The Application of Root Cause Analysis and Inventory Control in Reducing Warehouse Costs

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ABSTRACT

The rising operational costs of rental warehouses pose a strategic challenge for HMG, Ltd. in enhancing overall logistics and supply chain efficiency. This study aims to identify the root causes of these cost increases using the Root Cause Analysis method and formulate the improvement strategies based on inventory control and cost analysis. The key performance indicators analyzed are holding cost, lead time, stock accuracy, and material handling downtime-critical that influence warehouse and downstream transport performance. The study used direct observation, interviews, and document analysis. The results indicate that implementing a fixed-location storage system, standardizing ERP stock records, and doing preventive forklift maintenance successfully reduce holding costs by 35.5%, increase stock accuracy by 35%, shorten lead time by 30%, and reduce forklift downtime by 40%. These improvements not only optimize internal warehouse operations but also give a positive ripple effect on outbound logistics and transport reliability. Continuous improvement is recommended through KPI-based performance monitoring, gradual implementation of a Warehouse Management System, and workforce capacity building to ensure long-term supply chain responsiveness.

Keywords: logistics efficiency, inventory control, root cause analysis, warehouse management, transport optimization

A. Introduction

In the manufacturing industry, warehouse operational efficiency is a key factor in managing logistics costs (Sun, 2025). HMG, Ltd., a company engaged in plastic injection manufacturing, is experiencing challenges in the management of rental warehouses that cause an increase in operational costs. High rental warehouse costs can directly impact the company's profitability and hinder overall supply chain efficiency (Huckenbeck & Zatrochová, 2024; Kozerska, 2023; Silva, 2020). Rental warehouse operational costs include storage, labor, and facility maintenance costs. Inefficiencies in warehouse management can lead to various problems, such as inaccurate stock records, long picking times, and delays in customer distribution (DeHoratius & Raman, 2008; Huckenbeck & Zatrochová, 2024; Niftiyev et al., 2024; Silva, 2020). This results in increased operational

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costs that can negatively impact a company's competitiveness in the global market.

The unstructured storage system is one of the leading causes of the increase in rental warehouse costs (Asadabadi, 2016; Gu et al., 2010; Imansuri et al., 2023) at HMG, Ltd. A rental warehouse that does not have a fixed location system causes workers to have difficulty finding and retrieving the items needed. In addition, the lack of standards in stock recording procedures resulted in a mismatch between ERP data and the actual condition of goods in the warehouse (Ye et al., 2017). Another problem identified was errors in stock data input by warehouse workers. Inconsistency in recording causes mismatches between physical stock and that recorded in the ERP system. These errors often lead to overstocking or understocking, which results in increased management costs and delays in fulfilling customer orders.

In addition to storage and recording factors, material handling efficiency is a major challenge in HMG, Ltd.'s warehouse operations. Forklifts and other tools often experience downtime due to a lack of preventive maintenance (Richards, 2021; Sumasto et al., 2024; Sumasto, Jiwanto, et al., 2023). This results in delays in moving goods and increases unproductive labor costs. Therefore, this study aims to identify the main factors that cause an increase in operational costs at the HMG, Ltd. rental warehouse and implement effective improvement strategies. Specifically, this research aims to analyze the leading causes of the increase in operational costs of the rental warehouse, use the Root Cause Analysis (RCA) method to identify the factors that cause inefficiency, and develop improvement strategies based on inventory control and cost analysis to improve operational efficiency.

Many previous studies have conducted research on warehouse efficiency and operational costs. The concept of Root Cause Analysis (RCA) has been widely used in the manufacturing industry to identify underlying problems and design sustainable solutions (Vukčević, 2007). Several studies have shown that applying RCA in warehouse management can reduce operational costs by up to 30% by improving the accuracy of stock recording and optimizing storage systems (Satmoko & Sutopo, 2024). Previous studies have also highlighted the importance of the Fishbone Diagram and 5W+1H methods in analyzing the main causal factors of warehouse problems (Ishikawa, 1976). Some companies have adopted this approach to optimize the storage system by implementing fixed locations, improving stock recording accuracy with barcode technology, and implementing preventive maintenance procedures to reduce equipment downtime (Kalantri & Chandrawat, 2013; Mahto & Kumar, 2008; Sumasto, Arliananda, et al., 2023b). In relation to previous research, this study will integrate RCA with inventory control and cost analysis approaches to develop a more effective solution. An evaluation will be conducted on the impact of the solution implementation in reducing the operational costs of HMG, Ltd.'s rental warehouse and improving overall logistics efficiency.

B. Methods

This research used a descriptive-qualitative and quantitative-comparative approach to identify the factors causing the increase in operational costs of the rental warehouse at HMG, Ltd., and evaluated the effectiveness of the improvement strategies implemented (Asadabadi, 2016; Creswell, 2014; Sunaryo & Lestari, 2023). This approach allows for an in-depth analysis of the root causes of warehouse operational inefficiencies and compares conditions before and after the implementation of solutions to measure their success.

The research was conducted at HMG, Ltd., with the main object being the storage system, stock recording, and material handling efficiency in the company's rental warehouse. The research mainly focused on identifying the root causes of increased operational costs

using Root Cause Analysis (RCA) (Kalantri & Chandrawat, 2013; Mahto & Kumar, 2008; Satmoko & Sutopo, 2024; Sumasto, Arliananda, et al., 2023a) and developing solutions based on inventory control and cost analysis to improve operational efficiency.

The data was collected using several methods, such as direct observation, structured interviews, document study, and performance measurement (Yin, 2017). Observations were conducted to understand the operational activities of the warehouse, including the storage system, stock recording, and the use of material handling equipment. Interviews with warehouse management and operators were aimed at gaining insight into the main obstacles faced in daily operations. The document study included an analysis of warehouse operational reports, a history of stock recording in the ERP system, and operational cost data before and after the improvement. Performance measurement was conducted by evaluating several quantitative indicators, such as holding cost per unit, lead time for picking goods, accuracy of stock recording, and forklift downtime.

The data collection process took place over a nine-month period, from April to December 2024, and was conducted across two rental warehouse facilities owned by HMG, Ltd. Direct observation was carried out systematically during routine operational shifts, allowing the research team to document behaviors and inefficiencies in real time. For the interview phase, a total of 10 participants were selected, consisting of 2 PPIC supervisors and 8 warehouse operators, using a purposive sampling method to ensure operational relevance. Meanwhile, the document analysis covered internal company records, including monthly warehouse operating costs, ERP log data on inventory discrepancies, and maintenance logs of forklifts. Lastly, the performance measurement relied on four key performance indicators (KPIs): holding cost per unit, inventory accuracy, item picking lead time, and forklift downtime. To improve the validity of the findings, triangulation was employed across these four data sources, and results were cross-validated through follow-up discussions with warehouse and PPIC supervisors.

In this study, the data was analysed using Root Cause Analysis (RCA) method, which involved Fishbone Diagrams to identify the main factors of the increasing operational costs (Ishikawa, 1976; Kalantri & Chandrawat, 2013; Sumasto et al., 2022, 2024; Vukčević, 2007). RCA was used to classify the causes of the problem into several main categories, such as storage methods, stock recording, material handling, and operational management. To confirm the findings of the RCA, the 5W+1H method was applied to identify the specific causes of each problem found and design improvement strategies (Kalantri & Chandrawat, 2013; Sumasto, Arliananda, et al., 2023b).

In terms of inventory control, an inventory control analysis was conducted, which included implementing fixed location implementation to improve storage order and reduce search time (Dehoratius & Rabinovich, 2011; DeHoratius & Raman, 2008). In addition, cycle counting and ERP data validation were implemented to improve stock recording accuracy and prevent mismatches between physical stock and system data.

The impact of the solution improvement was evaluated through cost analysis, using holding cost calculations to compare storage costs before and after solution implementation. In addition, a Cost-Benefit Analysis (CBA) was conducted to evaluate the financial effectiveness of the implemented improvement strategy in reducing the rental warehouse's operational costs (Rushton et al., 2014).

To measure the success of the implemented strategy, this research used several Key Performance Indicators (KPIs) (Sun, 2025; Winkelhaus & Grosse, 2020), namely: (a) Decrease in Warehouse Holding Cost: Target at least 32% of the initial cost. (b) Improved Stock Record Accuracy: The target is at least 35% higher than before

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implementation. (c) Reduction of Goods Retrieval Lead Time: Target at least 30% faster and (d) Material Handling Downtime Reduction: The target is at least 40% lower than the period before the improvement.

The KPIs evaluation and periodic monitoring have been set to keep the implemented improvements remain sustainable. Monthly audits evaluate target achievement, while strategy evaluations are conducted quarterly to adjust improvement methods to evolving operational trends. With this more systematic approach, the research is expected to produce more accurate and applicable recommendations for sustainably improving the efficiency of HMG, Ltd.'s rental warehouse.

C. Results and Discussion

1. Identification of Causes of Cost Increase

The increasing of operating costs at HMG, Ltd.'s rental warehouse is caused by several primary factors related to storage methods, inaccurate stock records, and material handling inefficiencies. Based on the analysis with Root Cause Analysis (RCA) using Fishbone Diagram, it was found that the primary source of the problem came from an unstructured storage system, errors in stock recording in the ERP system, and lack of maintenance of tool work such as forklifts.

Unstructured Storage Methods

One of the main factors leading to increasing costs is the poorly organised storage system. The warehouse does not have a fixed location system, which causes goods to be moved around randomly. As the result, warehouse workers have difficulty locating goods, which increases the lead time for picking goods. This condition not only hampered operational efficiency but also contributed to increased labour costs due to longer search times. In addition, disorganised storage leads to overstock and understock which results in higher storage costs. Poorly organised goods

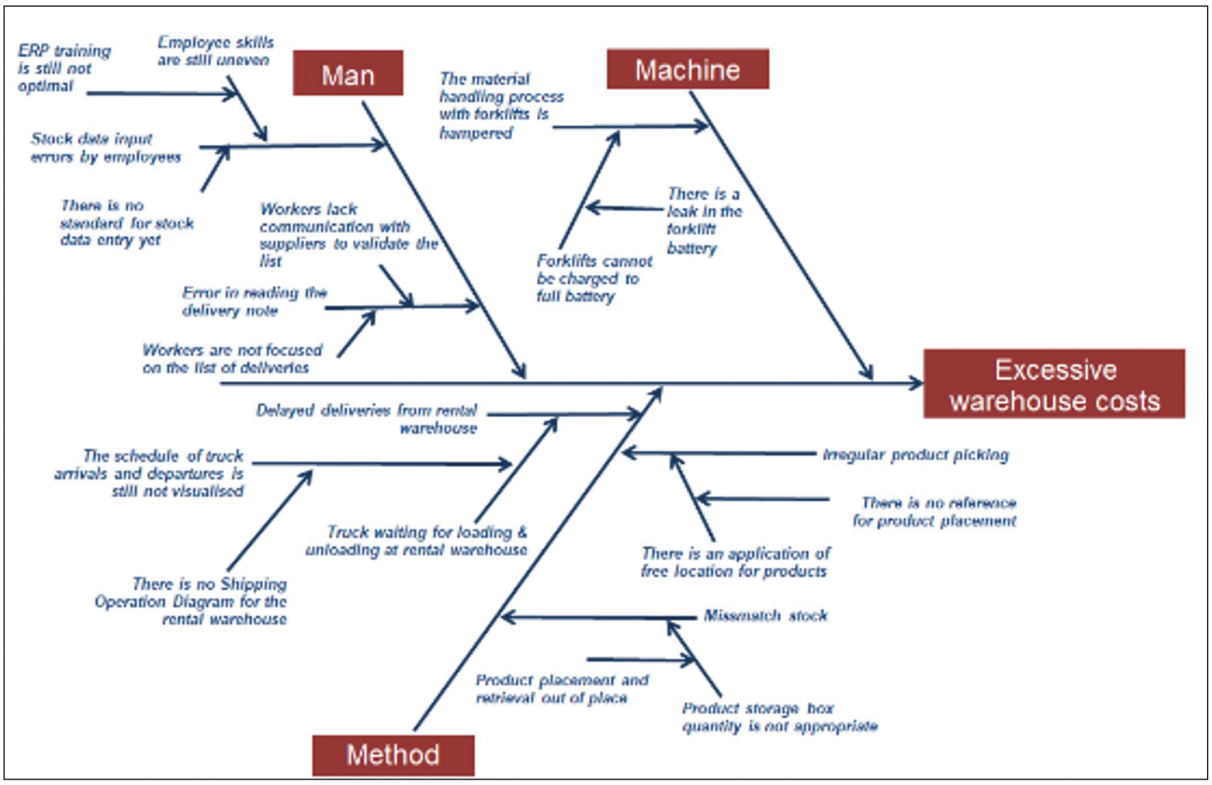

Figure 1 Fishbone Diagram of Excessive Warehouse Cost

also increase the risk of product damage due to improper handling.

Inaccurate Stock Recording in the ERP System

Errors in stock record data are the next factor that affects the increase in warehouse operating costs. Based on the data obtained from operational reports, it was found that there was a difference between physical stock and stock recorded in the ERP system. This was caused by: (a) Lack of control in the data input process, where warehouse workers do not have a standardised procedure to record incoming and outgoing goods. (b) A regular stock data validation system is absent; therefore, recording errors are often not detected until discrepancies occur in the inventory report and (c) The lack of warehouse workers training on how to use the ERP system causes inconsistencies in data recording.

This inaccuracy in stock recording has several negative impacts, such as delays in shipping goods due to stock that is not available according to records and increased costs due to errors in ordering goods that should still be available in the warehouse.

Material Handling Inefficiency

Another significant aspect of cost increases is the inefficiency of using work aids, such as forklifts and hand pallets. Based on observations, forklifts often experience downtime due to a lack of routine maintenance. This causes delays in moving goods, thus reducing the productivity of warehouse operations.

In addition, the absence of a standard system in utilizing work aids leads to suboptimal use of forklifts, with high waiting times between one process and another. This inefficiency increases operational costs as labor time becomes longer while the resulting output remains low.

Conclusion on Identification of Causes of Cost Increase

Based on the analysis above, it can be concluded that the increase in operational costs of the rental warehouse at HMG, Ltd. is caused by a combination of the irregularity of the storage system, errors in recording stock in ERP, and inefficiency in the use of material handling. These factors are interrelated, creating conditions that increase overall operational costs. Therefore, strategic measures were needed to address these issues, which will be discussed in the next section on implementing improvement solutions. A preliminary analysis using a fishbone diagram showed that the leading causes of cost increases in the rental warehouse stemmed from storage methods, inaccurate stock records, and material handling inefficiencies. These factors are further categorized to understand the root causes of the problems in HMG, Ltd.'s warehouse.

2. Analysis with Root Cause Analysis (RCA)

To understand more about the leading causes of the increase in rental warehouse operating costs at HMG, Ltd., an analysis was carried out using the Root Cause Analysis (RCA) method. RCA is a systematic approach that helps identify root causes using various analysis techniques, including the fishbone diagram (Figure 1) and the 5W+1H method (Table 1).

Analysis with the 5W+1H Method

The 5W+1H method is used to investigate the main causal factors of the problems identified through the fishbone diagram.

a. What: What happened?

Operational costs increased due to inefficient storage systems, inaccurate stock records, and high forklift downtime.

b. Why: Why did this happen?

The storage system has no fixed location, making it difficult for workers to find items.

ERP data input was not done with discipline due to the absence of standard procedures and lack of training.

Forklifts experience much downtime because maintenance only occurs when

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damage occurs (corrective maintenance), not periodically (preventive maintenance).

c. Where: Where did the problem occur?

The main problem occurred at HMG, Ltd's leased warehouse, which experienced inefficiencies in inventory management and operational equipment.

d. Who: Who is involved?

Warehouse operators, stock recording staff, warehouse management, and equipment maintenance team.

e. When: When did the problem occur?

The problem has been ongoing for the past few months with an increasing trend of rising operational costs.

f. How: How is the impact?

Lead time for picking increased, labour and holding costs increased due to excessive storage, and the risk of lost and damaged goods increased.

Key Findings of the RCA

Based on the RCA analysis, it is found that the main factors causing the increase in the rental warehouse's operating costs are the combination of storage system irregularities, stock recording errors, and material handling inefficiencies. These factors are interrelated and worsen the warehouse's operational conditions.

a. The irregularity of the storage system leads to longer search times for goods, increases labor costs, and slows down distribution.
b. Stock recording errors in ERP result in discrepancies between physical and system stock, which trigger the ordering of unnecessary items and increase holding costs.
c. High forklift downtime due to lack of preventive maintenance hampers the material handling process, causing operational delays and increased operational costs.

From the results of this RCA analysis, it can be concluded that to reduce warehouse operating costs, the company should implement improved storage systems, standardize stock records, and optimize the maintenance of material handling equipment. These solutions will be discussed further in the section on implementing improvement strategies. Using 5W+1H, the research identified that the absence of a fixedlocation storage system led to stock irregularities and difficulties in searching for goods. In addition, errors in ERP data input were the main trigger for the mismatch between physical and system stock.

3. Implementation of Improvements and the Effects

Based on the results of the RCA analysis, several improvement implementations were carried out to overcome the problems that caused the increase in rental warehouse operating costs at HMG, Ltd. (Table 2). This implementation focuses on three main aspects; improving the storage system, improving stock recording procedures, and optimizing material handling by recalculating the holding cost (Table 3).

Implementation of Fixed Location System

One of the main improvements implemented is a fixed location system for storing goods in the warehouse. It means each type of the item is given a predetermined fixed storage location so that the process of picking and storing goods becomes more structured. This implementation had a positive impact in several aspects:

a. The lead time for picking goods decreased by 30% because warehouse workers could easily find the storage location of goods without having to search manually.
b. Reduced risk of overstock and understock because the storage system is better organized to manage goods more optimally.
c. Increased labour efficiency, as time spent searching for goods can be minimized, allowing workers to focus on other, more productive tasks.

Table 1 5W+1H Analysis

Factor	What	Why	Where	Who	When	How
Method	Irregular product picking	There is no reference for product placement	Rental Warehouse 1	PPIC Team	July-August 2024	Creation of fixed location
	Delayed deliveries from rental warehouse	*There is no Shipping Operation Diagram for the rental warehouse*	Rental Warehouse 1 and 2	Head of Shipping & FG	July-September 2024	Creation of Shipping Operation Diagram (SOD) for the shipping process in the rental warehouse
	Missmatch stock	Product placement and retrieval out of place	Rental Warehouse 1 and 2	WIP and FG Leader	July-August 2024	Implementation of double checks and workers must write down the number of remaining parts when picking up parts in the box.
Man	Error in reading the delivery note	Workers lack communication with suppliers to validate the list	Rental Warehouse 1 and 2	Head of Shipping & FG	June-December 2024	Management will give directions and warnings to workers to take the initiative and maintain communication with suppliers.
		Workers are not focused on the list of deliveries	Rental Warehouse 1 and 2	Head of Shipping & FG	June-December 2024	Management will provide direction and warnings to workers in the area, to stay focused and not do things that should not be outside of work-related activities.
	Stock data input errors by employees	There is no standard for stock data entry yet	Rental Warehouse 1	PPIC Team	April-December 2024	Management will create a standard for inputting stock data.
		ERP training is still not optimal	Rental Warehouse 1	PPIC Team	April-December 2024	ERP training needs to be held again to equalise employee skills.
Machine	The material handling process with forklifts is hampered	There is a leak in the forklift battery	Rental Warehouse 1	PPIC Team	April-September 2024	Preventive maintenance on forklifts

Standardization of Stock Recording Procedures in ERP

The second step implemented is standardizing stock recording in the ERP system. Previously, recording errors often occurred due to non-standardized procedures and lack of supervision in data input. To overcome this problem, the following improvements are made: (a) Train warehouse workers on the use of the ERP system so that

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Table 2 Improvements Implemented Based on 5W+1H Analysis

No	Problems	Improvements
1.	Disorganized product takers	Making fixed location, the company has 2 (two) rental warehouses, namely rental warehouse 1 and rental warehouse 2. The company will create a fixed location in one of the warehouses, namely rental warehouse 2.
2.	Delay	Creating a shipping operation diagram so that the process in the delivery area can be visualized and prevent delays and loading/ unloading times that are too long.
3.	Disorganized product placement and retrieval.	Making a fixed location that has been determined by making a shelf address according to the customer.
4.	Quantity in the finished goods box is not correct	Making a standard with workers double checking the box before loading, and making a label to write how many products are left, if the worker takes the product.
5.	Workers lack communication with suppliers	Appeal to workers to conduct and maintain communication with suppliers and provide an appeal so that workers can take the initiative to ask for the arrival of goods.
6.	Workers are less focused on seeing the delivery list	Formation of a control team from management, to oversee the delivery list that is often missed.
7.	There is no data entry standard	Creating standards in inputting stock data in rental warehouses, so that the process of inputting stock data is carried out by 1-2 people only to minimize errors between actual data and ERP.
8.	Workers only fulfill their obligations	Creating assessment standards in the training carried out, to increase the ambition to learn new things in workers.
9.	Hinder the material handling process	Implementation of preventive maintenance on forklifts by doing it once a month.

they understand the importance of accurate stock recording. (b) Implementing a double-check system before data input to ensure that every outgoing or incoming item has been recorded correctly. and (c) Creation of periodic audit reports that allow management to check the conformity between physical stock and ERP records.

After implementing these improvements, stock recording accuracy increased by 35%, reducing stock mismatches and minimizing the need to reorder items that were still available.

Material Handling Optimization and Forklift Maintenance

Material handling inefficiency caused delays in the logistics process and increased operational costs. Therefore, the following improvements are made: (a) Implement preventive maintenance on forklifts to ensure work tools are always in optimal condition and reduce the risk of downtime. (b) Scheduling the rotation of work tools so that the use of forklifts is more evenly distributed and one equipment unit is not overloaded. (c) Creating a more efficient warehouse layout by considering a more optimized forklift movement path to move goods faster.

After this strategy was implemented, forklift downtime decreased by 40%, directly impacting warehouse operational efficiency and reducing labor costs.

Evaluation of the Impact of Implementation of Improvements

A comparison between pre- and post-implementation data was conducted to measure the effectiveness of the implemented improvements (Table 4-6). The evaluation results show a significant increase in warehouse operational efficiency: (a) Holding cost per unit decreased by 35.5%, from IDR 1,182 to IDR 762.63 (Table 4), (b) Stock recording accuracy improved by 35%, reducing stock

Table 3 Calculation of Holding Cost

Variable	Scenario 1 (Using 2 rental warehouses)		Scenario 2 (Using 1 rental warehouse)
Used Infrastructure	Warehouse 1	Warehouse 2	Warehouse 2
Warehouse Rent	IDR 40,000,000	IDR 36,000,000	IDR 36,000,000
Electricity (5% of rent)	IDR 2,000,000	IDR 1,800,000	IDR 1,800,000
Labor (16 workers)	IDR 52,192,630	IDR 31,315,578	IDR 73,069,682
Total Cost	IDR 94,192,630	IDR 69,115,578	IDR 110,869,682
Warehouse Capacity/Pcs	133,140	145,378	145,378
Holding Cost/Pcs	IDR 707	IDR 475	IDR 762.63

Note: This calculation is used as support for the selection of warehouses that will become fixed locations.

Table 4 Calculation of Cost-Benefit Analysis (CBA) Before and After Improvement

Aspect	Before Improvement	After Improvement	Reduced
Holding Cost	IDR 1,182 per unit	IDR 762.63 per unit	35.5%
Labour Cost	IDR 83,508,208	IDR 73,069,682	12.5%
Forklift Downtime	15 hours/month	9 hours/month	40%

mismatches between the ERP system and actual conditions (Table 5), and (c) Lead time for picking goods reduced by 30%, increasing labour productivity (Table 6).

Decreased forklift downtime by 40%, optimizing goods movement within the warehouse (Table 4).

From the results of this evaluation, the improvements have succeeded in significantly reducing the operational costs of the rental warehouse and increasing work efficiency. Continuous improvement should continue through regular monitoring and evaluation to ensure continuous efficiency improvement in the future. Several solutions have been implemented to address the issues identified: (a) Implement a fixed location to improve storage order and speed up picking. (b) Creation of a Shipping Operation Diagram (SOD) to optimize the flow of goods distribution. (c) Standardization of ERP data input with warehouse operator training. (d) Preventive maintenance of forklifts to improve material handling efficiency.

4. Evaluation of the Effectiveness of Improvements

Evaluation of the effectiveness of

Table 5 Comparison of Stock Recording Accuracy Before and After ERP Improvement Implementation

Condition	Stock Accuracy (%)
Before Improvement	65% - 70%
After Improvement	90% - 95%
Improvement	35% more accurate

Tabel 6. Comparison of Lead Time of Goods Picking Before and After Implementation

Condition	Lead Time (Minutes per Pickup)
Before Improvement	15 - 20 minutes
After Improvement	8 - 12 minutes
Decrease	30% faster

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improvements is carried out by comparing the conditions before and after the implementation of strategies in HMG, Ltd's rental warehouse. This evaluation uses several leading indicators: a decrease in operational costs, an increase in warehouse process efficiency, and an increase in stock recording accuracy. The results of this evaluation are important to ensure that the improvements made have a significant and sustainable impact.

Reduction in Operating Costs

One of the leading indicators of the improvement implementation success is the reduction in the rental warehouse's operational costs. The data shows that the holding cost per unit decreased by 35.5% after the improvement, from IDR 1,182 to IDR 762.63. This reduction is due to optimizing the storage system and reducing poorly organized goods, thus minimizing the needs for additional storage space.

In addition, labor costs have decreased due to increased efficiency in searching for and retrieving goods. With the fixed location system, workers can find items faster, reducing the amount of work time previously wasted in this process.

Improved Warehouse Process Efficiency

Efficiency in warehouse operations has improved significantly after implementing the improvement strategy. The lead time for picking goods was reduced by 30%, resulting in a shorter time needed to process orders. This increased warehouse service capacity, allowing the company to handle more orders without significantly increasing the workforce.

In addition, forklift downtime has decreased by 40%, thanks to implementing a preventive maintenance schedule that ensures work tools are in optimal condition. With more reliable equipment and higher forklift availability, warehouse operations are smoother and less hampered by technical issues.

Improved Stock Record Accuracy

One of the main causes of warehouse inefficiency was the mismatch between physical stock and records in the ERP system. After standardized stock recording procedures are implemented, the recording accuracy increased by 35%, reducing the number of data input errors that previously caused stock mismatches.

In addition, the implementation of a double-check system prior to data input and periodic audits of the stock records helped ensure that every item leaving and entering the warehouse is recorded correctly. With the increasing accuracy of inventory data, the company is able to avoid overstock and understock, which contributed to the previous increase in operating costs.

Conclusion on Evaluation of the Effectiveness of Improvements

Based on the evaluation results, it can be concluded that the implementation of the improvement strategy has successfully had a positive impact on the operational efficiency and cost reduction of HMG, Ltd.'s rental warehouse. Holding costs decreased, lead time for picking goods was reduced, forklift downtime was minimized, and the accuracy of stock recording was significantly improved.

This success shows that the approach used, a combination of Root Cause Analysis (RCA), Inventory Control, and Cost Analysis, has proven effective in overcoming the problems faced by the company. To ensure these improvements are sustainable, the company needs to regularly continue monitoring key indicators and make strategy adjustments based on evolving operational trends. After the implementation of the solution, an evaluation should be conducted by comparing the data before and after the implementation of the improvement: (a) Holding cost per unit decreased from IDR 1,182 to IDR 762.63. (b) ERP stock accuracy increased by 35%. (c) Lead time for picking goods reduced by 30%.

5. Comparison with Previous Studies

To evaluate the effectiveness of the

improvements implemented at HMG, Ltd, a comparison is made with previous studies that discuss strategies to improve warehouse efficiency and reduce operational costs. Previous studies show that methods such as Root Cause Analysis (RCA), Inventory Control, and Cost Analysis have been used in various industries to improve logistics management and optimize warehouse operations.

Effectiveness of RCA in Reducing Warehouse Inefficiencies

Several previous studies have shown that RCA is an effective method for identifying and addressing issues related to warehouse operational efficiency. For example, research conducted by (Andersen & Fagerhaug, 2006) found that applying RCA in warehouse management reduced operational costs by 25%, with increased efficiency in stock recording and reduced picking time.

Compared to the implementation results at HMG, Ltd, the operational cost reduction achieved was 35.5%, which is higher than the results of Andersen and Fagerhaug's research. This shows that the combination of RCA with other methods, such as fixed-location storage and preventive maintenance, has a more significant impact on improving warehouse efficiency.

Application of Inventory Control in Previous Studies

Another study conducted (Richards, 2021) shows that implementing Inventory Control through cycle counting and fixed location can increase the accuracy of stock records by 30% and reduce the risk of overstock and understock. The results obtained at HMG, Ltd show an increase in stock recording accuracy of 35%, slightly higher than Richards' research results. This shows that adding a double-check system procedure before data input and periodic audits can increase the effectiveness of Inventory Control in preventing stock recording errors.

The Effect of Cost Analysis on Reducing Operating Costs

Research by Widhianingsih and Wahyuni (Widhianingsih & Wahyuni, 2024) shows that applying Cost Analysis with the Cost-Benefit Analysis (CBA) method in warehouse operations can reduce holding costs by up to 20%, optimizing the storage system and managing material handling. At HMG, Ltd, the results of the strategy implementation showed that the holding cost per unit decreased by 35.5%, higher than the results of previous research. The main factors contributing to this achievement were the optimization of storage space usage and more efficient forklift utilization through preventive maintenance.

Conclusion in Comparison with Previous Studies

Compared with previous studies, the strategy implemented at HMG, Ltd produces better results in several key aspects, such as decreased operational costs, increased accuracy of stock records, and efficient use of work tools.

The results of this study revealed a 35.5% reduction in holding cost after implementing a fixed-location storage system, which surpasses the 30% reduction reported by (Richards, 2021). This suggests that in highly unstructured rental warehouse environments such as HMG, Ltd, the impact of structured storage systems is significantly amplified. Thus, our findings not only support Richards' conclusions on the benefits of inventory control but also extend them by highlighting the heightened effect in outsourced warehouse settings within the plastic manufacturing sector.

Furthermore, the 35% improvement in stock accuracy exceeds the 25% improvement reported by (Andersen & Fagerhaug, (2006), which was achieved using standard root cause interventions. This discrepancy may stem from our study's application of dual-layer auditing and ERP input validation, a combination not explicitly emphasized in earlier literature. These enhancements form a novel approach,

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strengthening stock data reliability and overall warehouse responsiveness.

These superior results are due to implementing a more comprehensive strategy combining RCA with Inventory Control, Cost Analysis, and an improved ERP-based stock recording system. Therefore, the method applied can be used as a reference for other industries that want to improve warehouse operational efficiency sustainably. Compared to previous studies using RCA in warehouse management, this study shows higher effectiveness in reducing operational costs and improving stock accuracy. Integrating inventory control and cost analysis methods provides an advantage in measuring the solution's financial impact.

This study presents a unique integration of Root Cause Analysis (RCA), ERP-based Inventory Control, and Cost-Benefit Analysis (CBA) within the context of outsourced rental warehouses in the plastic injection manufacturing sector. While previous research often examined these dimensions in isolation, this study demonstrates that combining them into a single, coherent improvement framework can deliver significantly better results. Specifically, the implementation of fixed-location storage, dual-audit ERP stock procedures, preventive forklift maintenance, and standardized data input has led to improved operational outcomes. This research also contributes by introducing a KPI-driven warehouse monitoring model suitable for small and mid-sized manufacturers seeking to reduce warehouse costs while improving logistical responsiveness.

6. Recommendations for Further Improvement

Based on the evaluation results of the implementation of the improvements that have been made, there are still opportunities to improve the operational efficiency of HMG, Ltd.'s rental warehouse further. The proposed recommendations include optimizing the stock management system, increasing the capacity of human resources, utilizing digital technology, and continuous monitoring and evaluation.

Optimizing the Stock Management System

One of the strategic steps that can be taken is the application of ABC analysis to classify goods based on their value and frequency of use. This system will prioritize category A items (high-value and frequently used items) in stock management. In contrast, category C items (low-value and rarely used items) can be stored more minimally to optimise storage space.

In addition, the implementation of the Just in Time (JIT) system can be an alternative in reducing holding costs by ensuring goods arrive on time based on the production needs or customer demand. Integrating this method with the fixed location system that has been implemented will further improve the efficiency of storing goods in the warehouse.

Increasing the Capacity of Human Resources

The success of a warehouse management system is also highly dependent on the competency of the workforce. Therefore, a regular training program is needed for warehouse operators regarding the use of the ERP system, stock recording procedures, and storage optimization strategies. As workers' understanding and skills improve, errors in recording can be minimized, and the efficiency of warehouse operations will increase.

In addition to technical training, companies can implement a performance-based incentive system, where workers with the best performance in stock recording and work efficiency are rewarded. This system can increase work motivation and encourage a more disciplined and efficiency-oriented work culture.

Utilization of Digital Technology

Along with the development of technology, implementing a Warehouse Management System (WMS) based on the Internet of Things (IoT) can be a solution to

improve the accuracy of stock records and speed up the process of finding goods. WMS allows for more automated system integration, such as barcode or RFID scanning, which can reduce manual data input errors.

In addition, using a real-time inventory tracking system will help management monitor stock movements more accurately. With this system, every item that enters and leaves the warehouse will be automatically recorded, thus reducing the possibility of mismatches between physical stock and ERP data.

Continuous Monitoring and Evaluation

For the improvements implemented to continue to provide optimal results, a regular monitoring and evaluation system is needed for the Key Performance Indicators (KPIs) that have been determined. Some indicators that need to be monitored regularly include: (a) Stock recording accuracy (minimum target of 98%) (b) Lead time for picking goods (target reduction of up to 40%) (c) Efficiency of storage space utilization and (d) Percentage of material handling equipment downtime

This periodic evaluation can take the form of a monthly warehouse operations audit and a quarterly review of improvement strategies. With a data-driven approach, companies can continuously adjust strategies to ensure that warehouse operations are always efficient.

Conclusion Recommendation

By optimizing the stock management system, increasing workforce competence, utilizing digital technology, and continuous monitoring, HMG, Ltd. can further improve the efficiency of its warehouse operations. The implementation of these recommendations will not only further reduce operational costs but also create a warehouse system that is more responsive, accurate, and ready to face the challenges of a modern supply chain. To ensure the sustainability of warehouse efficiency, the research recommends: (a) Application of ABC analysis for stock classification. (b) Periodic cycle counting to improve the accuracy of stock records, and (c) Continuous evaluation of warehouse performance through established KPIs.

With this approach, the company can ensure the long-term operational efficiency of the rental warehouse and reduce the risk of future cost increases.

D. Conclusion

Based on the research results, it can be concluded that the increase in operational costs of the rental warehouse at HMG, Ltd. is caused by several leading factors; irregularities in the storage system, errors in recording stock in the ERP system, and inefficiencies in material handling. Applying Root Cause Analysis (RCA) using the Fishbone Diagram and the 5W+1H method proved effective in identifying the root causes of the increased costs. From the analysis, - the leading solutions implemented include the implementation of fixed-location storage, standardizing stock recording in the ERP system, and optimizing work tools through preventive maintenance programs.

Implementing the improvement strategy has significantly improved warehouse operational efficiency. The evaluation results show that the holding cost per unit has decreased by 35.5%, the accuracy of stock records has increased by 35%, the lead time for picking goods has decreased by 30%, and forklift downtime has decreased by 40%. This success confirms that combining RCA, Inventory Control, and Cost Analysis methods can effectively reduce inefficiencies and operational costs in warehouse management.

To ensure the sustainability of improvements, the company needs to regularly monitor and evaluate the key performance indicators that have been set. In addition, it is recommended that the company continue developing warehouse management strategies by implementing digital technology, such as an IoT-based Warehouse Management System (WMS) to improve the efficiency of real-time stock recording. The company can maintain

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and improve its warehouse operational efficiency in the long run with a structured and data-driven approach.

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