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Redesign Layout Planning of Raw Material Area and Production Area Using Systematic Layout Planning (SLP) Methods (Case Study of CV Oto Boga Jaya)

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Abstract. CV Oto Boga Jaya (Oto Bento) is one of the largest industries which is producing Japanese food that is located in Bogor City and has many franchise partners throughout Indonesia. CV Oto Boga Jaya has the most significant problem and complained by most employees and operators (interview results) is a matter of factory layout between the raw material warehouse and the production area where the position of the two departments has an excess of more than 29 meters and takes time more than 10 minutes for one move. Therefore, researcher conducted observations and data processing with systematic layout planning (SLP) methods to design a new factory layout for CV Oto Boga Jaya. The processed data is the Operation Product Chart (OPC) data by selecting the product that has the highest and longest production process named shrimp roll, routing sheet, material handling costs, and initial layout as a reference. Then after conducting the research, the results obtained are in the form of 2 alternative layouts with distances and positions of different departments that have been processed in the FTC, ARC, ARD, AAD. The results of this study were chosen alternative layout 2, because it has shorter inter-departmental distances, a more orderly production / administration process, and fewer room intersections compared to alternative layout 1.

1. Introduction

Companies in terms of production require high effectiveness and efficiency. CV Oto Boga Jaya is a Japanese cuisine restaurant that was established on December 9, 1999. In the production process CV Oto Boga Jaya still has several problems that must be addressed by this company, namely the long distance between the warehouse of raw materials so that it takes time to move and requires more energy in the material handling used. Marked by the distance that is too far between the warehouse area of raw materials with a production area of more than 29 meters so it takes a longer transfer time to CV Oto Boga Jaya, which is more than 10 minutes. Based on the above problems, the researcher uses the systematic layout planning method, the researcher can help the company to evaluate and minimize the distance and time. The layout design did not add or change the existing production facilities during the study; use five types of reference products, those are the products that have the greatest demand, namely "Shrimp Roll"; and in research only discuss the operational costs of material handling.

2. Literature review and methods

2.1. Definition of Facility Layout

Facility layout is a function that involves analysis (synthesis), planning and design of the interrelationships between physical facility arrangements, material movements, activities

associated with personnel and information flow needed to achieve optimum performance in a range of related activities [1].

2.2. Definition of Warehouse

Warehouse is a building used to store goods [2]. The location for storing the product until demand is large enough to carry out its distribution [3].

2.3. Definition of Production Area

Production is all activities aimed at increasing or increasing the use of an object, or all activities aimed at satisfying others through exchange [4].

2.4. Definition of Layout Planning

Systematic Layout Planning (SLP) is widely applied to various types of problems including production, transportation, warehousing, support services and activities found in offices [5].

2.5. Method of Systematic Layout Planning (SLP)

The following are the steps for the preparation and research by the SLP method: Preliminary Data Collection and Activity, Flow Process Chart, Operation Process Chart, MPPC (Multi Product Process Chart), Production Order (routing sheet) , From To Chart, Analysis of Relationship of Work Activities (Activity Relationship), Activity Relationship Diagrams (ARD), Area Alocation Diagrams (AAD), Work Sheets, Block Templates [5] [6].

2.6. Material Handling Costs

This cost is the cost incurred for moving material or goods by considering the operator's salary and the cost of material handling equipment within a certain distance and time in accordance with the transfer. Cost per second is found from the operator's salary as a power plus the cost of moving equipment per second by taking into account the life of the tool. So the material handling costs (OMH) can be calculated as follows:

$$OMH = \text{Cost Per Second (Rp)} \times \text{Transfer Time (seconds)} \quad (1)$$

3. Results and discussion

3.1. Operation Process Chart (OPC)

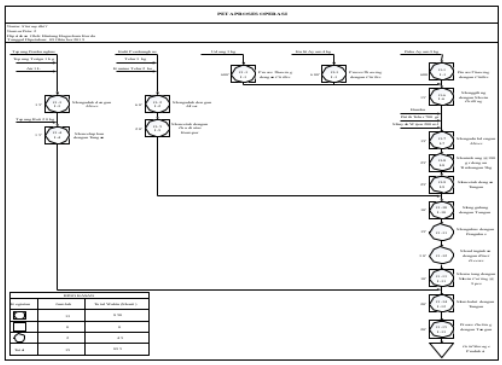

Figure 1. Operation Process Chart (OPC)

3.2. Routing Sheet

Table 1. *Routing Sheet*

Operation	Name	Machine	Standard Time (min)	Set-upTime (menit)	Scrap (%)	Reliability (%)	Efficiency (%)	Expected Amount	Prepared Amount	Amount after Reliability	Amount after Efficiency	Capacity	Number of Machine
Meat													
O - 1	*Thawing*	*Chiller*	600	2	0	90	95	105	105	116.667	122.807	53.997	2.274
O - 6	Grinding	*Drilling*	15	1	1	90	95	108.21	109.31	121.45 24	127.84 46	2159 .9	0.059
O - 7	Stirring	*Mixer*	15	1	1	90	95	107.13	108.21	120.23 79	126.56 62	2159 .9	0.059
O - 8	Weighing	Scale (5 kg)	25	2	0	90	95	180	180	200	210.52 63	1295 .9	0.162
O - 9	Printing	Hand	25	5	3	90	95	105	108.25	120.27 49	126.60 52	1295 .8	0.098
O - 10	Scrolling	Hand	10	3	1	90	95	105	106.06	117.84 51	124.04 75	3239 .7	0.038
O - 11	Steaming	Steamer	15	1	1	90	95	105	106.06	117.84 51	124.04 75	2159 .9	0.057
O - 12	Cooling	*Blast Freezer*	30	1	0	90	95	105	105	116.667	122.807	1080	0.114
O - 13	Cutting	*Cutting*	10	0.5	1	90	95	105	106.06	117.84 51	124.04 75	3240	0.038
O - 14	Binding	Hand	20	5	2	90	95	105	107.14	119.04 76	125.31 33	1619 .8	0.077
O - 15	*Packing*	Hand	20	3	1	90	95	106.06	107.13	119.03 55	125.30 05	1619 .9	0.077
Wrapping Skin													
O - 2	Stirring	*Mixer*	60	1	1	90	95	105	106.06	117.84 51	124.04 75	539. 98	0.23
O - 5	Printing	Stove	20	2	1	90	95	105	106.06	117.84 51	124.04 75	1619 .9	0.077
Wrapping Flour													
O - 3	Stirring	*Mixer*	15	1	1	90	95	105	106.06	117.84 51	124.04 75	2159 .9	0.057
O - 4	Dyeing	Hand	15	5	3	90	95	105	108.25	120.27 49	126.60 52	2159 .7	0.059

3.3. Multi Product Process Chart (MPCC)

Table 2. *Multi Product Process Chart (MPCC)*

Station	Meat	Wrapping Skin	Wrapping Flour
Raw Material Storage (a)	○		
Seasoning Storage (b)		○	○
Companion Material Storage (c)		○	○
Thawing (d)	○		
Processing (e)	○	○	○
Cooking (f)	○	○	
Cutting (g)	○		
Packing (h)	○	○	○
Finished Good Storage (i)	○	○	○
Steps	7	6	5

3.4. From To Chart (FTC)

Table 3. *From To Chart* (FTC)

From/ To	a	b	c	d	e	f	g	h	i	T	PP
a				144.01 432.03						144.01	432.03
b			288.01 288.01							288.01	288.01
c					3052.81 6105.62					3052.81	6105.62
d					52.81 52.81					52.81	52.81
e						62.41 62.41		105.61 316.83		168.02	379.24
f							81.61 81.61	120.01 240.02		201.62	321.63
g								52.81 52.81		52.81	52.81
h									124.81 124.81	124.81	124.81
i										-	-
T	-	-	288.01	144.01	3105.62	62.41	81.61	278.43	124.81	4084.9	-
PP	-	-	288.01	432.03	6158.43	62.41	81.61	609.66	124.81	-	7756.96

Table 4. FTC *Inflow*

From/To	a	b	c	d	e	f	g	h	i	T
a				1						1
b			1							1
c					0.98					0.98
d					0.02					0.02
e						1		0.38		1.38
f							1	0.43		1.43
g								0.19		0.19
h									1	1
i										-
T	-	-	1	1	1	1	1	0.97	1	-

3.5. Activity Relationship Chart (ARC)

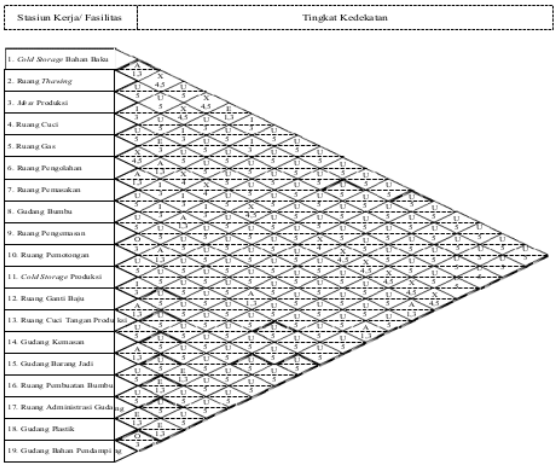

Figure 2. Activity Relationship Chart (ARC)

3.6. Activity Relationship Diagram (ARD)

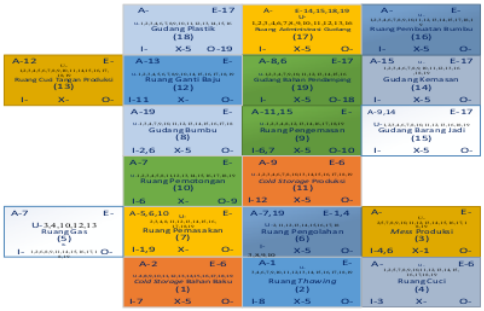

Figure 3. Activity Relationship Diagram (ARD) 1

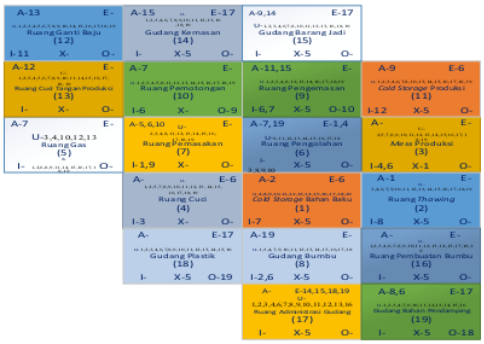

Figure 4. Activity Relationship Diagram (ARD) 2

3.7. *Area Allocation Diagram (AAD)*

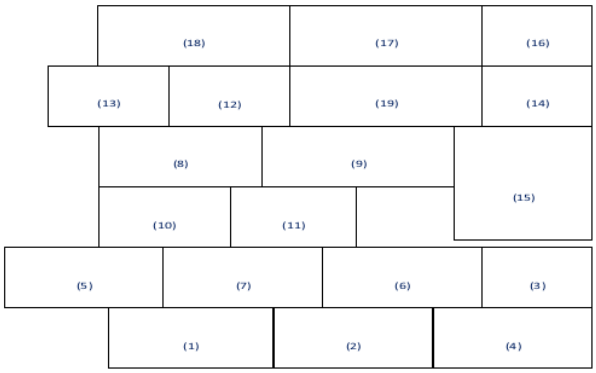

Figure 5. Area Allocation Diagram (AAD) 1

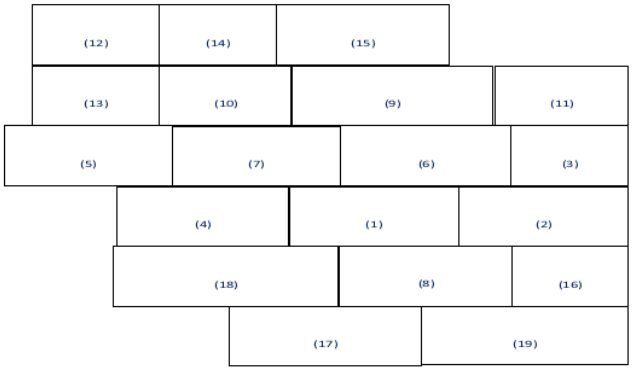

Figure 6. Area Allocation Diagram (AAD) 2

3.8. Flow Process Material Layout

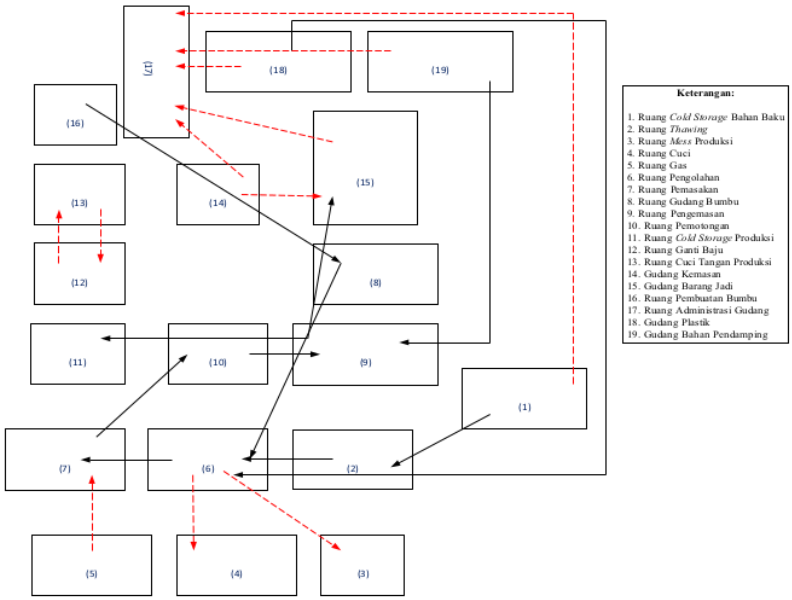

Figure 7. Flow Process Material Initial Layout

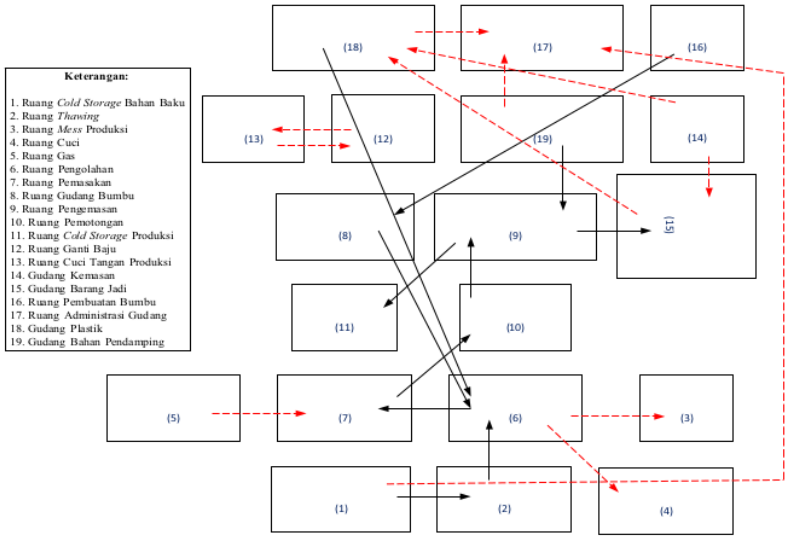

Figure 8. Flow Process Material Alternative Layout 1

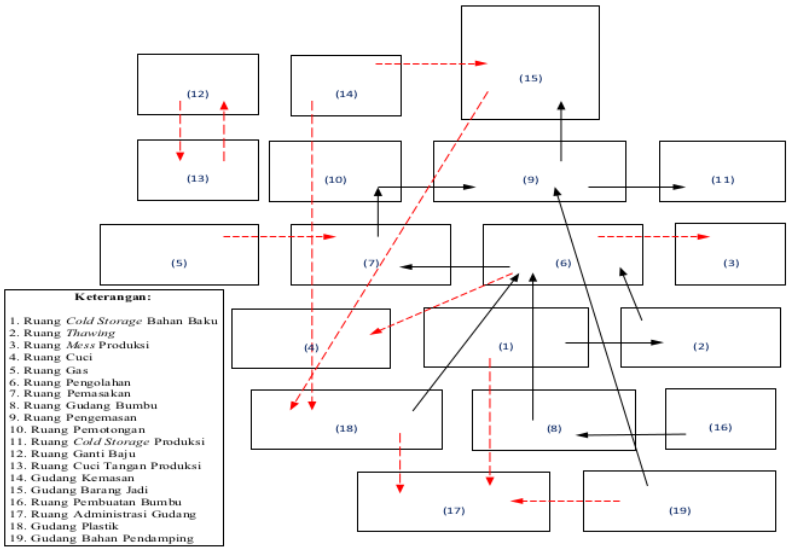

Figure 9. Flow Process Material Alternative Layout 2

3.9. General Floor Plan

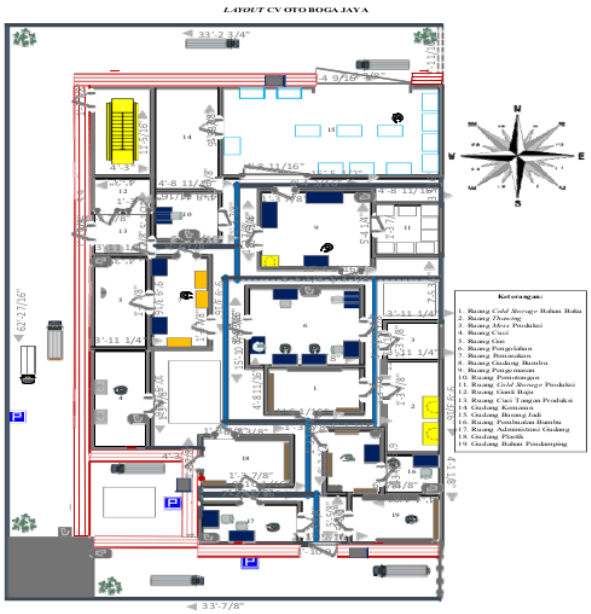

Figure 10. Floor Plan Alternative Layout 2 (Choosen)

4. Conclusion

Table 5. Results Analysis

Alternative Layout 1	Alternative Layout 2 (Choosen)
The production process line is less organized, it is seen that there are too many displacement paths passing through other departments to get to the destination.	The production process line is more organized, only a few departments are passed from one department to the intended department.
The distance of transfer of material is still far away, because several paths pass through several departments to get to the destination, thus affecting the distance of movement.	The relative displacement distance is closer, because it passes through a few departments for the material transfer path so that the automatic distance is closer.
The administrative process / application of SOP (Standard Operating Procedure) is less orderly, marked by red dotted lines that collide a lot.	The administration process / application of SOP (Standard Operating Procedure) is more organized, it can be seen in the red dotted line which has only a few crosses with other lines.
The administrative process / application of SOP is still a long distance, because many pass through departments for several administrative processes / application of SOP, thus affecting mileage.	The administrative process / application of SOP has a relatively close distance, because only a few departments are traversed for the administration / implementation of SOP.

The selection of alternative layouts considers the distance of material transportation which affects the cost of material handling in the production department. Then it can be concluded that alternative layout 1 and alternative layout 2 have different department positions. The initial layout has a long distance so it takes a long time and incurs material handling costs that are not supposed to. alternative layout 1 and alternative layout 2 can increase productivity by minimizing distance and cutting material handling costs. The result of the alternative layout chosen for CV Oto Boga Jaya's factory was alternative layout 2. The reason for choosing alternative layout 2 is because the production process is more organized compared to alternative layout 1, and has shorter distances in intersecting less space [both production processes and administrative affairs and SOP (Standard Operating Procedure)] than alternative layout 1. As in plastic storage section (18) and spice storage room (8) with processing room (6) and accompanying material warehouse (19) with packaging room (9). The reason for not choosing alternative layout 1 is because the distance between rooms that intersect farther and more rooms that intersect compared to alternative layout 2. spice warehouse (8), production cold storage room (11), and changing room (12). And also the spice making room (16) to the spice shed room (8) which must pass through the companion material shed (19).

5. References

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