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Analysis of Causes of Fleet Delays to Stuffing Locations (On Time Pick-Up) Using the Root Cause Analysis (RCA) Method (Case Study of Logistics Company in Surabaya)

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ABSTRACT

PT ABC Logistics is a company engaged in logistics services, especially providing truck and container services for land transportation. This company operates various types of trucks, including 20 feet, 40 feet, 21 feet, CDD, CDE, Fuso, and Tronton trucks. In carrying out its operations, as a logistics company, it must plan fleet needs accurately to fulfill each order. However, problems are still found in the form of fleet delays when heading to the stuffing location to the customer. To overcome this problem, the Root Cause Analysis (RCA) method is used to identify the root of the problem and reduce potential delays. The approaches applied include the use of Pareto Diagrams, Fishbone Diagrams, Failure Mode and Effect Analysis (FMEA), and proposing improvements using the 5W + 1H method. The results of the analysis show two main factors causing delays, namely fleet wait and container shortage. Priority improvements for fleet wait include optimizing route plans that have not been updated, incompatibility between delivery times and slot times, and lack of communication between the company and vendors. Meanwhile, to overcome delays due to container shortages, the focus of improvements is focused on improving communication systems, repairing damaged containers (such as leaks or holes), and optimizing communication between vendors and companies.

Keywords: *Root Cause Analysis, Stuffing, Fishbone Diagram, FMEA, 5W+1H*

Introduction

Every company that wants to create a competitive advantage in business must focus on fulfilling customer desires. Today, customers not only demand improved product quality but also demand greater excellence in service. One of the qualities that determines customer satisfaction in logistics services is punctuality [1],[2]. Customer satisfaction with a company's services can have a direct impact on customers' sense of trust and loyalty on an ongoing basis[1].

Companies with high customer satisfaction typically see better returns on investment, productivity, market value, shareholder value, and stock performance. Maintaining high satisfaction also boosts customer loyalty and serves as a strong strategy against price competition and product commoditization [1]. Transportation plays a vital role in connecting production processes with customers, as well as contributing to operational efficiency, cost reduction, improved service quality, and energy savings. An effective logistics strategy can certainly provide a competitive advantage for companies, where a strong logistics system requires well-integrated planning, organizing, and controlling [3]. An order-to-delivery system is a vital process that ensures products are shipped according to customer needs. Monitoring and evaluating this flow is essential to identify and address any issues, ultimately improving customer satisfaction [4].

As one of the largest logistics companies in Indonesia based in Surabaya, the company is engaged in the field of container rental services, warehousing, as well as sea and land transportation, by providing comprehensive transportation solutions to support customers in running a more efficient business. As part of the supply chain, the company always strives to provide the best service to improve customer satisfaction. This study focuses on land transportation services, especially in the delivery of truck and container fleets to customers. Several types of trucks used in their operations include 20-feet, 40-feet, 21-feet, CDD, CDE, Fuso, and Tronton trucks. In its implementation, the company uses third-party services for the fleet used, so the company must estimate the number of fleets needed accurately in order to meet customer demand. However, in practice there are still obstacles, one of which is the delay of trucks to the stuffing location, which is the process of putting customer goods into containers, which causes delays in trucks to the end customer. If the quality of service does not meet customer expectations, this can cause dissatisfaction that has the potential to reduce company profits because customers can switch to other service providers. Therefore, ensuring optimal service quality is very important.

Table 1. Recapitulation of the number of fleets that pick up orders

Order	NUMBER OF FLEET THAT PICK UP ORDERS													
	On Time	Late	On Time	Late	On Time	Late	On Time	Late	On Time	Late	On Time	Late	On Time	Late
	20'	20	21'	21'	40'	40'	CDD	CDD	CDE	CDE	FUSO	FUSO	TTON	TTON
Jan 23	499	188	-	-	46	24	3	-	-	-	2	-	-	-
Feb 23	610	297	-	-	55	24	2	-	-	-	1	-	-	-
Mar 23	425	195	-	-	46	24	-	-	-	-	3	-	-	-
Apr 23	334	170	-	-	22	17	1	-	-	-	1	-	-	-
May 23	488	261	-	-	64	39	1	-	-	-	1	-	-	-
Jun-23	434	212	-	-	27	13	1	-	-	-	-	-	-	-
Jul-23	464	95	-	-	40	14	-	-	-	-	-	-	-	-
Aug-23	488	-	-	-	48	-	-	-	-	-	1	-	-	-
Sep-23	449	144	-	-	59	-	2	-	-	-	1	-	-	-
Oct-23	547	136	-	-	45	-	1	-	-	-	1	-	-	-
Nov-23	510	90	-	-	79	-	6	-	-	-	1	-	-	-
Dec-23	583	30	-	-	61	5	2	1	-	-	2	2	-	-
Jan-24	509	236	1	1	31	12	5	1	-	-	-	-	-	-
Feb-24	583	111	1	1	53	5	2	2	-	-	1	-	1	1
Mar-24	425	45	-	-	51	6	3	-	1	-	-	-	-	-
Total	**7348**	**2210**	**2**	**2**	**727**	**183**	**29**	**4**	**1**	**0**	**15**	**2**	**1**	**1**

Based on observations of operational data, there are still many delays in the pick-up order process. Analysis of the data listed in table 1 shows that delays most often occur in 20-feet fleets. In a 15-month period, out of a total of 7,348 20-feet fleet orders, 1,375 were delayed. Therefore, this study focuses on the causes of delays in 20-feet fleets to the stuffing location. One example of a delay occurred with Sinar Sosro Pandaan customers heading to Mojosari, using a 20-feet SPIL fleet. If the delay exceeds 24 hours from the time of arrival of the truck, a stapling fee will be charged, which is 50% of the cost in the first 24 hours, and 100% in the next 24 hours. Stapling is a condition where the truck remains at the customer's location for more than 24 hours since its arrival for the loading process.

Clarifying the cause-and-effect relationship, as well as identifying uncertainties and risks are important things to do because they will have a significant impact on the company's operations. By finding the root cause and prioritizing the causal factors, the company will be able to allocate resources optimally, develop employee welfare strategies to minimize operational disruptions, maintain flexibility, and readjust distribution in the face of demand fluctuations and supply chain disruptions [5]. This study aims to identify the factors causing delays and find solutions to minimize these problems. The method used in this study is Root Cause Analysis (RCA). The Root Cause Analysis (RCA) method is used to analyze a problem by examining several existing root causes to find the root cause.[6]. To enhance the performance of deliveries, it is essential to examine, assess, and identify the underlying reasons behind delivery delays, as well as establish a connection to the 'most significant' cause of tardy deliveries. Investigators explored and analyzed various elements that could remarkably influence the timing of deliveries within the service sector and mapped these discovered elements employing the RCA technique. [7]

Common tools used in RCA include Pareto diagrams, which can identify major problems[8],[9]; fishbone diagrams, which can identify major causes of problems in terms of machines, people, methods, materials, and environment; Failure Mode and Effect Analysis (FMEA), which identifies major causes of failure [10], [11]; and 5W+1H to provide recommendations for improvement. These methods allow companies to take appropriate steps to prevent problems from recurring in the future [12].

Research Methods

This study collected data using various techniques. Primary data were gathered through interviews and brainstorming sessions with three respondents, the operations supervisor and two operational staff, along with direct observations in the operations department focused on fleet delays during stuffing. Additionally, expert interviews with three respondents were conducted to support the FMEA risk assessment for delay causes. Respondents were chosen for their 5-10 years of experience in logistics and truck stuffing management, representing roles from operations (including drivers) to warehouse and strategic logistics. Their diverse expertise offers a comprehensive and informed view of the delayed issues based on practical experience and understanding of the entire production process flow. For collecting secondary data from companies about the recapitulation of the number of fleets taking orders and the frequency of delays on certain fleets based on the cause of delays such as for 20-Feet Fleets. The delay in 20-feet truck fleet pick-up orders from January 2023

to March 2024 is the main topic of this study. The schedule, the time the fleet arrives, the time the fleet reaches the customer's location, and the delay time for each fleet are the basis for the 15-month data collection.

This study identifies factors causing fleet delays using a structured approach. Root Cause Analysis (RCA) begins with interviews to gather insights, followed by a Pareto Diagram to prioritize the most frequent delay causes. Key factors are analyzed further with a Fishbone Diagram to uncover root causes. The Failure Modes and Effects Analysis (FMEA) quantifies risks by calculating Risk Priority Numbers (RPN) based on questionnaire responses from three participants. Finally, the 5W+1H method is used to propose corrective actions, detailing what improvements are needed, why, who will handle them, and how, when, and where they will be implemented.

Results and Discussion

Dominant Factors Causing Fleet Delays

The causes of delays in the 20-feet truck fleet are dominated by the operational section. This occurs due to several activities carried out manually so that it takes a long time to complete the activity or the inconsistency between the work process and the procedures set by the company. The frequency of delays in the 20-feet fleet that has been categorized according to the cause of the delay can be seen in table 1.

Table 2. Frequency of delays in the 20-feet fleet based on the cause of the delays

Cause of 20 feet fleet delay	Month															Total
	Jan	Feb	Mar	Apr	May	June	Jul	August	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
Fleet waiting time	182	191	12	30	10	3	14	0	73	83	52	28	131	91	6	906
Container shortage	6	34	6	0	1	5	8	0	20	6	9	1	83	14	53	246
Inaccurate data from vendors	0	2	5	0	0	0	2	0	28	44	29	1	2	3	0	116
Schedule mismatch	5	10	15	17	0	10	3	0	2	6	5	7	10	0	0	90
Goods readiness	0	1	2	0	0	0	3	0	5	3	0	0	0	0	0	14

One of the main factors causing fleet delays is the fleet waiting time can be seen in the data in table 2 which is data from the company. The meaning of fleet waiting time is the time required in the process of picking up empty containers at the shipping depot before being loaded with customer goods. In addition, delays are also caused by fleets that are not ready because they are still waiting for the return load or unloading process, thus hampering the loading process. Another factor that contributes to delays is the shortage of containers, which is a condition when the availability of containers at the depot is limited or exhausted. PT. ABC Logistics itself does not have containers but rents them through vendors, so the company must wait until containers are available for use. This condition has an impact on the delay in the stuffing process.

In addition, the accuracy of data from vendors is also a cause of delays. Vendors often do not provide accurate information regarding vehicle registration numbers, departure times, estimated arrival at customer locations, and the identity of the driver assigned to pick up empty containers. This inaccuracy of data results in errors in the container pick-up process at the shipping depot. Schedule inconsistencies are also another factor that causes delays. Fleets often do not arrive at the location according to the predetermined schedule, resulting in delays in the stuffing process.

In addition to the above factors, the readiness of the goods also affects the delay in delivery. There are two main causes in this aspect. First, goods that are still in the packaging process, where the fleet must wait for goods that are still being packaged, such as fertilizer products that require more time because they are still in the filling stage into sacks. This process causes goods to be held in the warehouse before finally being moved to a temporary storage area. Second, the number of goods is not sufficient to be loaded into the container, so the fleet must wait until all customer orders are ready before they can be loaded into the container.

The five factors mentioned are sorted using the Pareto Diagram. The Pareto Diagram is a tool to find the main causes of a number of root problems, making it easier to determine the problems and solutions to be prioritized[8],[13]. The priority causes of 20 feet fleet delays using the Pareto Diagram are as follows:

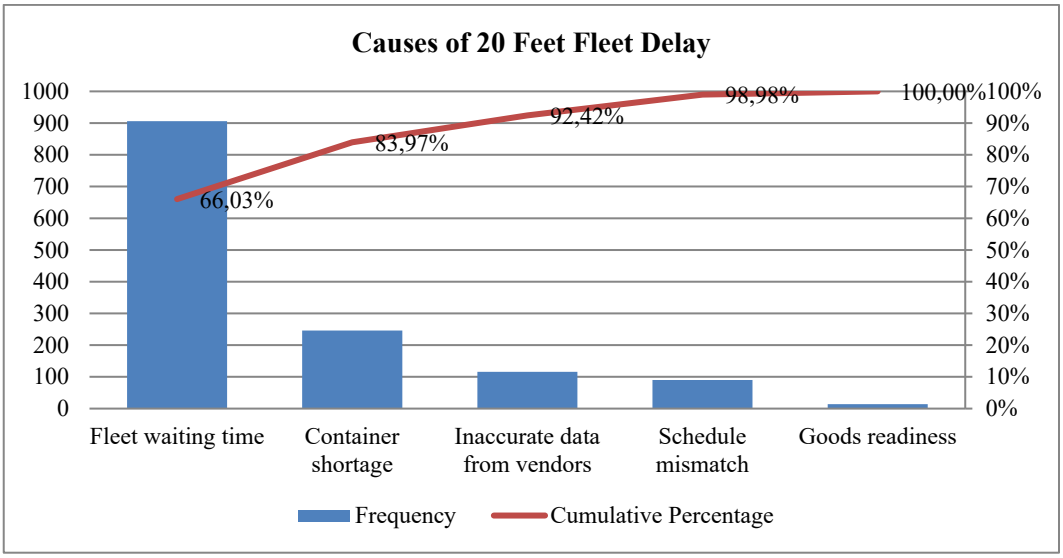

Figure 1. Pareto diagram of causes of 20 feet fleet delay

The cumulative line on the Pareto diagram above shows that the factors of fleet waiting time and container shortages account for more than 80% of the total delay events. With the Pareto principle that can classify problems based on their significance[9], it can be concluded that improvement efforts should be focused first on these two factors, because they have the greatest impact in reducing 20 feet fleet delays.

Fishbone diagram, also known as Ishikawa diagram or cause-effect diagram, is a visual technique used to describe the various causal factors of a particular event or phenomenon. This diagram has a shape resembling a fish skeleton and is useful for identifying and understanding the complex relationships between various causal factors in a particular problem or event [14]. The fishbone diagram in this article aims to understand the two dominant factors causing the delay of the 20-foot fleet, namely the fleet waiting time and the shortage of containers.

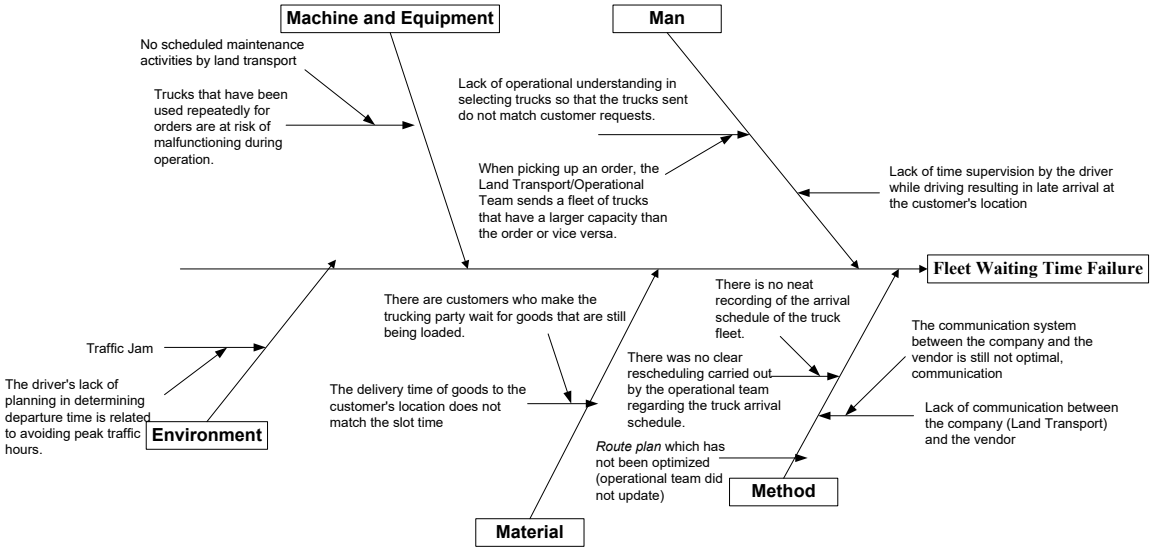

Figure 2. Fishbone diagram of 20 feet fleet waiting time

The main factors contributing to fleet waiting time are categorized into material, human, environment, machine, and method. Material factors include inconsistencies in delivery times due to lack of readiness of goods from customers, while human factors include fleet delivery that does not match customer needs. Environmental factors include congestion and road conditions caused by lack of driver planning in determining departure times from the starting point of departure, while machine factors relate to truck damage and lack of regular maintenance. In addition, method factors include lack of neat record keeping, suboptimal route planning, and ineffective communication between the company and vendors.

Meanwhile, the factors causing container shortages are grouped into five main categories: material, human, environment, machinery and equipment and methods. Material factors include defects in containers such as leaks or holes due to the lack of initiative of the operational team in repairing the condition of the container while still in the depot. Human factors include rushed operational work due to the high number of orders. Environmental factors indicate that many logistics companies rent containers, so that container supplies are limited. Method factors include the lack of accurate data on container conditions in the depot during the shortage period, suboptimal communication between planners and vendors, and lack of information obtained from external service teams regarding container searches. Machine and equipment factors include inefficient communication between planners and shipping companies,

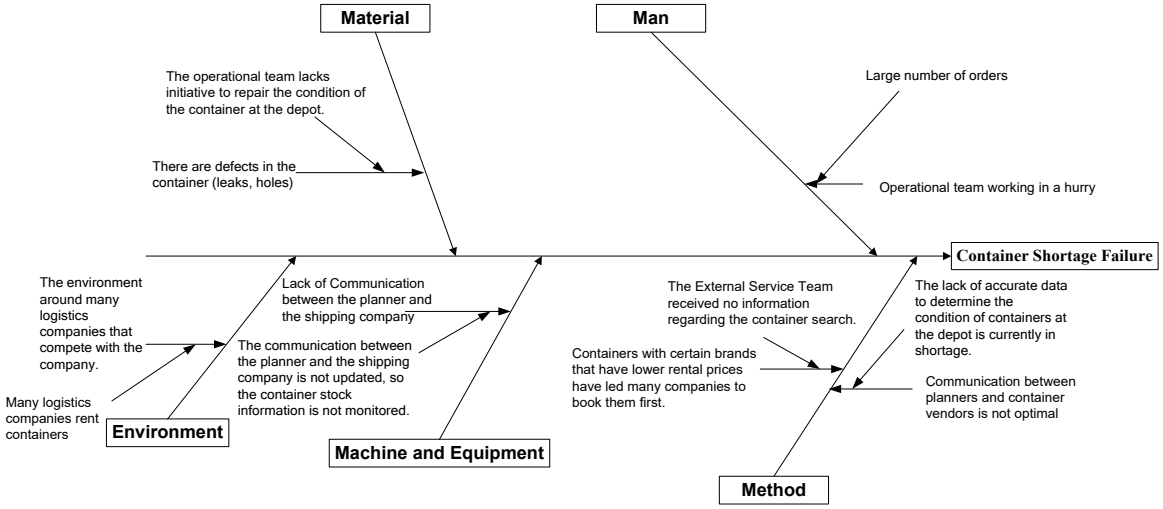

Figure 3. Fishbone diagram container shortage

Analysis of the Highest Failure Causes Using the FMEA Method

The FMEA method identifies the most critical failure causes based on the Fishbone Diagram. It ranks these causes using the Risk Priority Number (RPN), calculated as the product of three factors: Severity (impact of the failure), Occurrence (frequency of the failure), and Detection (difficulty in identifying the failure). Each factor is rated on a scale of 1 to 10, with higher values indicating greater impact, frequency, or difficulty in detection.

The assessment of severity, occurrence, and detection scales involves evaluations from 3 respondents at the supervisor and employee level within the company's operations team. Here are the RPN assessment results for fleet waiting time. The calculation method for severity, occurrence, and detection from 3 respondents was carried out by summing the results of respondents 1, 2, and 3, and then dividing the final sum by the number of respondents[11], [15]. After obtaining the questionnaire results for severity, occurrence, and detection, the next step is to determine the Risk Priority Number (RPN). The Risk Priority Number (RPN) can be calculated using the following formula:

$$RPN = Severity\ (S) \times Occurance\ (O) \times Detection\ (D) \quad (1)$$

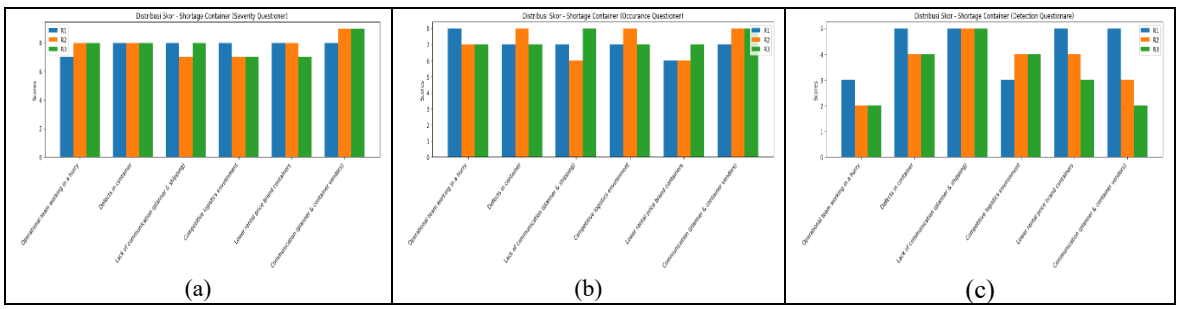

Figure 4. Recapitulation of FMEA shortage container questionnaire data severity questionnaire (a) Occurance questionnaire (b) Detection questionnaire

The recapitulation of the FMEA questionnaire related to Container Shortage can be seen in Figure 4 which has been filled in by 3 respondents who were selected based on their work experience in the field and also based on their understanding of the logistics flow being observed who can also be said to be an expert about the process in the company. The data analysis carried out shows consistency across all respondents regarding the main causes of delays, with average severity, occurrence, and detection scores each in the same range. This indicates that the data has reached good data saturation which can be said to show that the data collected and the respondents selected are reliable and unbiased. The following are the results of the failure mode assessment:

Table 3. Calculation of RPN for fleet waiting time failure

Factor	Potential Failure Modes	Cause	Effect	S	O	D	RPN	*Rank*
Man	Lack of time supervision by the driver while driving resulting in late arrival at the customer's location	SOPs are never implemented and field controls are not strict enough	Decreased customer trust	9	7	2	126	6
	Lack of operational understanding in selecting trucks so that the trucks sent do not match customer requests.	When picking up an order, the Land Transport/Operational Team sends a fleet of trucks that have a larger capacity than the order or vice versa.	There was a rejection from the customer and they asked to find another truck that met the customer's standards.	8	6	3	144	4
Material	The delivery time of goods to the customer's location does not match the slot time	There are customers who make the trucking party wait for goods that are still being loaded.	Customers are charged additional fees for exceeding the time specified for loading.	8	6	4	192	2
Environment	Traffic Jam	The driver's lack of planning in determining departure time is related to avoiding peak traffic hours.	The fleet arrival time was not according to schedule	6	6	4	144	5
Machine	Trucks that have been used repeatedly for orders are at risk of malfunctioning during operation.	No scheduled maintenance activities by land transport	Truck engines often break down and incur significant repair costs.	7	4	2	56	8
	There was no clear rescheduling carried out by the operational team regarding the truck arrival schedule.	There is no neat recording of the arrival schedule of the truck fleet.	Suboptimal scheduling has the potential to cause frequent delays.	8	6	2	96	7
Method	Lack of communication between the company (Land Transport) and the vendor	The communication system communication not optimal because between the company and the vendor just via Telephone WhatsApp	Missed communication occurs due to not implementing 3C (Communication, Collab, Coordination)	8	7	3	168	3
	Route plan which has not been optimized (operational team did not update)	The operational team does not yet have a real-time travel route planning system	Higher operational costs and slow down the process of sending fleets to customer locations and also add time, costs and fuel.	8	7	4	224	1

Three potential failures with the greatest RPN values for each kind of delay were found through analysis utilizing the FMEA method, and they should be the primary areas for improvement. The fleet waiting time delay, which is brought on by a route plan that is not optimal or not updated with an RPN value of 224, a mismatch between delivery time and slot time which obtained a value of 192, and a lack of communication between the company and vendors with a value of 168.

Table 4. Calculation of RPN for container shortage failure

Factor	Potential Failure Modes	Cause	Effect	S	O	D	RPN	*Rank*
Man	Operational team working in a hurry	Large number of orders	Operators become less careful in checking container stock	8	7	2	112	6
Material	There are defects in the container (leaks, holes)	The operational team lacks initiative to repair the condition of the container at the depot.	*Order* not picked up because they did not get a container, this can be detrimental to the company	8	7	4	224	2
Machinery and Equipment	Lack of Communication between the planner and the shipping company	The interaction between the planner and the shipping firm lacks updates, resulting in unmonitored container inventory data.	Cannot do pick-up order	8	7	5	245	1
Environment	The environment around many logistics companies that compete with the company.	Many logistics companies rent containers	Containers are difficult for the operational team to obtain because the stock of containers is low.	7	7	4	196	4
Method	Containers with certain brands that have lower rental prices have led many companies to book them first.	The External Service Team received no information regarding the container search.	Loss of orders from customers during shortage conditions	8	6	4	192	5
	Communication between planners and container vendors is not optimal	The lack of accurate data to determine the condition of containers at the depot is currently in shortage.	The company did not receive containers that met the established standards.	9	8	3	216	3

For delays caused by container shortages, priority steps for improvement that must be taken include minimal communication with an RPN value of 245, defects in containers such as leaks or holes with a value of 224, and suboptimal communication between vendors and companies with a value of 216. After knowing the main factors that cause high fleet delays when stuffing to customer locations in logistics companies, it can be concluded that improvements are needed to overcome these delays, considering the potential risks that arise.

Proposed Improvements with the 5W + 1H Method

Proper planning and implementation of actions can help companies evaluate and improve operational quality. One effective approach is the method 5W+1H, which can help in the planning process and decision-making. This method is also called the Kipling method, which involves a series of questions, along with their answers, to analyze a particular situation, namely what, who, when, where, how, and why.[12]. The table below shows the improvement suggestions for fleet wait times based on the questions in the 5W + 1H technique.

Table 5. Proposed improvement to fleet delays due to fleet waiting time

No	Factor	What	Why	Where	When	Who	How
1	Route plan that has not been optimized (the operational team did not update it)	Operators are having difficulty in planning	there is no route planning system yet.	Company Operational Area	Operating Hours	Operational Team	1. Enhance monitoring by regularly reviewing travel routes, enabling better updates on estimated arrival times for customers. 2. Conducting data and information analysis related to distance, travel time, and traffic conditions. 3. Foster an efficient work culture and enhance skills in utilizing implemented technologies.
2	The delivery time of goods to the customer's location does not match the slot time	There are customers who make the trucking company wait for the goods because the goods to be shipped are not yet ready for loading.	The customer did not create a schedule that aligns with the scheduled time allowance.	Customer warehouse	Operating hours	Driver and customer	1. Arrange the loading schedule to avoid queues. 2. Ensure drivers communicate with customers in advance so goods are ready for loading upon arrival, minimizing waiting time. 3. Include detailed service level agreements in contracts to align with customer expectations and ensure timely resolution of issues without missing deadlines.
3	Lack of communication between the company (Land Transport) and the vendor	The miscommunication between land transport and the vendor made it difficult to handle sudden scheduling.	Because of negligence or unintentional actions when the land transport department did not answer the question correctly or vice versa.	Land transport division	During operating hours	Head of the land transport division	1. Assign a PIC in the land transport division to manage vendor division inquiries. 2. Appoint the PIC from the vendor division who will be responsible for receiving calls from land

							transport and informing land transport about the assigned PIC. 3. Implement 3C (Communication, Collaboration, Coordination) to minimize errors, improve response times, and boost customer satisfaction through real-time monitoring and efficient delivery coordination.

Recommendations for improvements related to the container shortage can be seen in the table below.

Table 6. Proposed improvement to fleet delays due to container shortage

No	Factor	What	Why	Where	When	Who	How
1	Lack of Communication	The communication between the planner and the shipping company is not updated, so the container stock information is not monitored.	The planning team and the shipping company are not adequately sharing information regarding the situation at the depot.	Company Operational Area	Operating Hours	Planner and shipping container	1. Hold bi-monthly meetings between planners and the container shipping company to review stock, schedules, and related issues. 2. Offer monthly communication training for planners and container shipping staff to reduce miscommunication about container status in the depot.
2	There is a defect in the container (leaking, punctured).	The operational team lacks detail in inspecting and lacks initiative in making repairs to the condition of the containers at the container depot.	The selection of containers is often done at night.	Shipping Depot	Outside of operating hours	Operational Team	1. Shift the container inspection schedule to the afternoon to ensure proper lighting for quality checks. 2. Train the Outbound Team (DL) twice weekly on container quality checks before deliveries. 3. Establish standardization and team commitment to a

	zero-defect culture, with supervisors ensuring adherence through regular monitoring.

Conclusion

Based on the analysis using the Pareto Diagram method, the delay of the fleet in the stuffing process (on-time pick-up) to the customer's location is caused by six main factors, namely unprepared goods, container rejection due to non-compliance with customer standards, schedule discrepancies, container shortages, wait armada, and lack of commitment from the vendor.

Through analysis using the FMEA method, the factors causing delays were identified and prioritized based on the highest RPN scores. Factors with the highest scores have a significant impact on delays, a high frequency of occurrence, and a level of difficulty in identification, thus potentially causing substantial losses for the company. The priority improvements that need to be made include optimizing the fleet route plan that has not been updated (RPN 224), adjusting delivery times to the predetermined time slots (RPN 192), and enhancing communication between the company and the vendor (RPN 168). For delays due to container shortages, the necessary improvements include enhancing communication (RPN 245), handling containers with defects such as leaks or holes (RPN 224), and optimizing communication between vendors and the company (RPN 216).

Improvement measures for delivery delays are developed using the 5W+1H method, outlining what actions are needed, why they’re urgent, who is responsible, when and where they’ll be done, and the steps to enhance logistics efficiency. Key focus areas include refining delivery time planning, ensuring transportation and container quality, enhancing delivery monitoring with tracking technology and accessible information systems, and boosting communication, collaboration, and coordination. [16], [17].

This study is limited by its focus on a single logistics company and does not fully consider external factors like regulations or market changes. Future research with larger, more diverse samples could offer broader insights for the logistics industry. Additionally, exploring integrated machine learning for delay prediction and root cause analysis is a promising direction.

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