization of performance for each of these logistics activities is still below the company's target. This condition indicates that the effectiveness of the logistics process has not run optimally and there are still various operational obstacles that have the potential to affect service quality to customers. The low performance achievement in logistics activities not only impacts delivery delays but can also increase the number of customer complaints, reduce the level of distribution timeliness, and reduce the overall reliability of the logistics system.

This phenomenon is in line with the concept of logistics management proposed by Martin Christopher (2022), which explains that logistics activities are an integrated system starting from procurement, warehousing, Mail Processing Centre, Line Haul Transportation, Distribution, Distribution Center, Delivery Center, to Reverse Logistics. Each of these activities is interconnected and forms an inseparable process chain. Disruptions occurring in one activity will affect subsequent activities, thus impacting the overall performance of the logistics chain. Therefore, the low realization of Mail Processing Centre, Line Haul Transportation, Distribution, and Last Mile Delivery performance indicates that there are still problems in the logistics activity process that require comprehensive evaluation so that the effectiveness of the distribution system can be improved.

Previous studies generally show that the Mail Processing Centre is one of the logistics activities that plays an important role in improving the effectiveness of Distribution. The Mail Processing Centre functions as a center for receiving, sorting, consolidating, and controlling the flow of shipments before being forwarded to the next distribution network. The better the processing of shipments at the Mail Processing Centre, the higher the effectiveness of Distribution produced because sorting errors, process delays, and distribution route mismatches can be minimized (Alfianto et al., 2024; Lusel et al., 2024; Martikasari & Yulianto, 2024). In addition, previous studies also explain that Line Haul Transportation has a positive effect on Distribution because the timeliness of shipment movement between logistics hubs determines the smoothness of the distribution process to the destination area. Good line haul transportation performance allows goods to flow faster, on time, and efficiently, thus improving the effectiveness of Distribution (Li et al., 2024; Zhao & Jiang, 2026).

Other studies also show that Distribution is a factor that greatly determines the success of Last Mile Delivery as the final stage in the delivery process to customers. Effective Distribution can accelerate the flow of shipments to the Delivery Center so that the delivery process to customers can be carried out according to the company's established delivery time standards (Kumar & Chidambara, 2024; Ferreira & Esperança, 2025; Faisal & Khalid, 2024). In addition to these effects, several studies also confirm that Mail Processing Centre and Line Haul Transportation have a direct effect on Last Mile Delivery because both activities determine the smoothness of the shipment flow from the processing stage to the final delivery process to customers (Shelly, 2022; Nisa et al., 2025; Zhu et al., 2023; Mandal & Archetti, 2023; Fried et al., 2024). Other studies even explain that Distribution acts as a mediating variable that strengthens the relationship between Mail Processing Centre and Line Haul Transportation on Last Mile Delivery, so that improving the quality of logistics activities at the initial stage will

have an indirect impact on improving delivery performance at the final stage (Sulkowski et al., 2022; Zhu et al., 2023; Liu & Hassini, 2024).

However, not all studies produce consistent relationships between Mail Processing Centre, Line Haul Transportation, Distribution, and Last Mile Delivery. Some studies show that improving Mail Processing Centre performance is not always followed by a significant improvement in Distribution. This condition generally occurs in logistics companies that have implemented distribution automation systems, so that the effectiveness of Distribution is more influenced by distribution network capacity, logistics information systems, and transportation management compared to the shipment processing process at the Mail Processing Centre (Fan, 2024; Feng, 2024; Wu et al., 2025). Other studies also find that Line Haul Transportation does not always have a significant effect on Distribution because distribution effectiveness is also influenced by geographical conditions, transportation network density, fleet capacity, customer demand patterns, and operational policies of logistics companies (Ritzinger et al., 2024; Durán-Micco et al., 2025).

Differences in research results are also found in the relationship between Distribution and Last Mile Delivery. Some studies conclude that Distribution is the main factor determining the success of Last Mile Delivery, while other studies show that improving Distribution does not necessarily improve Last Mile Delivery performance if the company still faces limitations in the number of couriers, high density of distribution areas, changes in customer addresses, and low success rates of first-attempt deliveries (Ray & Paul, 2023). Similar inconsistencies are also found in the direct relationship between Mail Processing Centre and Line Haul Transportation on Last Mile Delivery. Some studies state that both variables have a significant positive effect, while other studies obtain insignificant results because the success of Last Mile Delivery is influenced by many other operational factors, such as Delivery Center capacity, scheduling system quality, information technology integration, and service area characteristics (Lamas-Fernandez et al., 2023; Boysen et al., 2023; Kumar & Chidambara, 2024). Even in testing indirect relationships, some studies show that Distribution can mediate the effect of Mail Processing Centre and Line Haul Transportation on Last Mile Delivery, while other studies obtain different results (Ray & Paul, 2023; Lyons & McDonald, 2023). These differences in research results indicate that the relationship between logistics activities is still contextual and influenced by the characteristics of the distribution system, type of service, operational technology, and business environment in each logistics organization.

2. LITERATURE REVIEW

The literature review contains a systematic review on previous research that are relevant to the topic. This section contains the strengths and weaknesses of previous research which can be used as an argument that this research is carried out to improve or develop previous research. This section also contains the theoretical basis in the form of a summary of theories from the literature that support the research, as well as an explanation of the basic concepts and principles needed for problem solving. The theoretical basis is in the form of qualitative descriptions, mathematical models, or tools that are directly related to the problems studied. The sources

referred to in this section must be included in the sentences/statements referred to and in the references. This section may include theoretical framework and/or hypothesis development.

2.1 Mail Processing Centre

The Mail Processing Centre is a strategic facility in the transportation and logistics system that connects various regions through the processing and distribution of shipments on a large scale (Dobrodolac, 2025). The dimensions of the Mail Processing Centre consist of Sorting Efficiency, Consolidation Capability, and Dispatch Readiness.

2.2 Line Haul Transportation

Line haul transportation is the process of transporting goods over medium to long distances between main facilities in the logistics network, such as from distribution centers to regional hubs, with a focus on route efficiency and load consolidation (Zhu X. et al., 2023). Line Haul Transportation consists of 3 dimensions: Transit Speed, Transport Reliability, and Capacity Availability.

2.3 Distribution

Distribution is the process of managing the movement and storage of goods as well as related information from suppliers to customers to create added value through time and place utility (Jakfar, 2024). The dimensions of Distribution consist of Distribution Speed, Distribution Accuracy, and Distribution Flexibility.

2.4 Last Mile Delivery

Last mile delivery is the final stage activity in the supply chain that delivers products from the distribution center to the end customer (Liu & Hassini, 2024). Last Mile Delivery consists of 3 dimensions: Timeliness, Delivery Accuracy, and Responsiveness and Flexibility.

2.5 Supporting Theory and Conceptual Relationships Between Variables

Previous research results state that Mail Processing Centre influences Distribution as stated by Alfianto et al. (2024), Lusel et al. (2024), and Martikasari and Yulianto (2024). Meanwhile, Mail Processing Centre does not significantly influence Distribution as stated by Fan (2024), Feng (2024), and Wu et al. (2025). Different research results indicate a research gap, thus providing an opportunity for other researchers to conduct research on the effect of Mail Processing Centre on Distribution.

Line Haul Transportation influences Distribution as stated by Li et al. (2024) and Zhao and Jiang (2026). Meanwhile, Line Haul Transportation does not influence Distribution as stated by Ritzinger et al. (2024) and Durán-Micco et al. (2025). Differences in research results prove that there is a gap that provides room for other researchers to conduct research on the effect of Line Haul Transportation on Distribution.

Distribution influences Last Mile Delivery as stated by Kumar and Chidambara (2024), Ferreira and Esperança (2025), and Faisal and Khalid (2024). Distribution does not influence Last Mile Delivery as stated by Ray and Paul (2023). The research conducted shows differences in research results. This proves that there are differences in research results. Different research results provide an opportunity for other researchers to conduct research with the same subject at the KCU Jakarta Oceania location.

Mail Processing Centre influences Last Mile Delivery as stated by Shelly (2022) and Nisa et al. (2025). Mail Processing Centre does not influence Last Mile Delivery as stated by Lamas-Fernandez et al. (2023) and Ray and Paul (2023). The contradiction in research results regarding Mail Processing Centre influencing Last Mile Delivery provides an opportunity for other researchers to conduct similar research at KCU Jakarta Oceania.

Line Haul Transportation influences Last Mile Delivery as stated by Zhu et al. (2023), Mandal and Archetti (2023), and Fried et al. (2024). Line Haul Transportation does not influence Last Mile Delivery as stated by Boysen et al. (2023) and Kumar and Chidambara (2024). The contrasting results between one researcher and another provide an opportunity for subsequent researchers to conduct research with the same material at KCU Jakarta Oceania.

Mail Processing Centre influences Last Mile Delivery through Distribution as stated by Sułkowski et al. (2022). Mail Processing Centre does not influence Last Mile Delivery through Distribution as stated by Ray and Paul (2023). This means there is a contradiction in research results, thus providing an opportunity for research.

Line Haul Transportation influences Last Mile Delivery through Distribution as stated by Zhu et al. (2023), Mandal and Archetti (2023), and Liu and Hassini (2024). Line Haul Transportation does not influence Last Mile Delivery through Distribution as stated by Lyons and McDonald (2023). The discrepancy in the above research results provides an opportunity for researchers to conduct research on the same matter but at KCU Jakarta Oceania. Differences in research results between two groups of researchers prove that there is inconsistency that creates a research gap, providing an opportunity for the author to conduct research on the effect of Line Haul Transportation on Last Mile Delivery through Distribution. Considering the problems faced by KCU Jakarta Oceania and considering the opinions of experts presented in the above research, the author conducted research with the title.

2.6 Affirmation of the Role of Distribution

In this study, the Distribution variable has a very important role because it is not only positioned as one of the logistics activities but also as an intervening variable (mediating variable) that bridges the effect of Mail Processing Centre and Line Haul Transportation on Last Mile Delivery. Conceptually, Distribution is an operational stage that connects the shipment processing process at the Mail Processing Centre with the shipment delivery process to customers at the Last Mile Delivery stage.

In the operations of PT Pos Indonesia, after shipments have been processed at the Mail Processing Centre and transported through Line Haul Transportation to the destination office, the success of delivery is not yet fully determined. The Distribution stage becomes the process that ensures shipments are allocated to the Delivery Center or the correct distribution area, arranged according to delivery routes, and prepared for handover to last mile officers. Thus, the quality of Distribution will determine the smoothness of the delivery process at the final stage.

The placement of Distribution as an intervening variable is based on the logistics management concept proposed by Christopher (2022), which explains that logistics activities are a series of interconnected processes ranging from Mail Processing Centre, Line Haul Transportation, Distribution, to Last Mile Delivery. Performance in each activity will affect subsequent activities, thus forming an inseparable logistics flow.

In addition to being supported by theory, the placement of Distribution as an intervening variable is also based on empirical conditions at PT Pos Indonesia Main Branch Office Jakarta

Oceania. Operational data shows that the realization of Distribution performance only reached 87.75%, lower than the company's target of 95%. This condition indicates that the distribution process is still not optimal, thus potentially hindering the achievement of Last Mile Delivery performance, which also only reached 88.20%. Thus, the low Last Mile Delivery performance is not only influenced by the final delivery process but also by the effectiveness of the preceding Distribution process.

This study views that improving Mail Processing Centre and Line Haul Transportation performance does not necessarily directly improve Last Mile Delivery performance if the Distribution process is not effectively managed.

2.7 Characteristics of the Postal Service Concept

The characteristics of the postal service concept at PT Pos Indonesia indicate that postal services are intangible services, produced and consumed simultaneously, have quality variations, cannot be stored, and are highly dependent on timeliness (H+1, H+2, H+3), security, and service reliability. Along with the development of digital technology and the increasing need for goods distribution due to e-commerce growth, the postal service concept has transformed into an integrated logistics service that integrates pickup, processing, transportation, distribution, and last mile delivery processes to create added value for customers and increase user satisfaction.

3. METHODS

3.1 Hypotheses

Based on the conceptual framework and literature review, the following hypotheses are proposed:

Table 3. Research Hypotheses

Hypothesis	Description
H1	Mail Processing Centre has a positive and significant effect on Distribution
H2	Line Haul Transportation has a positive and significant effect on Distribution
H3	Distribution has a positive and significant effect on Last Mile Delivery
H4	Mail Processing Centre has a positive and significant effect on Last Mile Delivery
H5	Line Haul Transportation has a positive and significant effect on Last Mile Delivery
H6	Line Haul Transportation has a positive and significant effect on Last Mile Delivery
H6	Distribution mediates the effect of Line Haul Transportation on Last Mile Delivery

Source: Various Articles in Introduction (2026)

3.2 Type and Research Approach

This study uses a quantitative approach with descriptive and verificative (confirmatory) methods to analyze causal relationships between variables (Sugiyono, 2024). The descriptive method is used to describe and map the actual conditions of the variables studied, while the verificative method aims to test and confirm the hypotheses established in this study (Sugiyono, 2024). This research was conducted at PT Pos Indonesia Main Branch Office Jakarta Oceania

with a focus on Last Mile Delivery, Distribution, Mail Processing Centre, and Line Haul Transportation, during a six-month period, from September 2025 to February 2026.

3.3 Research Design and Research Model

The research design used is a causal research design with a survey method. The survey method was chosen because it allows researchers to obtain primary data directly from respondents who are employees of PT Pos Indonesia Main Branch Office Jakarta Oceania working as Executive General Manager, Deputy Executive General Manager, and Manager who understand and are knowledgeable about logistics activities at the Jakarta Oceania Office.

Figure 1. Research Model



Source: Adapted from Christopher (2022) and Various Studies

3.4 Object, Location, and Time of Research

The object of this research is logistics activities at PT Pos Indonesia which include Mail Processing Centre, Line Haul Transportation, Distribution, and Last Mile Delivery. These four activities are the main components in the operational logistics process that are interconnected and play a role in determining the success of delivery service operations.

The research location was conducted at PT Pos Indonesia Main Branch Office Jakarta Oceania. The selection of the research location was based on the consideration that this branch office is one of the strategic operational units of PT Pos Indonesia that handles shipment processing, intercity transportation, distribution, and shipment delivery to customers. In addition, based on company operational data, the performance of Mail Processing Centre, Line Haul Transportation, Distribution, and Last Mile Delivery has not yet reached the company's target of 95%, so the research location is considered relevant for examining the factors affecting logistics activity performance and obtaining empirical evidence regarding the relationship between the variables studied.

The research was conducted over five months, from February 2026 to June 2026. The research stages included instrument preparation, research permit processing, primary data collection through questionnaire distribution to respondents, secondary data collection from company operational documents, data processing and analysis using Structural Equation

Modeling--Partial Least Squares (SEM-PLS), interpretation of research results, and research report preparation.

3.5 Population and Sample

The population in this study consisted of 173 employees of PT Pos Indonesia Main Branch Office Jakarta Oceania working as Executive General Manager, Deputy Executive General Manager, and Manager. To obtain representative data, this study used stratified random sampling technique. The determination of the sample size was carried out using the Slovin formula with a precision level of 5% ($d = 0.05$).

The method for determining the sample size using the Slovin formula (Sugiyono, 2023) is as follows :

$$n = N / [1 + (N \times e^2)]$$

Where:

- n = Sample size
- N = Population size = 173 people
- e = Error tolerance level = 0.05

Calculation :

$$n = 173 / [1 + (173 \times 0.05^2)]$$

$$n = 173 / [1 + (173 \times 0.0025)]$$

$$n = 173 / [1 + 0.4325]$$

$$n = 173 / 1.4325$$

$$n = 120.76 \approx 121 \text{ people}$$

The sample size was 121 respondents.

3.6 Data Collection Techniques

The types of data used in this study consist of primary data and secondary data. Primary data were obtained directly from respondents through questionnaire distribution, while secondary data were obtained from internal company documents, operational reports, and relevant literature sources.

The main instrument for primary data collection was a structured questionnaire developed based on the indicators of variables formulated in Chapter II. Each statement in the questionnaire was designed to represent the dimensions and indicators of the research variables.

3.7 Operational Definition of Variables

Operationalization of Variables is a table that explains the definition of the variables studied, the dimensions of each variable, and the indicators of each variable studied (Sugiyono,

2023). This table is used to limit that the variables studied in this research are limited to the variables, dimensions, and indicators written in the Operational Table.

Table 4. Operationalization of Variables

Variable	Dimension	Indicator	Code	Scale
Mail Processing Centre is a strategic facility in the transportation and logistics system that connects various regions through the processing and distribution of shipments on a large scale (Dobrodolac, 2025)	Sorting Efficiency	Fast sorting process for letters and packages	MPC1	Likert 1-5
		Accurate separation of shipments based on destination	MPC2	Likert 1-5
		Ability to process high shipment volumes	MPC3	Likert 1-5
	Consolidation Capability	Packages are consolidated according to distribution zones	MPC4	Likert 1-5
		Grouping shipments facilitates the line haul process	MPC5	Likert 1-5
	Dispatch Readiness	Shipments are ready to be sent to the distribution center on time	MPC6	Likert 1-5
		Documents, labels, and shipment data are ready for onward shipment	MPC7	Likert 1-5
Line Haul Transportation is the process of transporting goods over medium to long distances between main facilities in the logistics network (Zhu X. et al., 2023)	Transit Speed	Speed of inter-hub delivery according to target time	TLH1	Likert 1-5
		Travel time between Mail Processing Centres is relatively fast	TLH2	Likert 1-5
	Transport Reliability	Line haul departure schedules run consistently	TLH3	Likert 1-5
		Line haul fleet delay rate is low	TLH4	Likert 1-5
		Line haul travel frequency matches distribution needs	TLH5	Likert 1-5
	Capacity Availability	Vehicle capacity is adequate for shipment volume	TLH6	Likert 1-5
		Fleet availability supports distribution continuity	TLH7	Likert 1-5
Distribution is the process of managing the movement and storage of goods as well as related information from suppliers to customers to create added value through time and place utility (Jakfar, 2024)	Distribution Speed	Speed of goods distribution from hub to customer area is fast	DIST1	Likert 1-5
		Distribution lead time accuracy according to target	DIST2	Likert 1-5
		Delivery frequency to distribution nodes runs consistently	DIST3	Likert 1-5
	Distribution Accuracy	Goods are sent to the correct distribution area	DIST4	Likert 1-5
		The quantity of goods distributed matches demand	DIST5	Likert 1-5
		Goods are received in good condition at distribution points	DIST6	Likert 1-5
	Distribution Flexibility	Distribution network can adjust to demand changes	DIST7	Likert 1-5
		Distribution routes are easy to adjust when obstacles occur	DIST8	Likert 1-5
Last Mile Delivery is the final stage activity in the supply chain that delivers products from the distribution center to the end customer (Liu & Hassini, 2024)	Timeliness	Transit time from depot to customer is relatively fast	LMD1	Likert 1-5
		Same-day/next-day delivery according to SLA	LMD2	Likert 1-5
		Packages are received by the correct customer	LMD3	Likert 1-5
		Destination address matches data in the system	LMD4	Likert 1-5
	Delivery Accuracy	Goods are received in complete and undamaged condition	LMD5	Likert 1-5
		Company responds quickly to delivery schedule changes	LMD6	Likert 1-5
		Couriers handle failed deliveries or returns quickly	LMD7	Likert 1-5
	Responsiveness & Flexibility	Customers can easily choose time slots and delivery locations	LMD8	Likert 1-5
		Transit time from delivery centre to customer is relatively fast	LMD9	Likert 1-5
		Same-day/next-day delivery according to SLA	LMD10	Likert 1-5

Source: Author's Compilation from Literature Review (2026)

3.8 Data Analysis

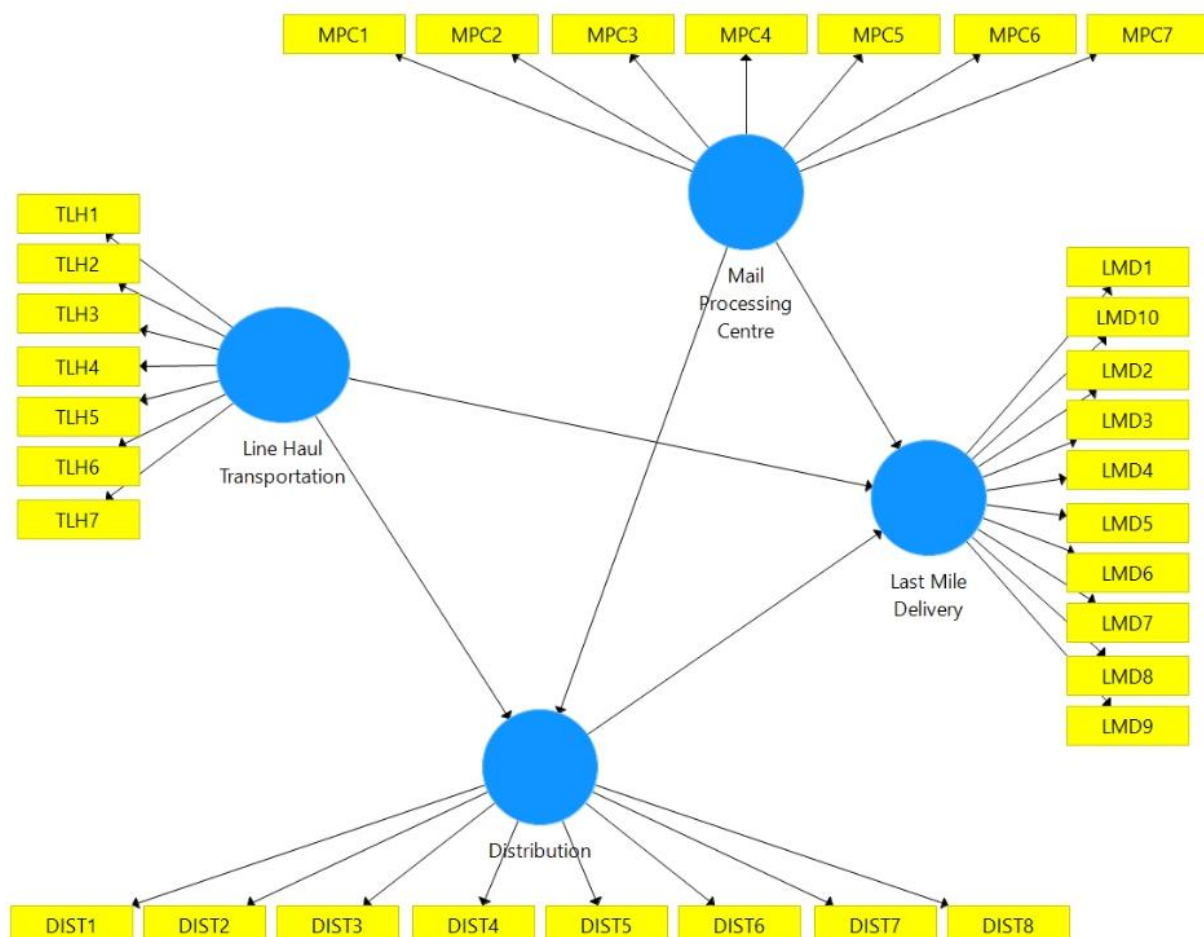
Data collection was carried out using a structured questionnaire with a 5-point Likert scale (Sugiyono, 2024). The analysis procedure using SmartPLS 3.0 (Imam Ghazali, 2023) consists of:

1. Evaluation of the Measurement Model (Outer Model) : Assessing validity (Outer Loading > 0.700) and reliability (Cronbach's Alpha & Composite Reliability > 0.700, AVE > 0.500).
2. Evaluation of the Structural Model (Inner Model) : Testing hypotheses through Path Coefficients, T Statistics (> 1.96), and P Values (< 0.05), as well as evaluating the model's predictive capability (R^2) (Imam Ghazali, 2023; Hair et al., 2022).

4. RESULTS AND DISCUSSION

4.1 Research Results

4.1.1 Inferential Analysis



Inferential analysis is a statistical analysis method used to draw conclusions or make generalizations about population characteristics based on data obtained from the research sample (Sugiyono, 2023). This analysis not only describes data but also tests hypotheses, measures relationships between variables, and predicts the effect of one variable on another. In

quantitative research, inferential analysis is used to answer research problem formulations and test whether the relationships or effects found in the sample also apply to the population statistically. The stages of model evaluation are: Measurement Model Analysis (Outer Model) and Structural Model Analysis (Inner Model) (Hair et al., 2022).

4.1.2 Outer Model (Measurement Model Analysis)

The outer model (measurement model) is a model in Structural Equation Modeling--Partial Least Squares (SEM-PLS) used to evaluate the relationship between latent variables (constructs) and their forming indicators. The evaluation of the outer model aims to ensure that each indicator can measure the intended construct validly and reliably before testing the relationships between variables in the structural model (inner model).

According to Hair et al. (2022), the evaluation of the outer model is conducted to test the quality of research instruments through validity and reliability testing of constructs so that the indicators used truly represent the measured latent variables.

4.1.2.1 Convergent Validity Test

Convergent validity is a test aimed at determining the extent to which indicators measuring a construct have a strong relationship with that construct. The convergent validity test is conducted using two measures:

1. Outer Loading : Measures the strength of the relationship between the indicator and the latent construct. Criteria: ≥ 0.70 = very good.
2. Average Variance Extracted (AVE) : Measures the average variance of indicators that can be explained by the construct. Criteria: $AVE \geq 0.50$.

4.1.2.1.1 Outer Loading

Table 5. Outer Loading Results

	Distribution	Last Mile Delivery	Line Haul Transportation	Mail Processing Centre
DIST1	0.782			
DIST2	0.842			
DIST3	0.870			
DIST4	0.855			
DIST5	0.833			
DIST6	0.839			
DIST7	0.805			

	Distribution	Last Mile Delivery	Line Haul Transportation	Mail Processing Centre
DIST8	0.770			
LMD1		0.756		
LMD10		0.751		
LMD2		0.796		
LMD3		0.839		
LMD4		0.743		
LMD5		0.786		
LMD6		0.738		
LMD7		0.758		
LMD8		0.744		
LMD9		0.738		
MPC1				0.819
MPC2				0.792
MPC3				0.818
MPC4				0.782
MPC5				0.761
MPC6				0.793
MPC7				0.716
TLH1			0.862	
TLH2			0.866	
TLH3			0.846	
TLH4			0.798	
TLH5			0.841	
TLH6			0.883	
TLH7			0.747	

Source: Questionnaire (2026)

Overall, the results of the convergent validity test show that all indicators for the variables Distribution, Last Mile Delivery, Line Haul Transportation, and Mail Processing Centre have outer loading values above 0.70. Thus, all indicators in this study have met the convergent validity criteria.

4.1.2.1.2 AVE

Table 6. Average Variance Extracted (AVE)

	Average Variance Extracted (AVE)
Distribution	0.681
Last Mile Delivery	0.586
Line Haul Transportation	0.699
Mail Processing Centre	0.614

Source: Questionnaire (2026)

Overall, all constructs in this study have AVE values above 0.50, namely Distribution at 0.681, Last Mile Delivery at 0.586, Line Haul Transportation at 0.699, and Mail Processing Centre at 0.614. These results indicate that each construct can explain more than 50% of the variance of its indicators.

4.1.2.2 Discriminant Validity Test

Discriminant validity is a test aimed at ensuring that a construct is truly different from other constructs. The discriminant validity test is conducted using:

1. Fornell-Larcker Criterion
2. Heterotrait-Monotrait Ratio (HTMT)

4.1.2.2.1 Fornell-Larcker Criterion Test

Table 7. Fornell-Larcker Criterion Test

	Distribution	Last Mile Delivery	Line Haul Transportation	Mail Processing Centre
Distribution	0.825			
Last Mile Delivery	0.753	0.766		
Line Haul Transportation	0.517	0.502	0.836	
Mail Processing Centre	0.452	0.505	0.201	0.784

Source: Questionnaire (2026)

Based on the Fornell-Larcker table, all $\sqrt{\text{AVE}}$ values for each construct are greater than their correlation values with other constructs. Thus, based on the Fornell-Larcker criteria, all constructs in this study have met discriminant validity.

4.1.2.2 Heterotrait-Monotrait Ratio (HTMT) Test

Table 8. Heterotrait-Monotrait Ratio (HTMT)

	Distribution	Last Mile Delivery	Line Haul Transportation	Mail Processing Centre
Distribution				
Last Mile Delivery	0.787			
Line Haul Transportation	0.537	0.502		
Mail Processing Centre	0.480	0.544	0.217	

Source: Questionnaire (2026)

All HTMT values between constructs are below the maximum limit of 0.90, indicating that each construct has an adequate level of difference and there is no overlap between constructs.

4.1.2.3 Construct Reliability Test

Construct reliability is a test aimed at determining the level of consistency of indicators in measuring a construct. Reliability testing is conducted using: Cronbach's Alpha and Composite Reliability (CR).

4.1.2.3.1 Cronbach's Alpha Test Results

Table 9. Cronbach's Alpha Test

	Cronbach's Alpha
Distribution	0.933
Last Mile Delivery	0.922
Line Haul Transportation	0.928
Mail Processing Centre	0.896

Source: Questionnaire (2026)

All variables have Cronbach's Alpha values above 0.70, indicating very good internal consistency.

4.1.2.3.2 Composite Reliability Test

Table 10. Composite Reliability Test

	Composite Reliability
Distribution	0.945

	Composite Reliability
Last Mile Delivery	0.934
Line Haul Transportation	0.942
Mail Processing Centre	0.917

Source: Questionnaire (2026)

All variables have Composite Reliability values above 0.70, confirming that all constructs are reliable.

4.1.3 Inner Model (Structural Model Analysis)

The inner model (structural model) is part of the SEM-PLS analysis used to evaluate the relationships between latent variables according to the conceptual model and research hypotheses. According to Hair et al. (2022), the evaluation of the inner model is conducted after the measurement model (outer model) meets the validity and reliability requirements.

4.1.3.1 Hypothesis Testing and Path Coefficients

Hypothesis testing is conducted using the bootstrapping procedure that produces T Statistics and P Values. According to Hair et al. (2022), a hypothesis is accepted if T Statistics > 1.96 and P Values < 0.05.

Table 11. Hypothesis Testing Results

	Original Sample	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Distribution -> Last Mile Delivery	0.571	0.576	0.068	8.379	0.000
Mail Processing Centre -> Distribution	0.363	0.370	0.074	4.912	0.000
Mail Processing Centre -> Last Mile Delivery	0.214	0.213	0.065	3.300	0.001
Transportation Line Haul -> Distribution	0.444	0.445	0.071	6.274	0.000
Transportation Line Haul -> Last Mile Delivery	0.163	0.163	0.063	2.600	0.010
Mail Processing Centre -> Distribution -> Last Mile Delivery	0.207	0.213	0.050	4.153	0.000

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Transportation Line Haul -> Distribution -> Last Mile Delivery	0.254	0.257	0.053	4.773	0.000

Source: Questionnaire (2026)

All seven hypotheses are accepted, confirming the positive and significant relationships between variables.

4.1.3.2 R Square (Coefficient of Determination)

Table 12. R Square Results

	R Square	R Square Adjusted
Distribution	0.394	0.383
Last Mile Delivery	0.620	0.610

Source: Questionnaire (2026)

The Distribution variable has an R^2 Adjusted of 0.383 (38.3% explained), while Last Mile Delivery has an R^2 Adjusted of 0.610 (61.0% explained), indicating the model has good explanatory power.

4.1.3.3 F Square Test (Effect Size)

Table 13. F Square Test Results

	Distribution	Last Mile Delivery	Line Haul Transportation	Mail Processing Centre
Distribution		0.521		
Last Mile Delivery				
Line Haul Transportation	0.312	0.051		
Mail Processing Centre	0.209	0.096		

Source: Questionnaire (2026)

Distribution has a large effect on Last Mile Delivery ($f^2 = 0.521$). Line Haul Transportation and Mail Processing Centre have medium effects on Distribution (0.312 and 0.209 respectively).

4.1.3.4 Q Square Test (Predictive Relevance)

Table 14. Q Square Test Results

	SSO	SSE	Q ² (=1-SSE/SSO)
Distribution	968.000	718.251	0.258
Last Mile Delivery	1210.000	795.190	0.343
Line Haul Transportation	847.000	847.000	
Mail Processing Centre	847.000	847.000	

Source: Questionnaire (2026)

Both Q² values are greater than zero, confirming the model has good predictive relevance.

4.2 Discussion

Based on the hypothesis testing results at PT Pos Indonesia Main Branch Office Jakarta Oceania, all hypotheses H1 through H7 are proven to have positive and significant effects. These findings indicate that the multi-echelon logistics system model that places Distribution as an intervening variable receives strong empirical support.

H1: Effect of Mail Processing Centre on Distribution

The research results show that Mail Processing Centre has a positive and significant effect on Distribution ($\beta = 0.363$, $t = 4.912$, $p = 0.000$). This finding indicates that the better the sorting, consolidation, control, and grouping activities of shipments at the Mail Processing Centre, the more effective the distribution process. These findings support the multi-echelon logistics system theory and are in line with research by Alfianto et al. (2024), Lusel et al. (2024), and Martikasari and Yulianto (2024).

H2: Effect of Line Haul Transportation on Distribution

The research results show that Line Haul Transportation has a positive and significant effect on Distribution ($\beta = 0.444$, $t = 6.274$, $p = 0.000$). This indicates that the better the fleet schedule punctuality, route reliability, and inter-hub transportation efficiency, the smoother the goods distribution process. These findings support research by Li et al. (2024) and Zhao and Jiang (2026).

H3: Effect of Distribution on Last Mile Delivery

The research results show that Distribution has a positive and significant effect on Last Mile Delivery ($\beta = 0.571$, $t = 8.379$, $p = 0.000$), being the largest effect in the model. This confirms that Distribution is the most critical driver of Last Mile Delivery success. These findings are consistent with Kumar and Chidambara (2024), Ferreira and Esperança (2025), and Faisal and Khalid (2024).

H4: Effect of Mail Processing Centre on Last Mile Delivery

The research results show that Mail Processing Centre has a positive and significant effect on Last Mile Delivery ($\beta = 0.214$, $t = 3.300$, $p = 0.001$). This indicates that the better the sorting process, address validation, and package readiness from the initial stage, the higher the delivery success. These findings align with Shelly (2022) and Nisa et al. (2025).

H5: Effect of Line Haul Transportation on Last Mile Delivery

The research results show that Line Haul Transportation has a positive and significant effect on Last Mile Delivery ($\beta = 0.163$, $t = 2.600$, $p = 0.010$). This confirms that transportation reliability contributes positively to final delivery performance. These findings support Zhu et al. (2023), Mandal and Archetti (2023), and Fried et al. (2024).

H6: Effect of Mail Processing Centre on Last Mile Delivery through Distribution

The research results show that Distribution can positively and significantly mediate the effect of Mail Processing Centre on Last Mile Delivery ($\beta = 0.207$, $t = 4.153$, $p = 0.000$). This confirms that Distribution is a strategic mechanism connecting upstream processing with final delivery. These findings align with Sułkowski et al. (2022).

H7: Effect of Line Haul Transportation on Last Mile Delivery through Distribution

The research results show that Distribution positively and significantly mediates the effect of Line Haul Transportation on Last Mile Delivery ($\beta = 0.254$, $t = 4.773$, $p = 0.000$). This confirms the importance of Distribution as an intervening variable in the logistics system. These findings support Zhu et al. (2023), Mandal and Archetti (2023), and Liu and Hassini (2024).

5. CONCLUSION AND LIMITATION

The conclusions of the study are based on the findings and discussions that have been discussed. The substance of the conclusions is based on research findings, problem formulation, research objectives, and research contributions without numerical and is presented in one paragraph. For limitations explain weaknesses, constraints, or limitations that affect the results of the study. This section also explains the direction of future research.

5.1 Conclusion

The research results provide several conclusions as follows:

1. There is a positive and significant effect of Mail Processing Centre on Distribution with a path coefficient of 0.363, t-statistic of 4.912, and p-value of 0.000.
2. There is a positive and significant effect of Line Haul Transportation on Distribution with a coefficient of 0.444, t-statistic of 6.274, and p-value of 0.000.
3. There is a positive and significant effect of Distribution on Last Mile Delivery with a path coefficient of 0.571, t-statistic of 8.379, and p-value of 0.000. This is the strongest effect in the model.

4. There is a positive and significant effect of Mail Processing Centre on Last Mile Delivery with a coefficient of 0.214, T Statistics of 3.300, and p-value of 0.001.
5. There is a positive and significant effect of Line Haul Transportation on Last Mile Delivery with a path coefficient of 0.163, T Statistics of 2.600, and p-value of 0.010.
6. There is a positive and significant effect of Mail Processing Centre on Last Mile Delivery through Distribution with a path coefficient of 0.207, t-statistic of 4.153, and p-value of 0.000.
7. There is a positive and significant effect of Line Haul Transportation on Last Mile Delivery through Distribution with a coefficient of 0.254, t-statistic of 4.773, and p-value of 0.000.
8. Overall, these results indicate that Distribution functions as an important mechanism that bridges the effect of upstream operations, namely Mail Processing Centre and Line Haul Transportation, on the success of downstream services, namely Last Mile Delivery.
9. Because the direct effects are also significant, the form of mediation in these relationships can be categorized as partial mediation, which means that Mail Processing Centre and Line Haul Transportation affect Last Mile Delivery both directly and through Distribution at the Main Branch Office Jakarta Oceania.

5.2 Recommendations

5.2.1 Theoretical Recommendations

1. Based on the research results proving that Mail Processing Centre, Line Haul Transportation, and Distribution have positive and significant effects on Last Mile Delivery, both directly and through Distribution as an intervening variable, theoretically this research provides reinforcement to the multi-echelon logistics system perspective. These findings confirm that Last Mile Delivery performance cannot be explained partially from only one operational process but must be understood as the result of systemic integration between upstream, intermediate, and downstream processes in the logistics network. Therefore, future research is recommended to continue to develop theoretical models based on integration between logistics nodes so that causal relationships between variables in modern logistics systems can be explained more comprehensively.
2. Theoretically, this research suggests that the development of research models in the field of logistics and supply chain management should not only focus on direct effects between variables but also include indirect relationship mechanisms through intervening and moderating variables. The results of this study have proven that Distribution has an important role as a transmission mechanism for the effect of Mail Processing Centre and Line Haul Transportation on Last Mile Delivery. Thus, future theory development needs to emphasize the middle-process mechanism as an approach to explain how operational processes at the upstream logistics stage are translated into performance improvement in downstream delivery performance.
3. This research also provides a theoretical suggestion that further studies expand the conceptual model by including contingency variables relevant to modern logistics dynamics, such as digital logistics capability, logistics information system integration, route optimization, service level agreement, customer density, and real-time tracking visibility. The addition of these variables is important to enrich theory development, particularly in explaining conditions that can strengthen or weaken the relationships between Mail Processing Centre, Line Haul Transportation, Distribution, and Last Mile Delivery.

5.2.2 Practical Recommendations

1. Based on the research results showing that Mail Processing Centre, Line Haul Transportation, and Distribution have positive and significant effects on Last Mile Delivery, the practical recommendation that can be given to the Executive General Manager Jakarta Oceania is the need for integrated operational control improvement across all stages of the logistics process. The main priority should be focused on optimizing the Mail Processing Centre through improving sorting accuracy, accelerating the shipment consolidation process, and strengthening monitoring of potential miss-routing and initial process delays.
2. The Executive General Manager Jakarta Oceania is advised to strengthen the management of Line Haul Transportation through improving fleet departure schedule punctuality, evaluating transportation vendor performance, optimizing routes between logistics nodes, and developing an early warning system for travel delays. The research results prove that Line Haul Transportation has a significant effect on Distribution and Last Mile Delivery, so strengthening the line haul transportation function will accelerate the flow of goods to the distribution hub in the West Jakarta area.
3. Furthermore, because Distribution is proven to be the variable with the strongest effect on Last Mile Delivery and also functions as a significant intervening variable, the Executive General Manager Jakarta Oceania needs to make Distribution the main strategic focus. Efforts that can be made include rearranging inter-regional zoning, balancing shipment loads per delivery point, improving courier assignment accuracy, utilizing data-based route optimization, and strengthening real-time monitoring dashboards for delivery status. Improvements in this aspect are very relevant to increase operational performance achievement, which is currently still in the range of 87%-88%, to reach the minimum target of 95%.
4. More strategically, the results of this research also suggest that the Executive General Manager Jakarta Oceania develop a performance management policy that integrates Mail Processing Centre, Line Haul Transportation, Distribution, and Last Mile Delivery indicators into an integrated logistics Key Performance Indicators (KPI) system. With this approach, any disruption in the upstream process can be immediately identified for its impact on downstream delivery performance. The implementation of this integrated KPI is expected not only to improve service quality but also to have a direct impact on increasing logistics revenue, which currently only reaches 81.60% of the annual target. Thus, optimizing the entire logistics process chain is a strategic step to encourage the achievement of a minimum revenue target of 95% at Jakarta Oceania.

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