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Analysis of Bottle Warehouse Facility Layout Design Using the System Layout Planning Method (SLP) Using Software Craft In PT.XYZ

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Abstract. Increasingly advanced industry and increasingly fierce business competition encourage companies to improve employee work output and supporting facilities, including warehouses. PT. XYZ, a bottled water manufacturing company, is facing inefficiencies in its bottle warehouse. The initial layout was not optimal, with less than optimal space utilization and high moving costs. This causes obstruction to the smooth flow of materials and products, as well as reduced productivity. This research aims to redesign the layout of PT's bottle warehouse facilities. Atlantic Biruraya uses the Systematic Layout Planning (SLP) method to maximize productivity. The SLP method was used to redesign the layout of the bottle warehouse by considering factors such as material flow, space requirements and efficiency. Data was collected through observation, interviews and literature study. Data were analyzed using SLP software. The research results show that the new layout can increase productivity by reducing total costs by IDR 90.439. With the results of the proposed layout that has been created using craft software, the company can maximize productivity because the costs and distances required have been optimized using the Layout Planning System method using craft software.

Keywords: Facility layout, Craft, Systematic Layout Planning (SLP), Productivity,

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1. Introduction

Layout is a design problem but location problem is an optimization problem. A design problem is a problem for which there is no well-defined optimal solution. A solution is optimal if every other possible solution to the problem is worse or as good in terms of the selected criteria. The location problem should be treated as a design problem as it has several characteristics of a design problem. For facility layout problems, we look for the best layout solutions, and also, for facility location problems, we look for the best facility locations. although location problems can be formulated more precisely than layout problems, location problems should not be characterized as optimization problems (15). The layout will also have an impact on the company's competitiveness because planning is done in the most efficient way. layout, the production process can be more efficient with good facilities and workforce. This makes

the company superior in terms of quality and quantity of products produced. Therefore, to achieve company goals, good operational implementation techniques are needed, which regulate the production of goods in certain quantities, quality, prices, time, costs and locations according to customer needs (1). From the above phenomenon, it can be concluded that the optimal layout of production facilities or the location where production takes place is a good layout for implementing production (18). The definition of a warehouse itself is a place to store materials needed in the product manufacturing process, these materials will continue to be in storage until they are ready to be processed at the specified time of order or customer order (12). Activities that are usually carried out are related to storing materials in the warehouse, namely Receiving, Initial Packing, Putting away, 24 Hour Storage, Order Picking, Packaging, Sorting, Accumulation, Packing and Delivery. Research was conducted to overcome problems at PT. Atlantic Biruraya is a company engaged in manufacturing. PT. Atlantic Biruraya produces AMDK products, as a manufacturing company PT. XYZ, the bottle warehouse layout must be well designed for bottle storage so that activities can be carried out more easily. but the reality on the ground is very different from what was expected. There are several problems and obstacles with the layout of PT's bottle warehouse. Atlantic Biruraya today.

According to (20) selecting and placing alternative layouts is a critical step in the production facility planning process. saving space usage, increasing satisfaction, and increasing work safety (1hu). Setting up independent work stations effectively and using optimum floor area and matching material flow patterns can facilitate the total product processing process (4). (7) according to Raw material and component warehouses, is a place to store main raw materials and supporting raw materials. The Activity Relationship Chart (ARC) functions to display the relationship between work stations in a production in working on products (6). ARC (Activity Relationship Chart) determines the relationship between testing machines/facilities by discussing and interviewing test operators (9).Activity Relationship Diagram (ARD) is a diagram of the relationship between activities (departments/machines) (14) ARD can help in understanding and analyzing the relationships between activities in the system, identifying possible conflicts (8). Activity relationship diagrams are diagrams created based on the relationships between activities from activity relationship charts (5). When compiling the ARD, the possibility of errors is very large because we start from the assumption that all departments are close to each other (19).

Systematic layout planning (SLP) and Blocplan are methods for redesigning the layout of production facilities (17). According to (3), Systematic Layout Planning (SLP) is the stages of the layout design process developed by Richard Muther. Systematic Layout Planning (SLP) was created to solve problems involving various kinds of problems including production, other office activities (11). Systematic Layout Planning (SLP) was created to solve problems regarding various kinds of production material flow problems (10). The Systematic Layout Planning technique uses graphic and schematic analysis for material flow (2). The problem of layout analysis will come down to the problem of how best to arrange it so that the work schedule to meet the desired product volume can be achieved (20). ARC or activity relationship map uses degrees of relationship and the sign of each degree (16). the aim of this research is redesigning the layout of the bottle warehouse facilities using Craft to maximize productivity with the Systematic Layout Planning (SLP) Method.

PT. XYZ is a company engaged in manufacturing. PT. XYZ produces AMDK products, as a manufacturing company PT. XYZ, the bottle warehouse layout must be well designed for bottle storage so that activities can be carried out more easily. but the reality on the ground is very different from what was expected. There are several problems and obstacles with the layout of PT XYZ's bottle warehouse today. Space utilization is less than optimal, where the warehouse area is too dense with raw materials and empty bottles, making it difficult to pick up and move goods and increasing material handling costs. In connection with the problems currently being faced by PT. Atlantic Birur, the current layout of facilities in the bottle warehouse must be redesigned. This SLP method makes it possible to re-plan the layout of the bottle warehouse. Systematic layout planning (SLP) design solves various problems, such as transportation, warehousing, production, support, and maximizing the value of the required material handling

2. Methods

In this research, it is necessary to identify the research variables. Based on the title of the research, variables related to this research can be identified, namely the independent variable is a variable that influences other variables. The independent variable contains the area of the Warehouse and Warehouse Staff Office.. from the variables obtained will produce the flow of the research carried out can be seen in the following flowchart:

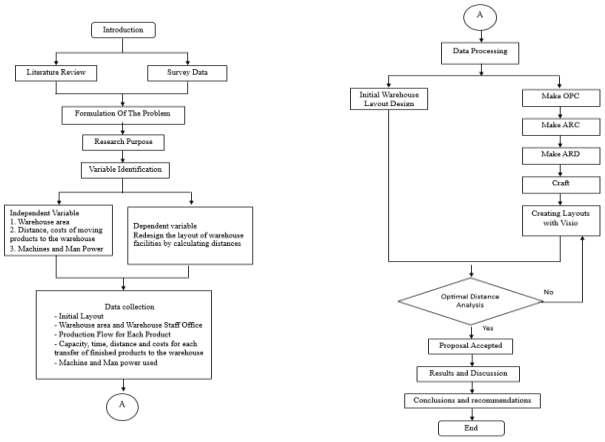

Figure 1. Flowchart

Data processing, completion steps, namely looking at the initial layout, making an OPC map, making ARC and ARD, making systematic layout planning. Where to calculate the distance between production to the finished product building using Excel and optimizing the layout in WINQSB. Then proceed with layout optimization. Analysis is a data processing stage that must be carried out properly and correctly. If it is valid, you can proceed to the next process, if not, data collection must be carried out again. Continuing from the results of existing data processing, analysis and discussion are then carried out based on the evaluation of the layout design. So it can be determined whether the proposed method used can be applied or not. There are 2 types of data collection, namely primary data, which is data obtained directly from sources that are observed and recorded for the first time. Then secondary data, namely data sourced from research results that are related to the object to be studied, to obtain secondary data can be done using data collection methods which are carried out by taking material from books or literature or documents from the company as well as other available information. relationship with the object to be studied. Data collection is one way to obtain research data, in the research primary data is used using observation and interview methods, in secondary data it is obtained by searching through references.

3. Results and Discussion

The data that will be used in the research, the data that will be collected comes from the research location, namely PT. XYZ. The data obtained includes: Initial layout, warehouse area, distance and time data in the bottle warehouse, machines and man power. In the data collection that has been carried out, the initial layout of the warehouse is obtained which is in accordance with the initial conditions of the bottle warehouse. The following is a picture of the initial layout of the bottle warehouse

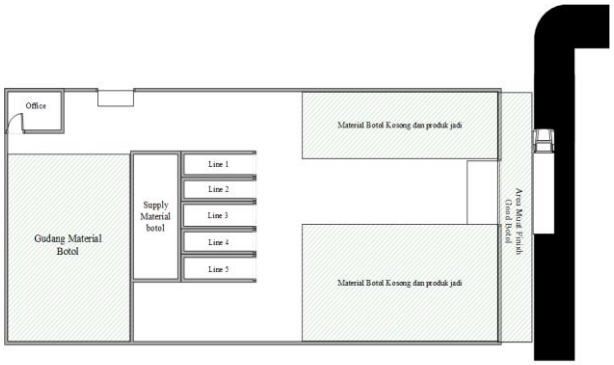

Figure 2. The initial layout of the Bottle Warehouse

In the data collection that has been carried out, it was found that several machines are used in the bottled AMDK production process at PT, XYZ, the following are the machines used, namely Bottle Blow Molding Machines, Washing Machines, Filling Machines, Capping Machines, Label Machines, Conveyors and Forklifts. After obtaining the required data, an Operation Process Chart (OPC) is created, as follows:

3.1. Operation Process Chart

Activity Relationship Chart (ARC) works for displays linkages between station work on something production in do product. With ARC, the level of closeness between one process and another can be determined

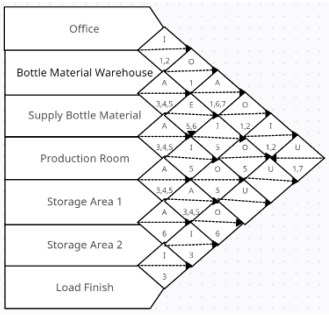

Figure 3. *Activity Relation Chart* (ARC)

Table 1. Priority Scale for Bottle Building Facilities

Activity Relationship Work Sheet							
No	*Activity Department*	*Degree Of Closement*					
		A	E	I	O	U	X
1	Office	4		2,6	3,5	7	
2	Material Warehouse	3	4	1,5	6	7	
3	Supply Materials	2,4		5	1,6	7	

4	Production Room	1,3,5,6	2	7	
5	Storage Area 1	4,6	7,2,3	1	
6	Storage Area 2	4,5	1,7	2,3	
7	Finish Loading Area		5,6	4	1,2,3

3.2. *Activity Relationship Diagram (ARD*)

Activity relationship diagram is a diagram created based on the relationship between activities from the map *activity realtionship chart* which was made previously. This information is used as a basis for planning the relationship between material flow patterns and the location of production activities

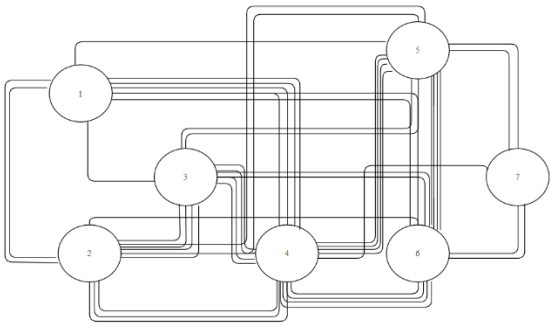

Figure 4. *Activity Relationship Diagram*

3.3. *CRAFT*

From the data collection that has been carried out, the distance between departments (areas) in the bottle building is obtained

From the data obtained above, the OMH Matrix (Material Handling costs) can be found, namely:

Table 2. OMH Mathix for Each Department

	Department	1	2	3	4	5	6	7
1	Office		0	0	0	0	0	0
2	Bottle Material Warehouse	0		2,870	5,488	13,835	13,835	0
3	Supply Bottle Material	0	2,870		3,039	10,572	10,572	0
4	Production Room	0	5,488	3,039		7,654	7,654	0
5	Storage Area 1	0	13,835	10,572	7,654		7,570	12,749
6	Storage Area 2	0	13,835	10,572	7,654	7,570		12,749
7	Finish Loading Area	0	0	0	0	12,749	12,749	

Next, after finding the OMH Matrix, Craft processing is carried out using WinQSB Software to optimize the 2-Way Exchange layout

Department	Department	Location Fixed	To Dep. 1 Flow/Unit	To Dep. 2 Flow/Unit	To Dep. 3 Flow/Unit	To Dep. 4 Flow/Unit	To Dep. 5 Flow/Unit	To Dep. 6 Flow/Unit	To Dep. 7 Flow/Unit	Initial Layout in
1	Kantor	yes		0	0	0	0	0	0	(1,1)-(3,2)
2	Gudang	No	0		2870	5488	13835	13835	0	7,1)-(16,3)
3	Supply	No	0	2870		3039	10572	10572	0	7,4)-(13,5)
4	Ruang	No	0	5488	3039		7654	7654	0	7,6)-(13,8)
5	Ruang	No	0	13835	10572	7654		7570	12749	,11)-(7,18)
6	Ruang	No	0	13835	10572	7654	7570		12749	11)-(16,18)
7	Area Muat	yes	0	0	0	0	12749	12749		19)-(16,19)

Figure 5. Layout Information for Optimization

Figure 5. show us about the input information that will be used in processing using WinQSB software

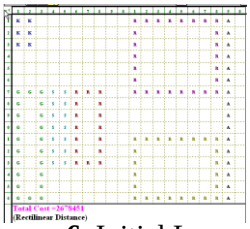

Figure 6. Initial Layout

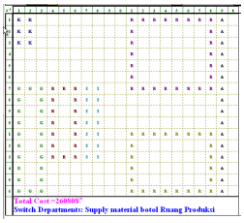

Figure 7. Iterasi 1

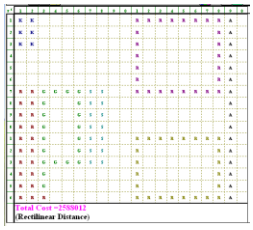

Figure 8. Iterasi 2 & Final layout

The following are the results of the initial layout that has been entered into the WinQSB software, where the total cost is IDR 2,678,451. In Figure 7, after the first iteration, the cost is IDR 2,608,087. In Figure 8, after the second iteration, the total cost is IDR 2,588. .012 and where in the material warehouse and material supply areas there is a change in shape. In Figure 8 is the final layout iteration where the iteration was optimal in 2 iterations with a total cost of IDR 2,588,012

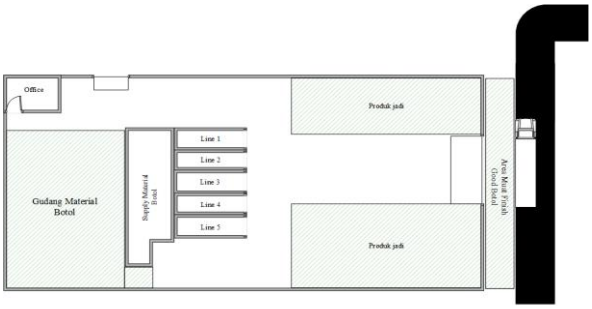

Figure 9. Final Layout with Microsoft Visio

After obtaining the final initial layout which has gone through 3 iterations until the most optimal one is obtained, then the following are the results of the proposed layout that has been created with Visio software.

4. Conclusion

From the initial layout which was less than optimal due to less than optimal use of space where the warehouse area was too congested with raw material and empty bottles making it difficult to pick up and move goods and increasing moving costs, where the initial layout was known to have a total cost of *: IDR 2,678,451* as in Figure 7, where after the 1st iteration the total cost was obtained: *IDR 2,608,087*, in the 2nd iteration the total cost was obtained: IDR 2,588,012 which was the final iteration and obtained a more optimal cost with a cost difference of IDR 90.439. Then several changes were made to the layout in the bottle material warehouse department, bottle material supply, and production room. So you get a final proposed layout that has been drawn using Microsoft Visio. With the results of the proposed layout that has been created using craft software, the company can maximize productivity because the costs and distances required have been optimized using the Layout Planning System method using craft software.

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