REDESIGN OF PLASTIC WASTE PROCESSING FACILITY LAYOUT AT PT INASTEK USING COMPUTERIZED RELATIONSHIP LAYOUT PLANNING (CORELAP) METHOD

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Abstract

Factory layout is the main foundation of the industrial world. A well-planned factory layout will help determine the efficiency and effectiveness of production activities and in some cases will also maintain the survival or success of a company. Based on the results of field observations and interviews that have been conducted, the problem faced by the company is the arrangement of the production floor layout that has poor flow, including workstations that have a relationship of material flow sequences that are placed far apart. This causes a lot of land area used and high OMH costs. One of the proposed methods that can be used to solve this problem is the Computerized Relationship Layout Planning (CORELAP) method. The CORELAP method was chosen to improve the facility's layout by producing a minimum material movement distance. In addition, this method allows for maximum area utilization, higher production capacity, and a more regular production flow. The total distance in the old layout is 39.25 meters and the new layout is 26.75, proving that the distance traveled by the proposed layout is more minimal meets the requirements of a proposed layout, and can reduce the company's OMH value.

Keywords: CORELAP, Facility Layout, Redesign of Plastic

INTRODUCTION

The arrangement of workspace and facility design is currently a challenge faced by the industry. Lack of consideration of production process flow, machine location, and production activity needs in facility architecture results in high material handling costs which impact production costs and the length of the production process (Amal et al., 2023). This is due to the potential for alternating current and intersecting currents so that a product must travel a longer distance and take longer or inefficiency on the production floor (Maulidah et al., 2022).

Layout planning is one way to organize factory facilities and support the smooth running of the production process. Factory layout includes planning and arranging the layout of machines, equipment, material flow, and people working at each workstation (Dewi et al., 2017). According to (Aziz & Kurnia, 2023) facility layout is a procedure for arranging factory facilities to support the smooth running of the production process. The main objective achieved in designing the layout of a production house is to minimize costs related to cost elements such as construction costs, installation, material transfer costs, production costs, repairs, security, and storage costs for semi-finished products and optimal factory layout arrangements will provide convenience in every supervision process and face future factory expansion plans (Sihombing et al., 2021).

Resource management through proper facility layout will be able to increase the efficiency and effectiveness of the company (Karisma & Fatimah, 2022). According to (Arianto et al., 2023), the selection and determination of alternative layouts is a crucial step in designing a facility layout, because here the layout chosen depends on its production activities. According to (Siagian et al., 2022), in designing a good facility layout, of course, there are measures by which a layout is said to be good. According to (Rauan et al., 2019) a good layout design is the output produced per day meets capacity standards, the design is an efficient path, and the number of workstations is minimal.

The purpose of designing a facility layout is to utilize the existing area, use larger labor machines, and minimize material handling (Daissurur, 2023). The principles of designing a facility layout are the principle of total integration, the principle of minimum

material movement distance, the principle of flow from a work process, and the principle of space utilization (Wignjosoebroto, 2015).

CORELAP calculates the busiest activities in the layout or those with the most connections. The number of connections between activities is compared, and the activities are compared, and the activity with the largest number is placed first in the layout matrix (Sugiyono, 2018). Area allocation using the CORELAP method is carried out by placing one by one the areas that have a relationship with the previous area so that the existing layout conditions can be known to obtain good layout effectiveness (Febianti et al., 2020). CORELAP (Computerized Relationship Layout Planning) is a construction algorithm that determines layout arrangements (Adiyanto & Clistia, 2020). By using this method, the minimum distance will be obtained. The Total Closeness Rating of the location or department to be placed is mainly the TCR which has the highest value (Fauzi & Cahyana, 2021). This method is a construction algorithm that determines the layout arrangement, its working principle uses the results of the Total Closeness Rating (TCR) calculation of each department.

TCR is the sum of the numerical values that indicate the close relationship between departments (Fajarika et al., 2019). In general, a well-planned factory layout will also determine efficiency and some of these things will also maintain the survival or success of an industry (Nugroho, 2022). In some companies, material handling can reach half of the total production costs incurred or contribute 30-75% of the total product cost (Supriyadi et al., 2019). Material Handling Cost is the cost that arises due to the activity of moving materials from one machine to another or from one department to another (Hasanah et al., 2022). Material handling is the activity of handling materials in the factory environment (Amalia et al., 2017).

Activity Relationship Chart is an activity or activity between each section that illustrates the importance of a room or department that is adjacent to other service departments (Aulia et al., 2023). Activity Relationship Chart (ARC) researchers must collect questionnaire data from respondents to obtain proximity variables (Wahyukaton, 2019). To determine the activities to be placed, a grouping of degrees of proximity has been established followed by a sign for each degree of proximity (Rosyidi, 2018). In selecting workstation placement, the CORELAP method uses a proximity relationship rating expressed in the Total

Closeness Rating (TCR). TCR is the sum of numerical values calculated based on the systematic proximity relationship rating (Rafael et al., 2023).

REVIEW OF LITERATURE

Based on Nisa's research (2023), the results of the study showed that the layout design resulting from the application of the CORELAP method was able to provide a significant increase in the efficiency of the production floor layout, with a distance reduction of 210m, making it an effective solution choice for companies in optimizing production flow. Based on Gunanti's research (2021), in this study the results of data processing showed that CORELAP succeeded in increasing space utilization, facilitating the movement of materials, and even adding toilet facilities without having to change the shape of the building. By using CORELAP, researchers can design a facility layout that can increase production efficiency, minimize material handling costs, and maximize space utilization.

RESEARCH METHOD

This study uses primary data from the company by interview, and secondary data by looking at the company. The method used is CORELAP, with the final result being the optimal distance and reducing OMH costs. The independent variables are the initial layout, production floor area, production process flow, number and size of machines, distance between workstations, and material handling costs. The dependent variables are the proposed block layout, distance between workstations, and material handling costs.

RESULTS AND DISCUSSION

The data collection process was carried out using observation techniques and direct interviews with the head of the plastic waste processing production department at the company. The following is the initial layout of the company showing the original conditions in the field:

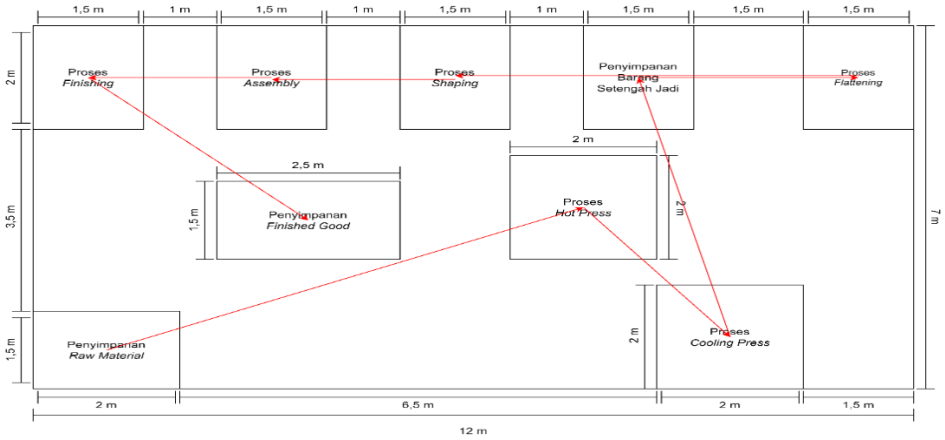


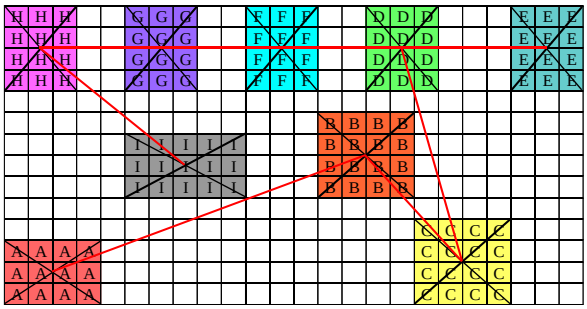
Figure 1
Initial Layout of Plastic Waste Processing Production Floor

The production floor area is the total area available for production activities in the company. This data will determine the space that can be used to place machines, equipment, and work areas so that there is no shortage or excess space, the production floor area can be seen below:

Table 1
Wide Production Chain

Code	Work Station	Length (m)	Width (m)	Area (m2)
A	Raw Material Storage	2	1,5	3
B	Hot Press Process	2	2	4
C	Cooling Press Process	2	2	4
D	Semi-Finished Goods Storage	2	1,5	3
E	Flattening Process	2	1,5	3
F	Shaping Process	2	1,5	3
G	Assembly Process	2	1,5	3
H	Finishing Process	2	1,5	3
I	Finished Goods Storage	2,5	1,5	3,75

The production floor area is the actual size of each room in the company consisting of 9 rooms with codes A-I. The distance between the initial layout work stations is needed to redesign the layout and reduce the distance to be traveled to increase the effectiveness of the production process and below is the calculation.



Picture 2
Initial Rectilinear Layout Distance Calculation

Based on Figure 2 above, you can see the coordinates of each work station in the initial layout to find out the X and Y points of the initial layout.

Table 2
Work Station Coordinates

Code	Work Station	Area		Coordinates	
		Length	Width	x	y
A	Raw Material Storage	2	1,5	1	0,75
B	Hot Press Process	2	2	7,5	3,5
C	Cooling Press Process	2	2	9,5	1
D	Semi-Finished Goods Storage	2	1,5	8,25	6
E	Flattening Process	2	1,5	11,25	6
F	Shaping Process	2	1,5	5,75	6
G	Assembly Process	2	1,5	3,25	6
H	Finishing Process	2	1,5	0,75	6
I	Finished Goods Storage	2,5	1,5	3,75	3,25

Table 3
Distance between Work Stations Initial Layout

From	Coordinates		To	Coordinates		Distance (m)
	x_i	y_i		x_j	y_j	
A	1	0,75	B	7,5	3,5	9,25
B	7,5	3,5	C	9,5	1	4,5
C	9,5	1	D	8,25	6	6,25
D	8,25	6	E	11,25	6	3
E	11,25	6	F	5,75	6	5,5
F	5,75	6	G	3,25	6	2,5
G	3,25	6	H	0,75	6	2,5
H	0,75	6	I	3,75	3,25	5,75
TOTAL						39,25

Based on table 3 above, the comparison of the initial and final layout coordinate points is to find out how far the coordinate distance changes from the initial and proposed layouts. The result of the comparison has a total of 39.25m.

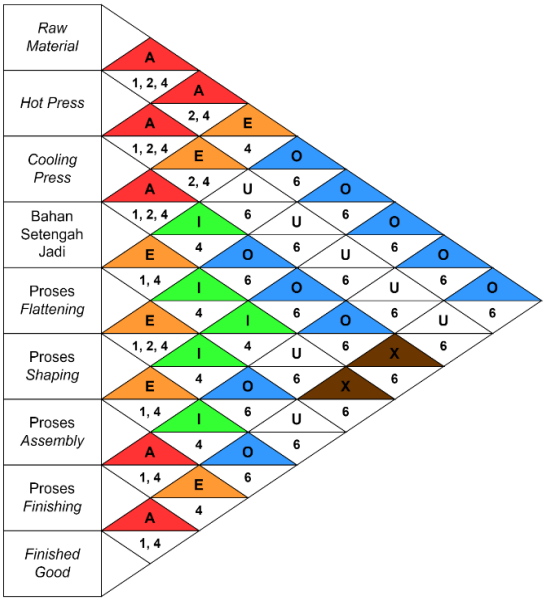


Figure 3
ARC

Activity Relationship Chart (ARC) is a diagram that shows the relationship between work stations or areas in the production process based on the level of importance of their proximity. The creation of Activity Relationship Chart (ARC) serves to determine how work stations should be placed in the layout in order to increase the efficiency of material flow and minimize time.

Table 4
Description of Total Closeness Rating Value

Proximity Relationship	Weight Value
A	5
E	4
I	3
O	2
U	1
X	0

Total Closeness Rating (TCR) is a value resulting from the sum of the relationship weights between workstations based on the Activity Relationship Chart (ARC). TCR

indicates how close the workstations should be placed to each other. TCR helps in determining the priority order of workstation placement in the design of the proposed layout.

Table 5
Results of Calculation of Total Closeness Rating Value

	1	2	3	4	5	6	7	8	9	TCR
1		A	A	E	O	O	O	O	O	24
2	A		A	E	U	U	U	U	U	19
3	A	A		A	I	O	O	O	X	24
4	E	E	A		E	I	I	U	X	24
5	O	U	I	E		E	I	O	U	20
6	O	U	O	I	E		E	I	O	21
7	O	U	O	I	I	E		A	E	24
8	O	U	O	U	O	I	A		A	21
9	O	U	X	X	U	O	E	A		15

Based on the table above, it can be seen that raw material storage (A), cooling press process (C), semi-finished goods storage (D), and assembly process (G) have the largest Total Closeness Rating (TCR) value, which is 24. Because there are 4 work stations that have the same TCR value, the work station that has a closer relationship A will be selected. Thus, the cooling press process will be placed in the center of the layout which is then followed by the next work station.

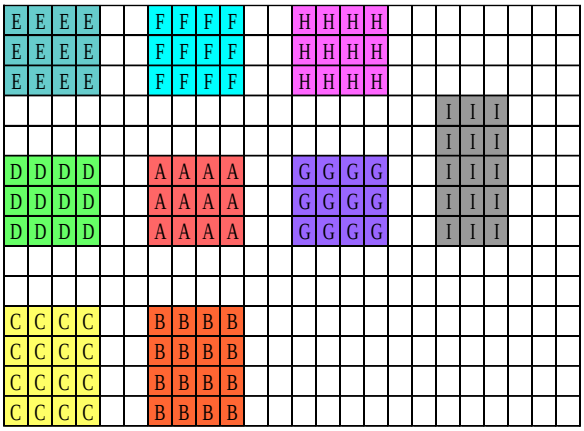


Figure 4
Proposed Block Layout with Corelap 1.0 Software

After data processing using the Computerized Relationship Layout Planning (CORELAP) method with the help of Corelap 1.0 software, the work station placement sequence was obtained based on the Total Closeness Rating (TCR) and Activity Relationship Chart (ARC). The data was then used as a basis for compiling the proposed block layout. At

this stage, the proposed block layout was designed by considering the results of the proximity analysis between work stations and other relevant aspects, such as the available area, size and number of machines, and space requirements

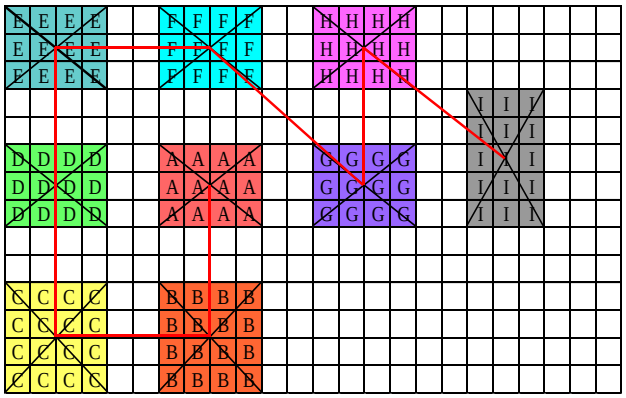


Figure 5
Distance Between Stations Proposed Layout

This stage involves a comparison between the initial layout and the proposed layout in terms of the distance between work stations. After obtaining the results of the distance between work stations passed by the material in the initial layout and the proposed layout, a comparison will be made to determine the difference in distance between the initial layout and the proposed layout.

Table 6
Distance Comparison

From	To	Distance (m)		
		Initial	Proposed	Difference
A	B	9,25	2,75	6,5
B	C	4,5	3	1,5
C	D	6,25	2,75	3,5
D	E	3	2,5	0,5
E	F	5,5	3	2,5
F	G	2,5	5,5	-3
G	H	2,5	2,5	0
H	I	5,75	4,75	1
TOTAL		37,75	26,75	12,5

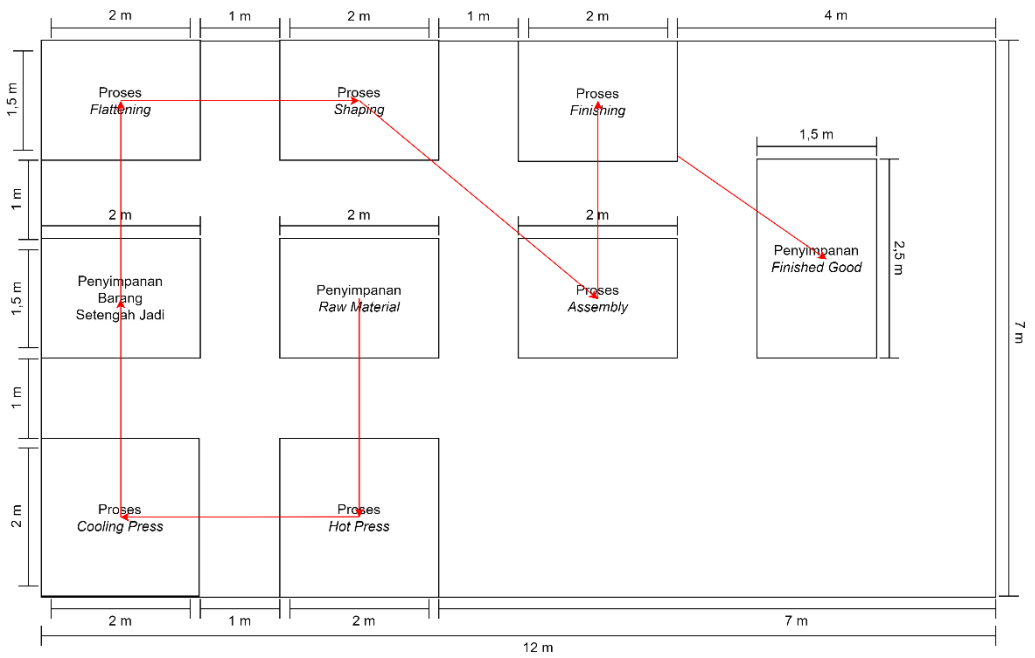


Figure 6
Proposed Layout of Plastic Waste Processing Production Floor

Figure 6 above shows the initial condition of the layout on the plastic waste processing production floor, where the placement of work stations has not fully considered the degree of proximity between work stations. The placement of work stations that do not match the sequence of the production process results in backtracking movements at several work stations, such as backtracking movements between the hot press process and the cooling press process and storage of semi-finished materials. In addition, backtracking also occurs in the storage of semi-finished materials with the flattening process and the shaping process.

CONCLUSION

Based on the calculation, the conclusion of the Computerized Relationship Layout Planning (CORELAP) method is that the proposed layout is obtained with changes in the placement of work stations based on the proximity relationship between work stations. The changes occur in several rooms with a total difference in distance between work stations of 12.5 meters where the proposed layout is more minimal and meets the requirements as a proposed layout. In addition, with the decrease in land use, it will affect the suppression of OMH costs. Suggestions for further research can add re-design with Material Handling Cost

and based on the increase in company production, and use several proposed layout improvements by considering the OMH aspect as a comparison.

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