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Priority Management of Fiber Suitcase Spare Part Warehouse Using 5S Method and Analytical Hierarchy Process (AHP)

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ABSTRACT

This research discusses the warehouse management of fiber luggage spare parts at PT Artlyn Kreasi Mandiri using the 5S method and Analytical Hierarchy Process (AHP). The problem that occurs is the messy arrangement of spare parts in the warehouse which results in losses due to damage to spare parts and makes it difficult for employees to do their jobs. Effective warehouse management is considered crucial in improving the efficiency and effectiveness of company operations. In this context, the 5S method is used to understand the qualitative aspects of warehouse management, while the AHP method is used for decision-making. The results on 5S indicate the need for improvement of warehouse working environment conditions to reduce spare part damage and increase operational efficiency. In addition, the application of the 5S concept in the warehouse is expected to improve the efficiency and effectiveness of spare parts warehouse management. The AHP calculation results provide weights for each criterion and alternative that support decision making. From the AHP calculation results, it can be concluded that moving to a new warehouse has a higher global weight (0.749) compared to optimizing the existing warehouse (0.251), so moving to a new warehouse is considered a more optimal warehousing strategy for the company

1. INTRODUCTION

Effective and efficient warehouse management is essential for companies to improve operations and minimize costs. This is especially true for PT Artlyn Kreasi Mandiri, which has just started producing fiber suitcases at its Parigi factory. Currently, the untidy arrangement of fiber suitcase spare parts and lack of maintenance causes damage and disrupts operations.

The problem of untidy warehouse arrangement and lack of attention to spare part maintenance triggers damage and losses. This study aims to optimize the management of PT Artlyn Kreasi Mandiri's fiber suitcase spare part warehouse with two approaches: 5S (Seiri, Seiton, Seiso, Seiketsu, Shitsuke) and Analytical Hierarchy Process (AHP). 5S will be applied to create a clean, tidy, healthy, safe, and comfortable work environment, while AHP will be used to determine the most prioritized alternative warehouse arrangement strategies.

The 5S method was chosen because it has proven to be effective in increasing efficiency and productivity in various industries. The AHP method was chosen because of its ability to consider various criteria and choose the best solution. This proposed strategy is expected to increase the efficiency and effectiveness of warehousing operations, as well as prevent the recurrence of spare part damage problems in the future.

2. LITERATURE REVIEW

Several previous studies have revealed the benefits of implementing the 5S and AHP methodologies in a corporate context. One of them is a study conducted by (Mardatillah et al. 2023), entitled Implementation of 5S and AHP to Reduce Defects in Pallets at PT Petrowidada. This study is related to the production process and quality of wooden pallets. The results of the study showed that the use of the 5S and AHP methods succeeded in reducing defects in wooden pallets, which had implications for improving product quality and production process efficiency.

The relevance to other studies is with the research written by (Dwi Febryanto et al. 2023) which focuses on the selection of online shop warehouse locations. The study shows that the AHP method is able to produce criteria weight values and alternative work that can be used to determine the best online shop warehouse location. The results of this study can help online shop companies in choosing the optimal warehouse location, so that they can increase logistics efficiency and increase customer satisfaction.

Furthermore, research (Qowim et al., 2020) on the implementation of 5S entitled "Implementation of 5S in the Warehouse Division" which focuses on the implementation of 5S in the spare part warehouse of PT Industri Sejati. This study applies 5S comprehensively in the spare part warehouse of PT Industri Sejati. The results show that the implementation of 5S in the spare part warehouse of PT Industri Sejati is able to increase the efficiency and effectiveness of warehouse management, such as reducing the time to search for spare parts, increasing the availability of spare parts, and reducing damage to spare parts.

In addition, research conducted by (Marnova & Tung, 2023) on the analysis of hazardous and toxic materials (B3) warehouse layout using the 5S method (Seiri, Seiton, Seiso, Seiketsu, and Shitsuke). shows that the 5S method can be used to improve the layout of B3 warehouses. The implementation of this research recommendation is expected to bring many benefits to the company.

Furthermore, in the study (Asmarani, 2015) entitled Selection of Raw Material Suppliers for PT. XYZ Production Using the Analytic Hierarchy Process (AHP) Method, this study shows that the AHP method can be used to select the best raw material supplier for PT. XYZ production. The application of the AHP method is expected to help PT. XYZ to get quality, reliable, and efficient suppliers.

This study uses the 5S method, which has been proven effective in various industries, used to create an orderly, safe and healthy work environment. This approach also forms a corporate culture that emphasizes the importance of neatness and cleanliness, as well as standards for handling and storing spare parts. The AHP method is used to assess and prioritize the most significant alternative warehousing strategies based on actual conditions. This study focuses on more specific management aspects, and is expected to have a broader impact, namely improving operational performance and minimizing damage or loss of spare parts.

3. RESEARCH METHODS

This study utilizes interpretive information through interviews with related parties and photo documents to apply the 5S and Analytical Hierarchy Process (AHP) methods. The 5S method in this study is to understand the qualitative aspects of warehouse management in more detail, and the photos serve as a tool to provide a deeper and contextual picture of conditions in the field. In addition, the AHP method approach in this study aims to assist in decision making in warehousing strategies.

5S (*Seiri, Seiron, Seiso, Seiketsu, Shitsuke*)

According to (Qowim et al, 2020), the implementation of the 5S method is carried out with the following steps:

a. *Seiri*(Concise): The first step, get rid of useless items, so that the workplace becomes more spacious and efficient.

b. *Seiton*(Neat): The second step, put items in their place, so they are not easily lost or damaged.

c. *Sunday*(Clean): The third step, cleaning the workplace, so that a comfortable and healthy working atmosphere is created.

d. *The Seiketsu*(Maintenance): The fourth step, maintain a neat, tidy and clean condition, so that it becomes a habit and work culture.

   Shitsuke(Diligent): The fifth step is to train yourself to always maintain the cleanliness and tidiness of the workplace, so that it becomes a shared responsibility.

Application of Analytical Hierarchy Process (AHP) Method

The following are the steps in implementing AHP. Basically, the procedures or steps in the AHP method include (Rahmansyah & Lusinia, (2016)):

1. Identify the problem and determine the desired solution, then compile a hierarchy of existing problems. Writing this hierarchy begins by establishing the main objectives of the system at the top level.
2. Determining element priorities
   a. The first step in determining element priorities is to make pairwise comparisons, that is, comparing elements with each other based on predetermined criteria.
   b. The pairwise comparison matrix is filled with numbers that represent the relative importance of one element to another.
3. Synthesis

   The considerations from these pairwise comparisons are synthesized to obtain overall priorities. The steps taken in this stage are:
   a. Adds the values from each column in the matrix.
   b. Divide each value of a column by the total of the corresponding column to obtain the normalization of the matrix.
   c. Add up the values from each row and divide by the number of elements to get the average value.
4. Measuring Consistency

   In making decisions, it is important to know the level of consistency because we do not want to make decisions based on inconsistent considerations. The steps taken in this stage are:
   a. Multiply each value in the first column by the relative priority of the first element, the value in the second column by the relative priority of the second element, and so on,
   b. Add up each row.
   c. The result of the row sum is divided by the corresponding relative priority element.
   d. Adding the quotient to the number of elements present, the result is called the consistency index.
5. Calculate the Consistency Index CI using the formula:

   $Ci = (\lambda_{maks} - n)/\ (n-1)$

   Where n = number of elements
6. Calculate the Consistency Ratio (CR) using the formula:

   $CR = CI/IR$

   Where:

   CR = Consistency Ratio

   CI = Consistency Index

   IR = Random Consistency Index
7. Checking hierarchy consistency

   If the value is more than 10%, then the judgment data assessment must be improved. However, if the consistency ratio (CI/IR) is less than or equal to 0.1, then the calculation result can be stated as correct.

4. RESULTS AND DISCUSSION

5S Results

The following are the results before and the proposed improvements in the warehouse. For more details in the Table 1.

Table 1. 5S Improvement Proposal

Method	Recent Introduction	Suggested Improvements
Seiri	*Spare parts*those used are not separated from spare parts that are not used	Massive cleaning and implementing red tagging
	Unused items are placed under the table	Handling damaged/rejected spare parts and disposing of unnecessary ones
Seiton	Poor lighting	Adding lights to the warehouse
	Very hot temperature	Adding aluminum foil to asbestos
	The width of the goods movement lane is narrow	Provision of road barriers on storage blocks
	*spare part*t is placed randomly	Grouping based on daily frequency of use using the ABC Classification method and rearranging spare parts
	*Spare parts*piled up outside the warehouse	
	*Material handling*not put in its place	Create a special spot to place material handling
Sunday	There is no cleaning schedule	Create clear cleanliness standards for each work area and ensure that cleaning tasks are carried out according to the standards.
	Trash is scattered on the work floor	
	All items are dusty and unclean	
	Limited availability of cleaning equipment	These cleaning tools should include brooms, mops, rags, and cleaning soap and these tools should be stored in an easily accessible place and in good condition.
	Damaged goods are not thrown away and left to pile up	Make repairs or dispose of damaged items regularly and create a special place to store damaged items.
The Seiketsu	The dividing line between spare parts is uneven	Creating a boundary line
	There are no clear instructions on where the product is stored.	Create a warehouse plan
	There is no cleanliness slogan	Place cleanliness slogans in strategic places that are easy for everyone to see
	Does not have a Standard Operating Procedure for picking up goods	Establish clear policies and operational standards for picking and receiving goods.
	Does not have a Standard Operating Procedure for receiving goods	
Shitsuke	Operators do not understand 5S culture	Conduct 5S training for company employees and make 5S activities a work culture and give awards to employees who carry it out well.
	Warehouse operator not wearing gloves	Provide gloves in easily accessible and organized locations throughout the warehouse.

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Determining the Hierarchy

The criteria used in this study are the results of the development of research conducted by (Dwi Febryanto et al., 2023) and supported by discussions and interviews with parties related to the warehouse. The resulting criteria include Cost, Facilities, Geographical Position, and Warehouse Area. The alternatives obtained are Moving the warehouse and Optimizing the existing warehouse.

The distribution of the Analytical Hierarchy Process (AHP) questionnaire was carried out to three respondents, namely the warehouse head and 2 warehouse staff. With the aim of collecting data on their preferences in choosing a warehouse location that is suitable for occupancy. The decision hierarchy can be seen in the image below.

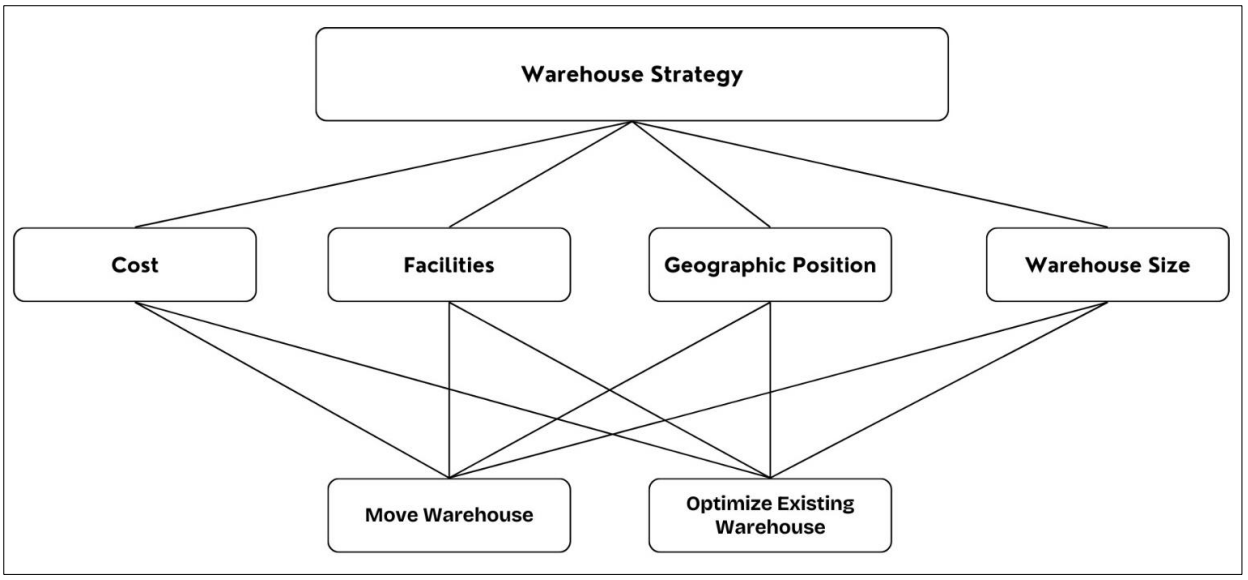

Figure 1. Decision Hierarchy

AHP Results

The calculation process of the Analytical Hierarchy Process (AHP) method includes steps to determine the weight of each criterion and alternative. After combining the questionnaire results from the respondents using the geometric mean, the following is the final weight calculation result. This result shows the criteria weight and global weight that have been integrated from the collected questionnaire data.

Table 2. Weighting Calculation Results

Level 0 (Goal)	Level 1 (Criteria)	Weight	Alternative	Weight	Global Weight
Warehousing Strategy	Price	0.077	New warehouse	0.383	0.029
			Optimize existing warehouse	0.617	0.047
	Facility	0.166	New warehouse	0.631	0.105
			Optimize existing warehouse	0.369	0.061
	Geographical Position	0.239	New warehouse	0.766	0.183
			Optimize existing warehouse	0.234	0.056
	Warehouse Area	0.518	New warehouse	0.833	0.432
			Optimize existing warehouse	0.167	0.086

The table above shows the results of AHP (Analytical Hierarchy Process) calculations to determine the optimal warehousing strategy for PT Artlyn Kreasi Mandiri.

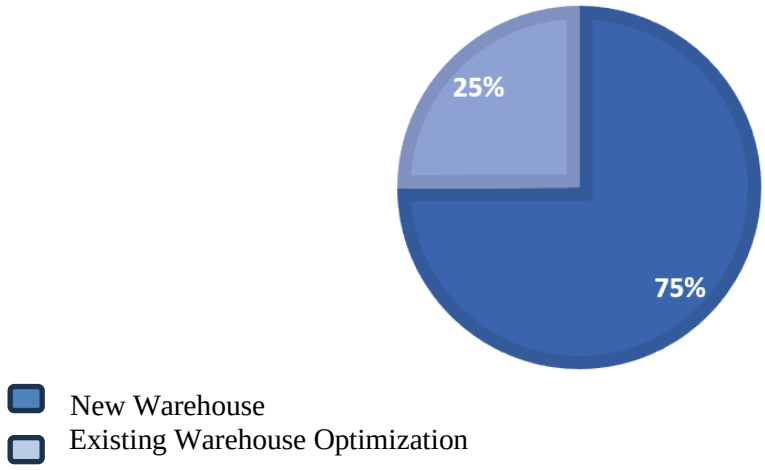

Figure 2. Global Weighting Results

Global weight shows the final value of each alternative warehousing strategy. This value is obtained by calculating the multiplication of the criteria weight and the alternative weight. In this table, the global weight for moving to a new warehouse is higher than the global weight for optimizing the existing warehouse, which is 0.749 compared to 0.251. This shows that moving to a new warehouse is a more optimal warehousing strategy for PT Artlyn Kreasi Mandiri.

5. CONCLUSION

Based on the research that has been conducted, the following conclusions can be drawn:

1. The results of the study using the 5S method showed that the warehouse work environment conditions needed to be improved. Improvement steps included major cleaning, disposal of unnecessary goods, handling*spare parts*damaged, and*red tagging*. In addition, storage stratification, item naming standards, and calculations are carried out.*ABC Classification*for storage based on frequency of use. The proposed 5S is expected to improve the efficiency and effectiveness of warehouse management, creating a more orderly and efficient working environment.
2. Based on the results of the AHP calculation, it states that the main criteria that are prioritized are cost criteria (0.077), followed by facility criteria (0.166), geographical position criteria (0.239), and warehouse area criteria (0.518). The first priority ranking of warehousing strategy is a new warehouse with a weight value of (0.749), in second place is optimizing the existing warehouse with a weight value of (0.251).

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