



## Improvement for Warehouse Activity Processes PT. Pos Logistik Indonesia Branch Office Makassar, Sidenreng Rappang's Area by Failure Mode and Effect Analysis (FMEA) & Fault Tree Analysis (FTA) Methods

Dodi Permadi<sup>1</sup>, Reza Fayaqun<sup>2</sup>, Carles Sitompul<sup>3</sup>, Desmah Fajriani<sup>4</sup>

<sup>1,2</sup> D4 Logistik Bisnis, Politeknik Pos Indonesia

<sup>3,4</sup> S2 Teknik Industri, Universitas Katolik Parahyangan

**ABSTRACT:** PT Pos Logistik Indonesia Branch Office Makassar is a company engaged in services or 3PL (Third-Party Logistics). This research aims to identify the factors causing product damage and the corrective actions that will be taken. This research uses the Failure Mode and Effect Analysis (FMEA) and Fault Tree Analysis (FTA) methods with the 5W+1H tools. The first stage of this research involves identifying the causes of damage using FMEA and determining the potential causes. The second stage details the potential causes identified in the first stage using FTA. The third stage involves proposing improvements using the 5W+1H method. Based on the analysis conducted, it was found that the factors causing product damage include frequent dropping of items during receipt and transfer to the storage area, rodent infestation, use of rough pallets, incorrect input of incoming and outgoing product quantities into the system, frequent dropping of items during storage and overly high stacking of goods.

**KEYWORDS:** Warehousing, Failure Mode and Effect Analysis (FMEA), Fault Tree Analysis (FTA), 5W+1H

### INTRODUCTION

The increasingly competitive business environment today requires every company to be able to reconfigure its strategies and systems, including companies in the logistics service sector. The essence of competition lies in how a company implements processes to produce better, cheaper and faster products, whether goods or services, compared to its competitors. Logistics companies offer various services, including warehousing or storage services. Often, the large volume of goods that need to be shipped cannot be sent all at once, requiring several days for the goods to reach the hands of consumers or recipients. Therefore, warehousing services are needed as temporary or recipients. Therefore, warehousing services are needed as a temporary storage place for shipping goods. One business model utilized by companies is third-party logistics (3PL). Third-party logistics (3PL) is a term used by companies that utilize logistics service providers to deliver their products to the company's customers (Meidute, 2012)

A 2016 study by Langley & Capgemini stated that warehousing logistics services are highly sought after by companies. One of the 3PL companies in Indonesia is PT Pos Logistik Indonesia, a subsidiary of a state-owned enterprise (BUMN) that provides warehousing services to its customers. PT Pos Logistik Indonesia has several branches across Indonesia, one of which is in Makassar—PT Pos Logistik Indonesia Branch Office Makassar (POSLOG Makassar). With the increasing competition in the logistics industry, particularly in the warehousing sector, companies must maintain the quality of their services to ensure that customers continue to use them. One factor that causes customers to switch to competitor warehousing services is damage to goods while stored in the warehouse.

This research utilizes a combination of Failure Mode and Effect Analysis (FMEA) and Fault Tree Analysis (FTA) methods to propose improvements in the warehousing activities at POSLOG Makassar. Several previous studies have employed similar combinations of these methods, or have used one of these methods, which served as a guide for the author in conducting this research. These studies include: 'Proposed Improvement for Hazard Sources in Assembly Area 2 Using Hazard and Operability Method and Fault Tree Analysis (Case Study: PT. Astra Daihatsu Motor)' by Fahmi Ardi and Singgih Saptadi in 2019; 'Analysis of Delivery Failure Using FMEA and FTA Methods: A Case Study at PT Pos Indonesia Central Jakarta 10900' by Edi Supardi and Wais Alkhorni (2019); 'Business Process Evaluation at PT. Merdeka Grafika Indonesia Using Failure Mode and Effect Analysis (FMEA) and Quality Evaluation Framework (QEF)' by Rusjda, Aditya, and Andi Reza (2019); 'Analysis of Delay Factors in Procurement Functions Using Failure Mode and Effect Analysis (Case Study at PT. Pertamina Trans Kontinental)' by Muhammad

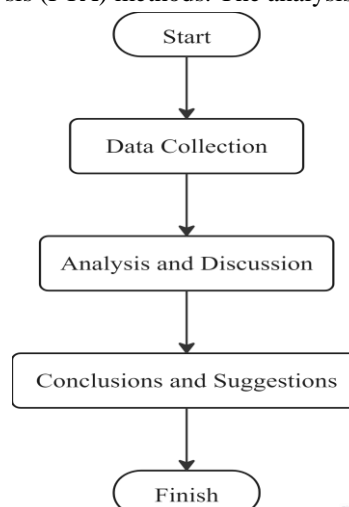


Faiz and Dyah Ika (2017); 'Problem Identification Analysis Using Failure Mode and Effect Analysis (FMEA) and Risk Priority Number (RPN) Methods in Sub Assembly Line PT Toyota Motor Manufacturing Indonesia' by Nia Budi, Ganesstri Padma, and Purnawan Adi (2017); and 'Quality Control in the Receiving Process to Reduce Defective Products with a Six Sigma Approach' by Annisa Indah and Ragil Yuli (2021).

The differences between this research and previous studies are the research location, the object of study, and the inclusion of additional improvement proposals for the SOP. This study aims to identify the causes of product damage and determine the recommendations that will be provided to POSLOG Makassar. The contribution of this research is to help reduce the rate of product damage at POSLOG Makassar, allowing the company to maintain its service quality, and to serve as additional reading material for readers or future researchers.

## RESEARCH METHODS

- 1) This research is based on several assumptions: the respondents are familiar with the storage system or flow in the warehouse and are aware of the causes of product damage occurring in the warehouse. The problem definition addressed in this research is the damage to goods occurring during the inbound to outbound activities at the POSLOG Makassar warehouse, specifically in the Sidenreng Rappang (SIDRAP) area.
- 2) There are several stages of activities carried out in this research before analyzing the problem formulation addressed in this study. The stages are as follows:
  - a. Conducting a preliminary study to obtain concepts and methods related to the issues raised.
  - b. Problem identification; this stage aims to determine the issues occurring within the company.
  - c. Problem formulation; this stage focuses on defining or concentrating on one or two problems for which solutions will be sought.
  - d. Research objectives; defining the targets to be achieved in this research based on the identified problems.
  - e. Data collection; this stage involves gathering the necessary data for the research.
  - f. Data processing; in this stage, the author processes the data obtained using FMEA (Failure Mode and Effect Analysis) and FTA (Fault Tree Analysis) methods.
- 3) This research employs two types of data collection techniques: interviews and observations. Interviews are conducted with individuals who are knowledgeable about warehousing, while observations are carried out to observe events occurring in the field directly.
- 4) The data obtained from the company includes information on product damage occurring from November 2020 to March 2021. The author then performs an analysis to propose improvements to the identified issues. This analysis uses Failure Mode and Effect Analysis (FMEA) and Fault Tree Analysis (FTA) methods. The analysis design for this research is as follows:



**Figure 1: Research Design**

Source: Writer, 2021



**RESULTS AND DISCUSSION**

The data to be analyzed in this research is the data on damaged goods stored from November 2020 to March 2021. Here is the data:

**Table 1: Data on Damaged Goods**

No.	Product	Total Arrical of Goods (5 Months)	Deffect (5 Months)			Total	Percentage (%)
			Dents	Tons	Difference in Goods		
1	Bumil	1250	45	23	10	78	6%
2	Balita	1100	60	36	0	96	9%
Total		2350	105	59	10	174	7%

Source: Poslog Makassar, 2021

**Failure Mode And Effect Analysis (FMEA)**

After obtaining data on the damaged goods in the warehouse, the author then conducted observations to identify which activities caused the failure mode and to determine the causes and effects of that failure mode. Here is the data:

**Table 2: Failure Mode, Effect of Failure, and Cause of Failure**

No.	Activity/ Process	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure
1	Receiving	Dents	Damaged packaging and broken biscuits inside, customer refused to accept the goods	Goods often fall during the receiving process
	Put-Away		Damaged packaging and broken biscuits inside, customer refused to accept the goods	Goods fall while being transported to the storage area
	Storage		Outer packaging dented	Stacks of goods are too high, causing the lower ones to get dented
			Damaged packaging and broken biscuits inside, customer refused to accept the goods	Goods often fall during storage
2	Storage	Torns	Outer packaging torn	Use of rough pallets
			Outer packaging torn and some biscuits were damaged, POSLOG Makassar did not release the goods	Damaged by rats
3	Receiving	Difference in Goods	The data for incoming goods does not match the system	Incorrectly entering the quantity of incoming goods into the system
	Picking		The data for outgoing goods does not match the system	Incorrectly entering the quantity of outgoing goods into the system

Source: Writer, 2021

The next step is to determine the values of the three variables (severity, occurrence, and detection), which are filled in by one respondent selected by the author. Then, a calculation is performed to determine the RPN (Risk Priority Number) for each cause of failure. Here are the results;



Table 3: RPN Calculation

System: Warehouse PT. Pos Logistik Indonesia Branch Office Makassar area Sidenreng Rappang								
FMEA Date: 9 Agustus 2021								
Prepared by: Desmah Fajriani								
Checked by: Mustari Muammar								
No.	Activity/ Process	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Severity (S)	Occurance (C)	Detection (D)	RPN
1	Receiving	Dents	Damaged packaging and broken biscuits inside, customer refused to accept the goods	Goods often fall during the receiving process	8	7	3	168
	Put-Away		Damaged packaging and broken biscuits inside, customer refused to accept the goods	Goods fall while being transported to the storage area	8	8	3	192
	Storage		Outer packaging dented	Stacks of goods are too high, causing the lower ones to get dented	9	7	3	189
			Damaged packaging and broken biscuits inside, customer refused to accept the goods	Goods often fall during storage	9	8	3	216
Total								765
2	Storage	Torns	Outer packaging torn	Use of rough pallets	7	7	3	147
			Outer packaging torn and some biscuits were damaged, POSLOG Makassar did not release the goods	Damaged by rats	9	9	3	243
Total								390
3	Receiving	Difference in Goods	The data for incoming goods does not match the system	Incorrectly entering the quantity of incoming goods into the system	9	8	3	216
	Picking		The data for outgoing goods does not match the system	Incorrectly entering the quantity of outgoing goods into the system	9	7	3	189
Total								405

Source: Writer, 2021

The last step in FMEA analysis is to determine the potential causes, which are taken from the highest RPN values. Here are the results:

Table 4: Determination of Potential Cause

No.	Potential Failure Mode	Potential Cause(s) of Failure	RPN	%	% Cumulative
1	Dents	Goods often fall during storage	216	28%	28%
		Goods often fall being transported to the storage area	192	25%	53%
		Stacks of goods are too high, causing the lower ones to get dented	189	25%	78%

		Goods often fall during the receiving process	168	22%	100%
2	Torns	Damaged by rats	243	62%	62%
		Use of rough pallets	147	38%	100%
3	Difference in Goods	Incorrectly entering the quantity of incoming goods into the system	216	53%	53%
		Incorrectly entering the quantity of outgoing goods into the system	189	47%	100%

Source: Writer, 2021

The table above shows that the potential causes for the failure of dents are: items often falling during storage, items falling when moved to the storage area, stacks that are too high causing dents at the bottom, and items often falling during receipt. The potential causes for the failure of tears are: damage by rats and the use of rough pallets. The potential causes for the failure of discrepancies are: incorrect entry of incoming item quantities into the system and incorrect entry of outgoing quantities into the system.

**Fault Tree Analysis (FTA)**

The next stage of analysis is the Fault Tree Analysis (FTA), which is used to delve deeper into the root causes of failures and is depicted using standard logical symbols. Here are the 8 potential causes that will be identified:

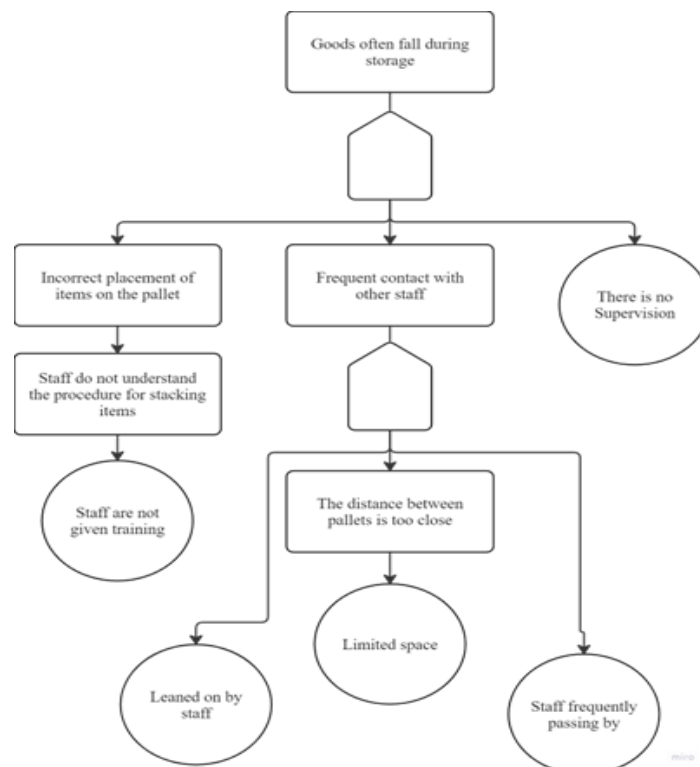
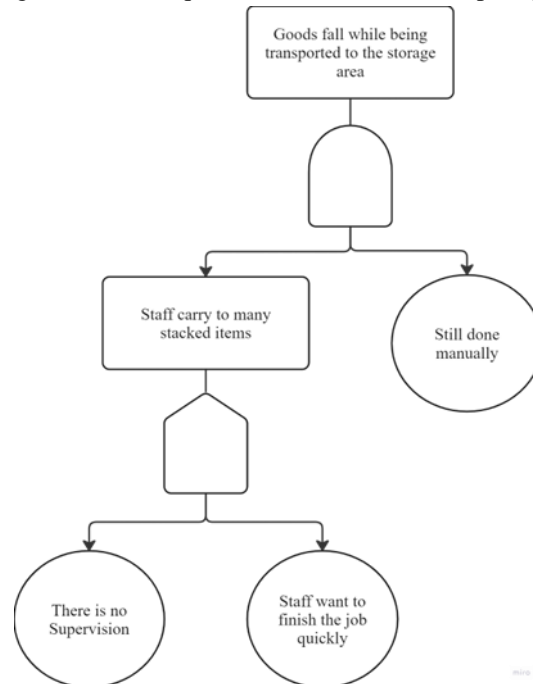


Figure 2: Goods often fall during storage

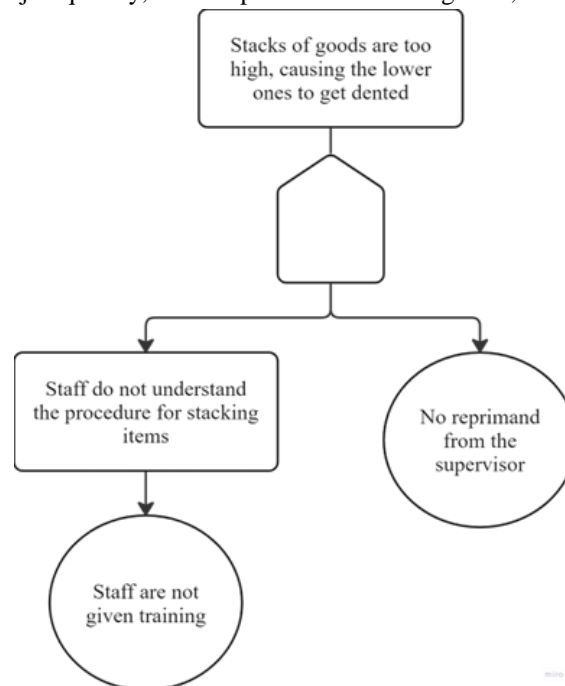
Source: Writer, 2021

Figure 2, the fault tree diagram above, at the top event where goods frequently fall during storage, with 5 basic events: staff not being given training, goods leaning against staff, frequent staff movement, cramped space, and lack of supervision.



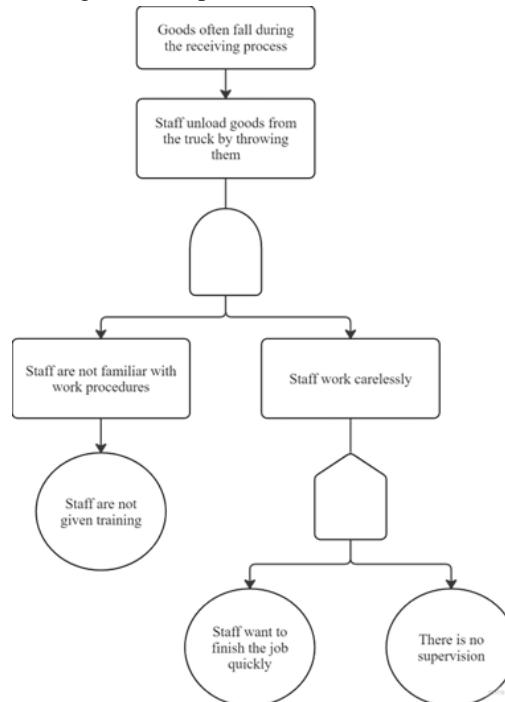
**Figure 3: Goods fall while being transported to the storage area**  
Source: Writer, 2021

In Figure 3, the fault tree diagram above, the top event is goods falling while being transported to the storage area, with 3 basic events: staff wanting to finish the job quickly, manual processes still being used, and lack of supervision.



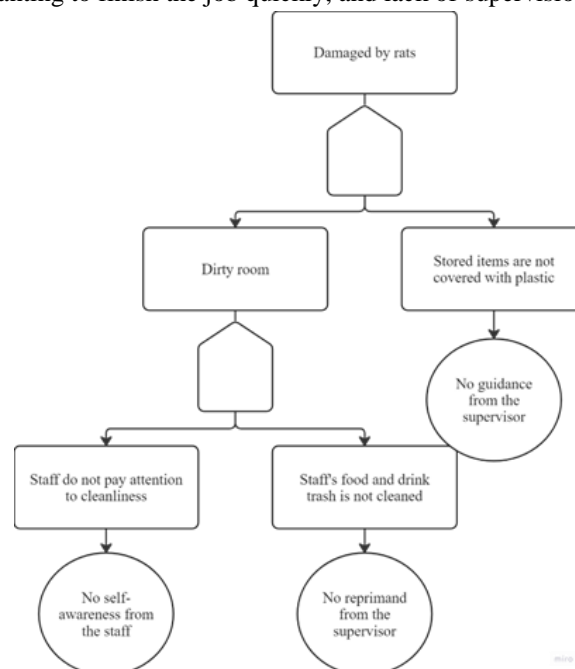
**Figure 4: Stacks of goods are too high, causing the lower ones to get danted**  
Source: Writer, 2021

In Figure 4, the fault tree diagram above, the top event is the stack of goods being too high, causing the bottom to get crushed, with 2 basic events: staff not being given training and no reprimand from the warehouse supervisor.



**Figure 5: Goods often fall during the receiving process**  
Source: Writer, 2021

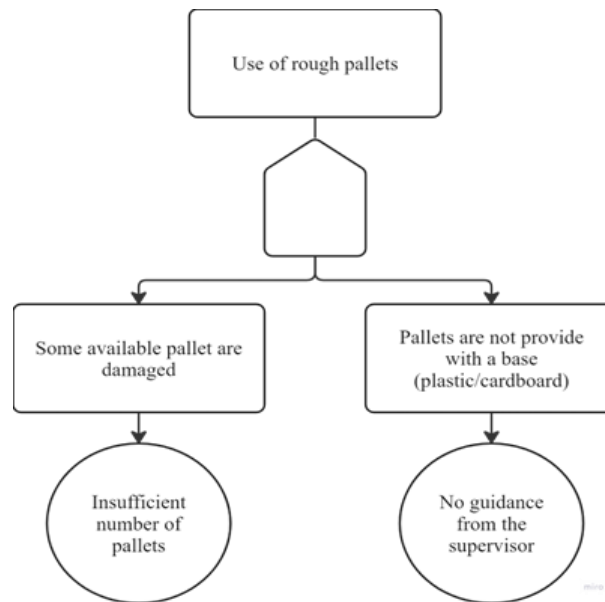
Figure 5, the fault tree diagram above, shows the top event where goods frequently fall during receipt, with 3 basic events: staff not being given training, staff wanting to finish the job quickly, and lack of supervision.



**Figure 6: Damaged by rats**  
Source: Writer, 2021

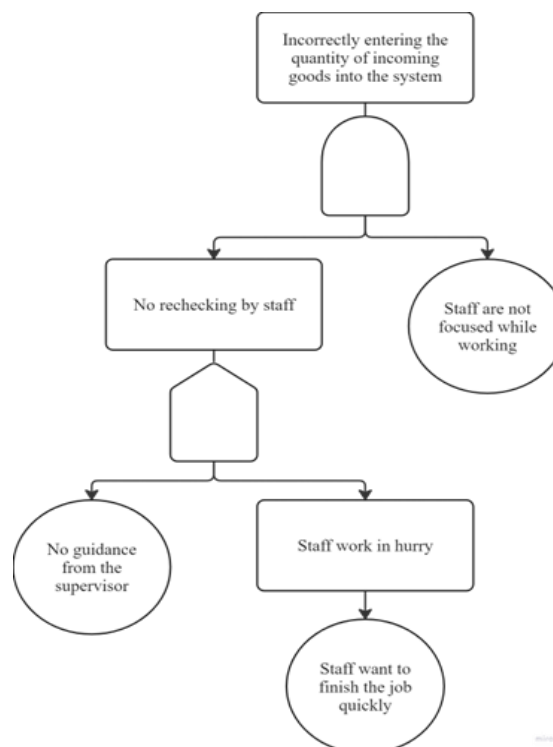


Figure 6 in the fault tree diagram above describes the top event "eaten by rats" with three basic events: lack of self-awareness among staff, no reprimand from supervisors, and lack of supervisor guidance.



**Figure 7: Use of rough pallets**  
Source: Writer, 2021

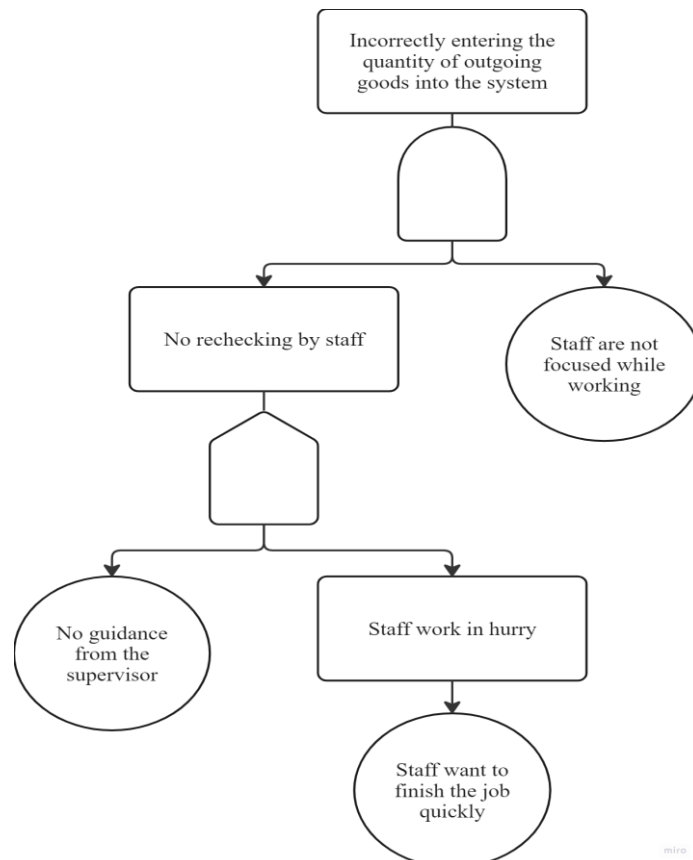
The explanation of Figure 7 in the fault tree diagram above describes the top event "use of rough pallets" with two basic events: an insufficient number of pallets and a lack of guidance from supervisors.



**Figure 8: Incorrectly entering the quantity of incoming goods into the system**  
Source: Writer, 2021



Figure 8 in the fault tree diagram above describes the top event "incorrectly entering the quantity of incoming goods into the system" with three basic events: lack of guidance from supervisors, staff wanting to finish the work quickly, and staff not being focused while working.



**Figure 9: Incorrectly entering the quantity of outgoing goods into the system**  
Source: Writer, 2021

The explanation of Figure 9 in the fault tree diagram above describes the top event "incorrectly entering the quantity of outgoing goods into the system" with three basic events: lack of guidance from supervisors, staff wanting to finish the work quickly, and staff not being focused while working.

**Analysis of Improvement 5W+1H**

After conducting a deeper analysis to determine the root cause of the failure, the next step is to provide improvement suggestions using the 5W+1H method.



**Table 5: Improvement for goods often fall during storage**

Potential Cause	What	Why	Where	When	Who	How
	What are the improvement plans to be implemented?	Why is there a need for an improvement plan?	Where will the improvements be implemented?	When should the improvements be made?	Who needs to carry out the improvements?	How is the plan to implement the improvements?
Goods often fall during storage	Improving the arrangement of goods on pallets, providing more space between pallets, and increasing the use of plastic.	So that goods don't easily fall, staff can move more freely, and the goods don't sway.	In the storage area.	As soon as possible, when goods arrive at the warehouse.	Starting from the warehouse manager down to the warehouse staff.	The warehouse manager will provide training or guidance on proper storage methods and instructions to cover goods with plastic.

Source: Writer, 2021

**Table 6: Improvement for goods often fall being transported to the storage area**

Potential Cause	What	Why	Where	When	Who	How
	What are the improvement plans to be implemented?	Why is there a need for an improvement plan?	Where will the improvements be implemented?	When should the improvements be made?	Who needs to carry out the improvements?	How is the plan to implement the improvements?
Goods often fall being transported to the storage area	Use of hand pallet	To prevent damage to goods and to ensure staff do not experience workplace accidents while transporting items to the storage area	In the Put-Away section	As soon as possible and while the goods are in the warehouse	Starting from the warehouse manager and then to the warehouse staff	Addition of tools/machines in the goods retrieval process (Hand Pallet)

Source: Writer, 2021



**Table 7: Improvement for stacks of goods are too high, causing the lower ones to get dented**

Potential Cause	What	Why	Where	When	Who	How
	What are the improvement plans to be implemented?	Why is there a need for an improvement plan?	Where will the improvements be implemented?	When should the improvements be made?	Who needs to carry out the improvements?	How is the plan to implement the improvements?
Stacks of goods are too high, causing the lower ones to get dented	Reducing pile-ups of goods	The bottom part does not get dented	Storage section	As soon as possible and when the goods arrive at the warehouse	Warehouse manager and staff	Providing training/knowledge about storage procedures and issuing warnings if it happens again

Source: Writer, 2021

**Table 8: Improvement goods often fall during the receiving process**

Potential Cause	What	Why	Where	When	Who	How
	What are the improvement plans to be implemented?	Why is there a need for an improvement plan?	Where will the improvements be implemented?	When should the improvements be made?	Who needs to carry out the improvements?	How is the plan to implement the improvements?
Goods often fall during the receiving process	Changing the method of unloading goods from the top of the truck	No longer experiencing damage	Receiving section	As soon as possible and when the goods arrive at the warehouse	Warehouse manager and staff	Supervising during the goods receiving process and providing training to warehouse staff

Source: Writer, 2021

**Table 9: Improvement for damaged by rats**

Potential Cause	What	Why	Where	When	Who	How
	What are the improvement plans to be implemented?	Why is there a need for an improvement plan?	Where will the improvements be implemented?	When should the improvements be made?	Who needs to carry out the improvements?	How is the plan to implement the improvements?
Damaged by rats	Creating a cleanliness duty schedule or calling a special cleanliness officer and using plastic	Goods are not eaten by rats	In the storage area.	As soon as possible, when goods arrive at the warehouse.	Warehouse head, warehouse manager, and staff	Creating a daily duty schedule before and after work and providing plastic to the stored goods

Source: Writer, 2021



Table 10: Improvement for use of rough pallets

Potential Cause	What	Why	Where	When	Who	How
	What are the improvement plans to be implemented?	Why is there a need for an improvement plan?	Where will the improvements be implemented?	When should the improvements be made?	Who needs to carry out the improvements?	How is the plan to implement the improvements?
Use of rough pallets	Not using rough pallets and providing a base (plastic/cardboard) on the pallet when it will be used	Goods are not scratched by the pallet	Storage section	As soon as possible	Warehouse manager and staff	Purchasing new pallets made of plastic and providing plastic bases for old pallets before use

Source: Writer, 2021

Table 11: Improvement for incorrectly entering the quantity of incoming goods by system

Potential Cause	What	Why	Where	When	Who	How
	What are the improvement plans to be implemented?	Why is there a need for an improvement plan?	Where will the improvements be implemented?	When should the improvements be made?	Who needs to carry out the improvements?	How is the plan to implement the improvements?
Incorrectly entering the quantity of incoming goods into the system	Performing a recheck	No discrepancy between the quantity of goods in the system and the physical quantity of goods received	Receiving section	As soon as possible and when the goods arrive	Warehouse manager and staff	Rechecking when the goods are in the receiving area and when they are moved to the storage area

Source: Writer, 2021



Table 12: Improvement for incorrectly entering the quantity of outgoing goods by system

Potential Cause	What	Why	Where	When	Who	How
	What are the improvement plans to be implemented?	Why is there a need for an improvement plan?	Where will the improvements be implemented?	When should the improvements be made?	Who needs to carry out the improvements?	How is the plan to implement the improvements?
Incorrectly entering the quantity of outgoing goods into the system	Performing a recheck	No discrepancy between the quantity of goods in the system and the physical quantity of goods leaving the warehouse	Packing section	As soon as possible	Warehouse manager and staff	Rechecking when the goods are loaded onto the truck

Source: Writer, 2021

**CONCLUSION**

Based on the research conducted regarding the Proposal for Improvement in the Storage Process at the POSLOG Makassar Warehouse, Sidenreng Rappang Area, Using the Failure Mode and Effect Analysis (FMEA) and Fault Tree Analysis (FTA) Methods, the following conclusions can be drawn:

- 1) Several activities in the warehouse contribute to product damage, such as:
  - a. In the receiving activity, there is a failure mode involving dented and mismatched quantities of goods. The cause of the dented goods is that staff take goods from the truck by throwing them. The mismatched quantities cause because staff incorrectly input the quantity of incoming goods into the system.
  - b. In the put-away activity, there is a failure mode involving dented goods, caused by staff carrying too many goods to the storage area without the aid of a hand pallet.
  - c. In the storage activity, failure modes involve dented and torn goods. The dented goods are caused by goods frequently falling during storage, improper placement on pallets, frequent contact with staff, and excessive stacking that causes the lower goods to become dented. The torn goods are caused by rats damaging some goods during storage due to the dirty and infrequently cleaned storage area. Another factor is the rough pallets used.
  - d. In the picking activity, there is a failure mode involving mismatched quantities of goods, caused by staff often inputting incorrect quantities of goods leaving the warehouse into the system.
- 2) Several improvement suggestions or recommendations are provided to POSLOG Makassar, specifically for the Sidrap area warehouse, based on the 5W+1H tool with a focus on the "How" (H) aspect. The proposed improvements are as follows:
  - a. For the receiving activity, the suggested improvement for dented goods is for the warehouse manager to supervise the warehouse and provide instructions to prevent repeating improper receiving practices. For mismatched quantities of goods, the recommendation is for warehouse staff to recheck the goods upon arrival at the receiving area and again when they are placed in storage.
  - b. For the put-away activity, the improvement suggestion for dented goods is for the warehouse manager to change the method of transporting goods from the staging area to storage by adding equipment or tools such as a hand pallet.
  - c. For the storage activity, the proposed improvement for dented goods is for the warehouse manager to provide guidance on rearranging the goods on pallets, wrapping the goods using proper techniques, and reducing one layer of stacked goods or the number of goods on each pallet to ensure that the goods at the bottom do not bear too much weight. For torn goods, the



suggested improvement is for the warehouse manager to create a cleaning schedule, instruct staff to cover goods with plastic, and either purchase new pallets or cover rough pallets with cardboard or plastic carpet.

- d. For the picking activity, the proposed improvement for mismatched quantities of goods is for warehouse staff to recheck the goods once they are loaded onto the truck or customer vehicle.

## REFERENCES

1. Annisa Indah Pratiwi, R. Y. (2021). Pengendalian Kualitas Pada Proses Penerimaan Barang Untuk Menurunkan Defect Produk Dengan Pendekatan Six Sigma. *Jurnal Industry Xplore*.
2. Dr. Ir. Suntoro, M. (2020). *Fundamental Manajemen Logistik*. Bandung: Kencana A.
3. Dr. Zaroni, C. C. (2017, Juni 22). Daya Saing *Perusahaan Penyedia Jasa Logistik Nasional*. Dipetik Mei 1, 2021, dari Supply Chain Indonesia: <https://supplychainindonesia.com/daya-saing-perusahaan-penyedia-jasa-logistik-nasional/>
4. Edi Supardi, S. M. (2019). Analisis Gagal Antar Dengan Penerapan Metode FMEA dan FTA Studi Kasus Di PT Pos Indonesia Jakarta Pusat 10900. *Jurnal Logistik Bisnis, Vol.09, No.2, November 2019, 9-15*.
5. Fahmi Ardi, S. S. (2019). Usulan Perbaikan Sumber Bahaya Pada Area Assembly 2 Dengan Metode Hazard And Operability Study Dan Fault Tree Analysis (Studi Kasus: PT. Astra Daihatsu Motor). *Jurnal Teknik Industri*, 111-118
6. Indonesia, P. P. (2021). *Beranda*. Dipetik Mei 1, 2021, dari Pos Logistik: <https://www.poslogistics.co.id/>
7. Rusjda Widya Rahmani, A. R. (2019). Evaluasi Proses Bisnis Pada PT. Merdeka Grafika Indonesia Menggunakan Failure Mode and Effect Analysis dan Quality Evaluation Framework (QEF). *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*, 7434-7443
8. Soemohadiwidjojo, A. T. (2017). Six Sigma: Stamatis, D. H. (2023). *Failure Mode and Effect Analysis FMEA From Theory to Execution Second Edition Revised and Expanded*. Wisconsin, Amerika Serikat: William A. Tony.

---

Cite this Article: Dodi Permadi, Reza Fayaqun, Carles Sitompul, Desmah Fajriani (2024). Improvement for Warehouse Activity Processes PT. Pos Logistik Indonesia Branch Office Makassar, Sidenreng Rappang's Area by Failure Mode and Effect Analysis (FMEA) & Fault Tree Analysis (FTA) Methods. *International Journal of Current Science Research and Review*, 7(9), 7311-7324, DOI: <https://doi.org/10.47191/ijcsrr/V7-i9-49>