

Optimization of Daily Warehouse Storage PT. XYZ with Shared Storage Method

Daily Warehouse
Storage

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ABSTRACT

PT XYZ is a company engaged in ship repair and maintenance services and port management services. The problems faced by PT XYZ in carrying out its business lines are related to the effective and efficient operational managerial activities of raw material warehousing. Problem solving steps are carried out by testing data processing and analysis using the shared storage method as a solution step related to the problem of warehousing layout and optimization. Problem solving with the shared storage method is a method of reconditioning the warehousing layout with the principle of First in First out or fast moving where the layout of goods is classified based on the order of the flow of goods movement according to the operational needs of PT XYZ activities. Based on the calculation results, if the company applies the proposed layout, there is an average distance savings of 4 m². The layout of the placement of raw materials based on the proposed improvements has a more organized condition and facilitates the flow of goods movement as well as inputting the flow of goods in and out which can be more efficient if the goods are organized and inputted administratively, this also affects the quality of goods.

Keywords: Warehouse, Shared Storage, First in First Out, Average Distance

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ABSTRAK

PT. XYZ adalah perusahaan yang bergerak di bidang jasa reparasi dan perawatan kapal serta jasa pengelolaan pelabuhan. Permasalahan yang dihadapi PT. XYZ dalam menjalani lini bisnisnya terkait dengan aktivitas manajerial operasional pergudangan bahan baku yang efektif dan efisien. Langkah penyelesaian masalah dilakukan dengan pengujian olah data dan analisa menggunakan metode shared storage sebagai langkah solutif terkait permasalahan tata letak dan optimalisasi pergudangan. Pemecahan permasalahan dengan metode shared storage merupakan metode pengkondisian ulang tata letak pergudangan dengan prinsip First in First out atau secara fast moving di mana tata letak barang diklasifikasikan berdasarkan urutan alur pergerakan barang sesuai kebutuhan operasional aktivitas PT. XYZ. Berdasarkan hasil perhitungan, jika perusahaan menerapkan tata letak usulan, terjadi penghematan jarak rata-rata sebesar 4m. Tata letak penempatan bahan baku berdasarkan usulan perbaikan memiliki kondisi yang lebih tertata rapi dan memudahkan arus pergerakan barang serta penginputan alur keluar masuk barang yang dapat lebih efisiensi jika barang tertata dan ter input secara administratif, hal ini pun berpengaruh terhadap kualitas barang.

Kata kunci: Gudang, Penyimpanan Bersama, Masuk Pertama Keluar Pertama, Jarak Rata-rata

INTRODUCTION

Warehouse management is an operational stage that has great involvement and influence on the sustainability of a company's productivity, where the warehouse has the main focus in maintaining the availability of storage of resources or goods related to the company's operational activities (Baruffaldi et al., 2019). Special activities and handling to maintain the stability of the value of resources or goods in the warehouse remain in a stable condition and do not experience a decrease or loss of value is a necessary stage in warehousing activities (Buzu, 2021). Underline Warehouse layout design involves arranging facilities to support the smooth production process, including machine placement, material movement, temporary and permanent storage, and personnel. Layout refers to the arrangement of a building in which people, materials, and machines work together to achieve certain goals (Kovács, 2020). Optimal warehouse layout is the key to achieving operational efficiency and minimizing costs (Naganawa et al., 2024). For example, the existence of a raw materials warehouse in a company will support the company's operational productivity in ensuring and handling the availability of components or materials used in the production process and supporting the continuity of company activities. Therefore, the warehousing system plays an important role in maintaining the productivity of a company. PT. XYZ is a company that operates in the field of ship repair and maintenance services as well as port management services. PT. XYZ has ship repair services, including ship repair and modification, installation and replacement of ship equipment, and ship engine repair. On the other hand, the company also provides port management services, including the provision of port infrastructure and facilities, as well as port maintenance and operation services (Notteboom et al., 2022).

Along with business growth, PT. XYZ experiences challenges in carrying out effective and efficient raw material warehousing operational activities. Based on the results of interviews with sources, Head of Daily Raw Material Warehousing (Assets & Logistics) PT. XYZ and the observations that have been made, it was found that the results of the background analysis of the warehouse were not in optimal conditions, which was characterized by the availability of inadequate infrastructure. Warehouse area conditions that are not optimal can be seen from the quantity of available resources where only one overhead crane is available. The condition of other infrastructure facilities cannot be used due to the absence of regular maintenance (Frangopol & Liu, 2019). Another thing that causes facility dysfunction is a change in managerial policy related to a fast-moving inventory system with the movement of goods moving within a period of two to three days as well as the implementation of the randomize storage

method which is not working well. This supports the decline in the productivity value of the warehousing area, which is reflected in the warehousing area that in procurement activities there is still a quantity of leftover goods in procurement each month (Wisner et al., 2021). As a result of the fast-moving inventory system which does not work well, it exceeds the flow of movement of goods which should move within two to three days, causing the quantity of leftover raw materials and the implementation of the randomize storage method where goods for operational repair needs are placed randomly and irregularly. Disruption of the goods inflow process and hampering the goods picking process due to the untidy and disorganized layout of goods in the warehouse. Raw materials for repair need and leftover goods that are not well organized and do not receive special handling can trigger a decrease in the value of the quality of goods (Chauhan et al., 2022). Irregular management results in excess costs which are allocated for maintenance needs of goods before they are put back into use (Bao et al., 2019).



Source: Author Documentation

Figure 1. Warehousing PT. XYZ

Previous empirical and theoretical research was conducted by Muhammad Zaenuri (2015), the results show that the role of warehouse layout has an influence in supporting warehouse performance. Optimizing warehouse operational activities by using shared storage methods to make it easier for the warehouse to pick up goods and a more optimal check-in system. In business model studies carried out in various types of industry, there is a research gap where the application of proposed improvements to the shared storage method for raw material warehouse layout is still limited (Baruffaldi et al., 2020). Therefore, this research tries to fill the research gap regarding proposed shared storage methods for raw material warehousing layouts in repair and shipping service companies. Based on the background of the problems that occurred at PT. XYZ's warehouse, this research tries to make improvements to the daily storage warehouse for raw materials (Assets and Logistics). The aim of this research is to optimize the daily warehouse storage of raw materials with a better layout determined based on a more controlled goods movement flow system, more attention to maintenance of warehousing facilities and infrastructure, as well as improved performance optimization to support warehouse performance productivity.

Previous research has shown various benefits from implementing shared storage methods in warehouse management. A study conducted by Ma'ruf Al Afif & Prehanto (2021), shows that combining each product into one part based on its activity can increase storage efficiency. According to Prasetyo et al. (2021), found that implementing shared storage methods can reduce floor area requirements by optimizing the use of storage shelves. They managed to increase the rack capacity from 4 to 6 slots, which significantly reduced space requirements. Apart from that, research by Fitri & Putri (2021), emphasizes the importance of arranging storage areas based on the condition of the warehouse floor area. They suggest placing the most frequently used items in easy-to-reach locations to increase operational efficiency. This research shows that by

rearranging the warehouse based on the frequency of use of goods, a better and more efficient layout can be achieved.

Shared storage methods can result in a more efficient and organized warehouse layout. This method not only helps in reducing floor area requirements, but also increases operational efficiency by placing items based on their characteristics and frequency of use. However, implementing this method requires careful mapping of storage space based on the characteristics of goods and business fields. Thus, the shared storage method is an effective solution in managing warehouse space. This can reduce floor area requirements and increase warehouse operational efficiency. However, the application of this method must take into account the characteristics of the goods and the specific needs of each business sector to achieve optimal results. These studies provide a strong basis for continuing to develop and optimize storage methods in warehouses.

METHOD

This research uses qualitative methods to explain the problem-solving process systematically. This method was chosen because it provides a clear and systematic solution (Flemming et al., 2019; Alam, 2021). This approach makes it easier to track data in the company, so that information and analysis results can be presented in an informative and factual manner (Piotrowski et al., 2019; Honovich et al., 2021). The method used is shared storage because it saves storage space by dividing by product category (Ivanov, 2021; Miyachi & Mackey, 2021). This method is also easy to implement and is a combination of random and special storage that takes advantage of differences in storage time on certain pallets in the warehouse (Khan et al., 2019). To get accurate data at PT. XYZ, various data processing methods were used, namely observation, interviews and literature studies. The observation method is effective for observing and monitoring target objects directly (Høye et al., 2021). In addition, it can be used to observe the storage of goods, such as the arrangement on shelves and the storage system used (Bevilacqua et al., 2019). These observations provide valuable information about shipping patterns and carrier needs. The interview method is carried out by asking questions directly to the source, both structured and unstructured (Low, 2019). In addition, literature methods are used to collect, analyze, and present data from library sources such as books, articles, and journals (Connaway & Radford, 2021). This approach is used to review previous research. After the data is collected, the problem is solved by determining the average number of goods leaving and entering the warehouse per month. The storage space is arranged to accommodate all materials properly, determining space allowances and product placement based on the level of importance and intensity of activity in the area (Tien et al., 2019). The straight distance is used to determine the area closer to the door.

RESULT

The available data outlines the receipt and release of goods in PT XYZ's daily warehouse during the period from January to March 2024. In January, the receipt of goods reached 65,373.99 units, while the release amounted to 24,234.28 units. This indicates a significant increase in stock since the number of goods received was much higher than the number of goods released. In February, the receipt of goods was very high, at 126,934.74 units. However, the release of goods this month far exceeded the receipts, with a total of 609,298.89 units released. This resulted in a significant stock reduction, indicating that the demand or distribution of goods was very high during this period. In March, the receipt of goods was 69,973.48 units, and the release was 55,052.60 units. The number of receipts was slightly higher than the releases, showing a stock increase, although not as significant as the reduction that occurred in February.

Over the three-month period, PT XYZ received a total of 262,282.21 units of goods and released 688,584.77 units of goods. The average monthly receipt was 87,427.40 units, while the average monthly release reached 229,527.92 units. This data shows that

the release of goods consistently exceeded the receipt of goods each month. To determine the maximum storage capacity needed, PT XYZ must consider the peak in goods receipt that occurred in February and ensure there is sufficient storage space to accommodate the fluctuations in the volume of goods coming in and going out. This preparation is crucial to maintaining efficient warehouse operations and avoiding a shortage of space when the volume of goods increases.

Table 1. Revenue and Expenditure Data January – March 2024

Month	Unit In	Unit Out
January	65.373,99	24.234,28
February	126.934,74	609.298,89
March	69.973,48	55.052,60
Total	262.282,21	688.584,77
Average	87.427,40	229.527,92

Source: PT.XYZ

The data in Table 2 illustrates the average and activity of receiving and releasing goods during the period January to March 2024 at PT. XYZ. In January, PT. XYZ had a remaining stock of 846,694.13 units after carrying out the activities of receiving and releasing goods. This indicates that before the start of activities in January, there was a considerable amount of stock available in the warehouse. February saw a significant decrease in remaining stock, dropping to 364,330.97 units. This reflects the high activity of releasing goods during that month, which exceeded the quantity of goods received. In March, the remaining stock slightly increased to 367,242.85 units. Despite continued releasing of goods, this increase suggests that the activity of receiving goods was able to partially balance out the releasing. In total, PT. XYZ had a remaining stock of 1,578,267.95 units during the three-month period. The monthly average remaining stock was 122,242.85 units. This data indicates that despite fluctuations in the activity of receiving and releasing goods, the company was able to maintain a relatively stable level of stock in the warehouse.

Table 2. Average and activity of Receipt and Disbursement of Goods

Month	Leftover
January	846.694,13
February	364.330,97
March	367.242,85
Total	1.578267,95
Average	122.242,85

Source: PT.XYZ

In carrying out goods receiving and releasing activities, PT. XYZ carries out these activities based on customer messages, this causes these activities to not run consistently every month. Based on the data from the calculation of the quantity of goods received and released as well as the calculation of the average quantity of goods in the first quarter of 2024, it becomes reference data in determining the warehouse area to accommodate the quantity of raw materials intended for PT. XYZ's operational activities.

$$\text{Space requirements} = \text{Lead time of goods} \times \text{average inventory}$$

$$\text{Space requirements} = 3 \text{ days} \times 122,242.85$$

$$\text{Space requirements} = 366,728.55$$

Based on the data from the calculation of the quantity of goods received and released as well as the calculation of the average quantity of goods in the first quarter of 2024, it becomes reference data in determining the warehouse area to accommodate the quantity of raw materials intended for PT. XYZ's operational activities.

$$\begin{aligned}\text{Diagonal} &= \sqrt{(\text{length})^2 + (\text{width})^2} \\ \text{Diagonal} &= \sqrt{(34,1)^2 + (14,5)^2} \\ \text{Diagonal} &= 37.054,82\end{aligned}$$

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Based on data from the product allowance calculation results used with the tool used in the form of an overhead crane which was used to determine the length of the aisle, it was 37.05 m². Based on the data from the calculation of the quantity of goods received and released as well as the calculation of the average quantity of goods in the first quarter of 2024, it becomes reference data in determining the warehouse area to accommodate the quantity of raw materials intended for PT. XYZ's operational activities.

$$\begin{aligned}\text{Formula : } T &= \frac{\text{average incoming goods}}{\text{number of packages in 1 pallet}} + \frac{\text{average outgoing goods}}{\text{number of packages in 1 pallet}} \\ &= \frac{87,4}{53,2} + \frac{229,5}{53,2} \\ &= \frac{31,7}{532} \\ &= 5.934\end{aligned}$$

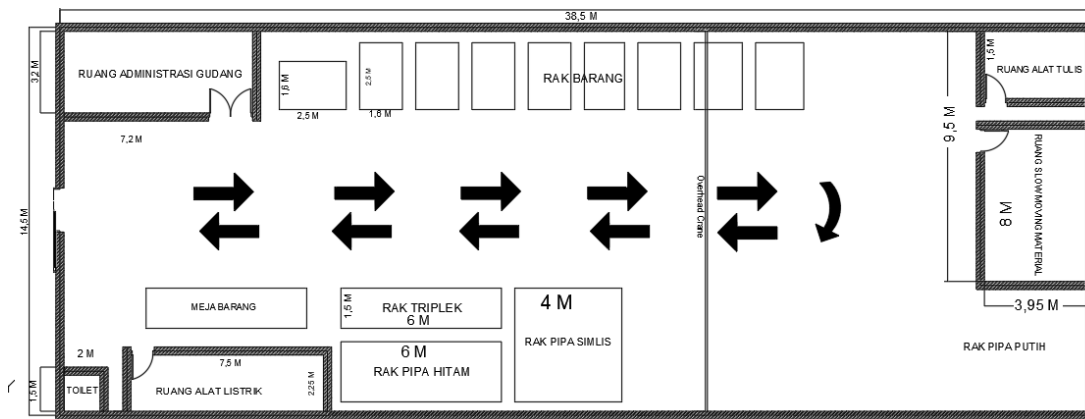
Based on the data from the calculation results, the Throughput and Space Requirement values become the basis for the reference values for calculating priority space placement for appropriate area material placement.

$$\begin{aligned}\text{Assignment} &= \frac{T}{S} \\ &= \frac{5.934}{366.728,55} = 0.0162\end{aligned}$$

The placement of zones is based on which type of product has the most frequency of going in and out near the door. The distance traveled from the material handling to the storage area is calculated using Rectilinear Distance. The distance is measured along the path using a perpendicular line from the storage area with the formula:

$$\begin{aligned}\text{Rectilinear distance} &= |Ax - Px| + |Ay - Py| \\ &= |7 - 10| + |9 - 8| \\ &= |3| + |1| \\ &= 4 \text{ meter}\end{aligned}$$

Based on the data from the calculation of the quantity of goods received-output as well as the calculation of the average quantity of goods in the first quarter of 2024, it becomes reference data in determining the warehouse area to accommodate the quantity of raw materials intended for PT. XYZ's operational activities.



Source: PT. XYZ

Figure 2. Proposed Layout

Based on the findings and focus of problems that have been identified in the process of observing activities at PT. XYZ, increasing the productivity of warehouse area performance is a top priority. The existing warehouse area currently faces significant challenges related to limited and inadequate spatial layout. Apart from that, the implementation and regular control of occupational safety and health in warehouses also needs special attention. To overcome these problems, solutions are needed that include systematic and sustainable steps. The first step that must be taken is to optimize and improve the layout of goods storage at PT. XYZ, especially in the XYZ Daily Warehouse warehousing area (Assets and Logistics). This optimization begins with a thorough evaluation of the available space in the warehouse. This evaluation includes physical measurements of space, identification of areas that are unused or less efficient in use, as well as mapping existing work flows.

After the space evaluation has been carried out, the next step is to analyze the volume and types of goods stored in the warehouse. This analysis aims to understand the characteristics of goods, such as size, weight, and special properties that influence how they are stored and handled. Apart from that, analysis of the frequency of access to each type of goods also needs to be carried out. Frequently accessed items should be placed in areas that are easy to reach, while items that are rarely accessed can be placed in areas that are more difficult to reach. Based on the results of the evaluation and analysis, the next step is to implement an efficient and structured storage system. One approach that can be used is to rearrange the layout of goods storage using the zoning method. In this method, the warehouse space is divided into several zones based on the characteristics and frequency of access to goods. Items with similar characteristics and frequency of access are placed in the same zone. In this way, the process of picking up goods becomes faster and more efficient.

In addition, the use of height-adjustable shelves and vertical storage systems can also help optimize the use of available space. Height-adjustable shelves allow storage space to be adjusted according to the needs of the items being stored, while vertical storage systems make it possible to utilize upward space that is often overlooked. The next step is to implement strict occupational safety and health procedures in the warehouse area. This includes regular training for employees on safe work practices, appropriate use of Personal Protective Equipment (PPE), as well as regular inspections to ensure all equipment and facilities are in safe and good condition. In this way, the risk of work accidents can be minimized and a safe work environment can be created. All these steps must be carried out systematically and continuously. This means that there needs to be regular monitoring and evaluation to assess the effectiveness of each step that has been taken. If problems or areas are found that can still be improved, adjustments and improvements need to be made. With this approach, PT. XYZ can ensure that the productivity of the warehouse area continues to increase along with the creation of a safe and efficient work environment.

CONCLUSION

Based on the results of analysis and testing of data processing related to the proposed improvement in the layout of PT. XYZ's raw material warehouse, significant conclusions were obtained. This research uses the shared storage method to evaluate and improve the efficiency of warehouse layout. The analysis results show that the proposed layout has smaller distances compared to the previous warehouse layout. This smaller distance means that employee movements in carrying out daily operational activities will be more efficient. Specifically, the total distance covered with the proposed layout is 4 m². This represents a significant reduction in the daily distance traveled by raw material warehouse employees. This reduction in distance is expected to increase operational efficiency, reduce time spent on movement, and allow employees to focus on other, more productive tasks. The total need for storage space in the warehouse is 366,7822 units, with a product placement flow of 0.016 in one storage shelf area. This storage shelf is divided into partitions or dividing boundaries that are adjusted to the type, classification and functional needs of the goods. This partition helps in organizing and grouping items, making it easier to retrieve and store items. The analysis and data processing carried out showed positive results, which can be said to be an effective solution to the warehouse layout problems faced. It is hoped that the implementation of the proposed layout will make it easier for employees and workers to carry out operational activities in the warehouse. This efficiency is not only related to the movement of goods but also includes the check-in process and administrative inventory of goods.

Efficiency in warehouse layout is very important because it has a direct impact on productivity and operational performance. With an optimal layout, the flow of goods movement becomes smoother, reduces congestion, and allows faster access to needed goods. In addition, good layout also reduces the risk of errors in picking and placing items, which in turn can increase inventory accuracy. This increase in efficiency is also expected to have a positive impact on operational costs. With shorter travel distances and more organized processes, labor and time usage can be optimized. This means that companies can reduce costs related to labor, use of internal means of transportation, and inventory management. In the long term, this layout improvement can also support company growth. With a more efficient storage system, companies can handle larger volumes of goods without the need for physical warehouse expansion. This allows companies to respond to increasing market demand without experiencing operational bottlenecks. Based on the results of data processing analysis and testing, the proposed layout using the shared storage method is proven to be more efficient compared to the previous layout in PT XYZ's raw materials warehouse. Reducing travel distances and improving product placement flows has a positive impact on operational efficiency and effectiveness. By implementing this layout, it is hoped that employees can work more productively, operational costs can be reduced, and the company can develop better.

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