Improve Productivity By Layout Optimisation In Manufacturing Industry

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Abstract- *According to the number of competitors in the global marketplace, it is important for companies to reduce their costs and expenses in order tobe a sustainable competitor. As a case study, a company producing railway coach interior located at Por, Vadodara was selected with aview of finding a sustainable layout that minimizes travel distance, material handling and losses. A few steps were taken to achieve this aim.Firstly, several layouts were generated using CRAFT Analysis Technique.The result showed that the Traveling distance of the selected layout reduced from 528 m to 414.74 m after optimizing. Based on this study, it was found that even the best selected layout could be improved, and it is necessary to conduct facilityand layout planning before any factory set up to ensure sustainable process and reduce losses.*

Keywords- Computerized Relative Allocation Of Facility Technique (CRAFT), Layout Optimization, Flow Matrix, Cost Matrix.

I. INTRODUCTION

As the number of competitors in the global marketplace isincreasing very fast, surviving in this environment is not easy.

Sustainable manufacturers have to produce high qualityproducts at the lowest possible price. Many factors affect thefinished-goods prices. The first step to decrease the price is to find the costs and losses in the factory. One of the mainfactors influencing costs is poor facility design that means apoor production layout in the factory. Muther [1] believed thatspending a little time on layout planning before installationreduces losses significantly. Obtaining a good layout at thetime of installation instead of poor layout will save a lot ofcapital investment and production lost. Poor layout requiressubsequent rearranging which is time-consuming and costly.Different methods and algorithms are developed by facilityplanners for obtaining a proper layout. The techniques that aregoing to be used in this study are explained in the followingsection. These manufacturers also need to produce a variety ofproducts and increase their capacity in order to compete in themarket place.

This study focuses on developing a new production layoutfor a meat processing company in view of the need to increasethe production capacity.

II. GENERAL OVERVIEW OF LITERATURE SURWAY

CREAFT (Computerized Relative Allocation Of Facility Technique)

It is introduced in 1963 by Armor, Buffa and Vollman.

CRAFT is a tool used to help improve the existing layout of the facilities.

The facility is improved by switching two or three departments to help arrange the facility in an optional floor plan.

CRAFT Method Considerations.

This procedure requires the following inputs.

1. From to Chart
2. Cost Matrix
3. Distances (determined for given layout and initial layout).

The major features of CRAFT are,

- Attempts to minimize transportation cost

Transportation cost = Flow x Distance x Unit cost

- CRAFT is a path-oriented method, the final layout is dependent on the initial layout.

Requires an assumption that,

- Move cost is independent of the equipment utilization.

- Move cost are linearly related to the length of the move.

Algorithm Approaches,

1. Determine the department centroids.
2. Calculate the inter department rectilinear distances.
3. Calculate the initial cost of the layout by multiplying the from to matrix with cost matrix.
4. CRAFT then consider all the possible two way or three way department exchange.
5. Update the layout and calculate the new department centroids.

III. METHODOLOGY

According to the problem statement mentioned in theintroduction section, the first step for this study is todetermine the required number of machines based on the newcapacity.

In developing a layout, several alternatives are needed inorder to select the best layout and then optimize it. Togenerate several alternatives, CRAFT Analysis Technique is used.

CRAFT Approaches,

Step 1. Determine the department centroids and calculate the inter department rectilinear distances.

Activity	Distance travelled (m)
Raw Material – LCM	34.65
LCM – BM	10.57
BM - Bolting & Tagging	6.8
Bolting & Tagging - WS1	6.8
WS1 - WS2	6.8
WS2 - WS3	6.8
WS3 - WS4	13.8
WS4 - WS5	6.8
WS5 – Cleaning	22.86
Cleaning - Sub-assembly	18.96
Padding - Sub-assembly	32
Pipe fittings - Sub-assembly	30
Grill sections - Sub-assembly	21.1
Sub-assembly – Assembly	11.94
Raw Materials – SM	27.2
SM – LCM	15.8
Raw Materials - Luggage Racks	31.7
Raw Materials – Toilets	37.69
Raw Materials – Boxes	41.39
Raw Materials - LCM – Frames	68.46
Raw Materials – Berth	42.28
Raw Materials – Windows	33.6
TOTAL	528

Table 1. Traveling distance of each component before layout optimization

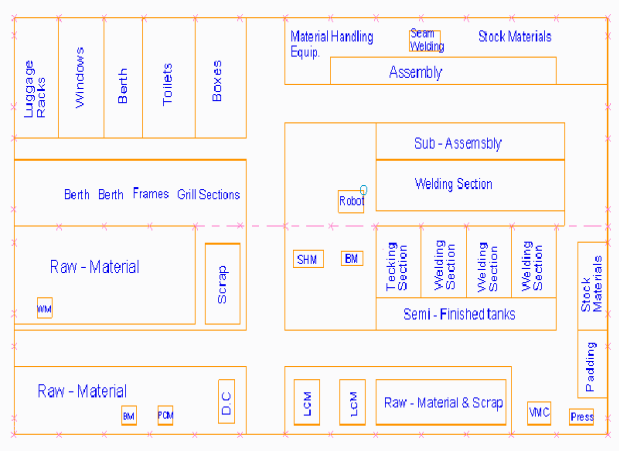

Figure 1. existing layout

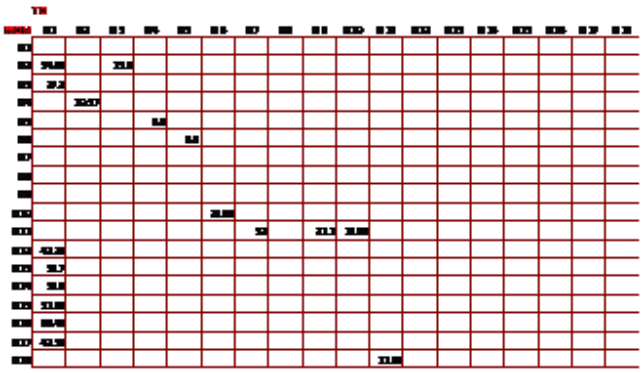

Table 2. Flow matrix

	Name	F/V	Area	Cells
1.Raw – materials	D 1	V	661.5	662
2.Laser cutting machine	D 2	V	50	50
3.Shearing machine	D 3	V	40	40
4.Bending machine	D 4	V	40	40
5.Bolting and Tacking	D 5	V	48	48
6.Welding	D 6	V	270	270
7.Padding	D 7	V	48	48
8.Semi-finished goods	D 8	V	72	72
9.Grill sections	D 9	V	72	72
10.Cleaning	D 10	V	120	120
11.Sub-assembly	D 11	V	324	324
12.Berth	D 12	V	72	72
13.Luggage Racks	D 13	V	78	78
14.Windows	D 14	V	72	72
15.Toilets	D 15	V	78	78
16.Frames	D 16	V	72	72
17.Boxes	D 17	V	72	72
18.Assembly	D 18	V	324	324

Table 3. Area of each department

Step 2. CRAFT then consider all the possible two way or three way department exchanges and identify the best exchange.

Facility Layout

Problem Name:	PRODUCTION	Method:	Traditional
Number Depts.:	18	Layout:	Aisle
Length(cells):	100	Fill Departments:	Yes
Width(cells):	50	Measure:	Euclidean
Area (cells):	5000	Number Aisles:	10
Cost:	14452	Dept. Width:	5

Department	Color	rea-require	Area-define	x-centroid	y-centroid	Sequence
D 1	1	662	665	3.74060154	58.3120308	1
D 2	2	50	50	7.5	62	2
D 3	3	40	40	7.5	53	3
D 4	4	40	40	7.5	45	4
D 5	5	48	50	7.5	36	5
D 6	6	270	270	9.62963009	13.7962961	6
D 7	7	48	50	12.5	28	7
D 8	8	72	75	12.5	40.5	8
D 9	9	72	75	12.5	55.5	9
D 10	10	120	120	12.5	75	10
D 11	11	324	325	16.5	77.9000015	11
D 12	12	72	75	17.5	40.5	12
D 13	13	78	80	17.5	25	13
D 14	14	72	75	17.5	9.5	14
D 15	15	78	80	21.875	6.25	15
D 16	16	72	75	22.5	21.5	16
D 17	17	72	75	22.5	36.5	17
D 18	18	324	325	23.1923084	75.2538452	18

Table 4. data of initial layout

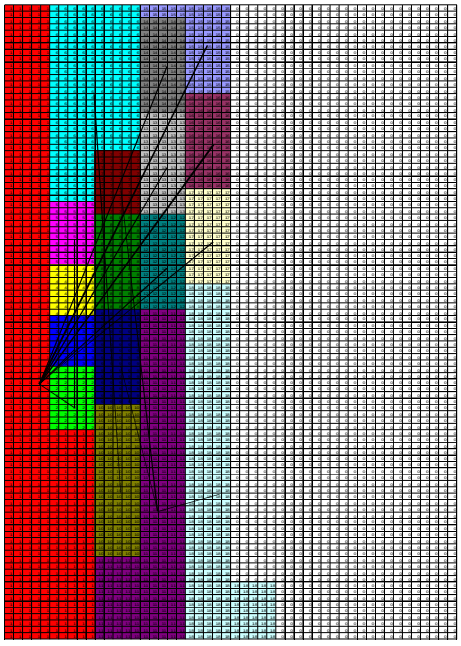

Figure 2. Initial Layout according to CRAFT

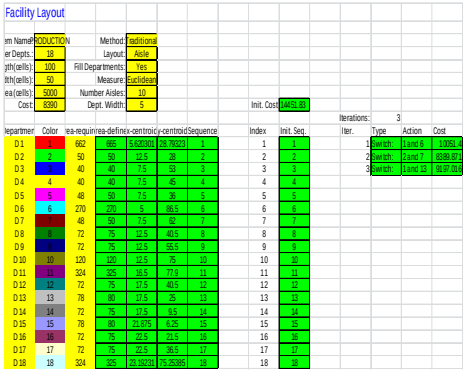

Table 5. data on switching department

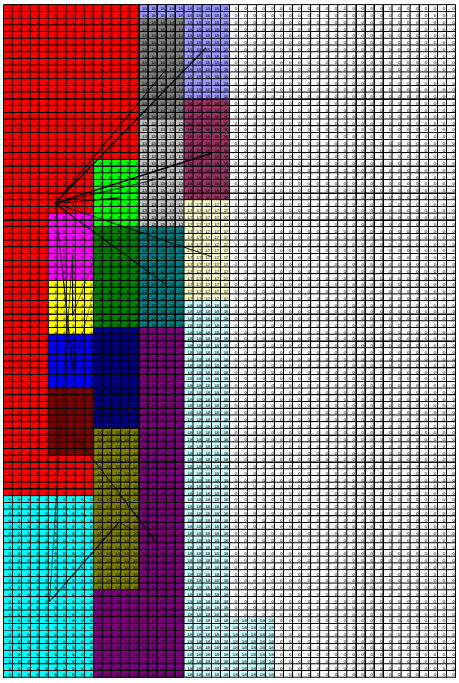

Figure 2. optimize Layout according to CRAFT

According to CRAFT technique exchanging Two or Three way department, following department are switching,

- switching the departments 1 and 6 cost is 10051.4
- switching the departments 2 and 7 cost is 8399.371
- switching the department 1 and 13 cost is 9197.06

There are Three layout generated but it has been cost is different, thus lower travelling cost required layout is to be selected (switching the department 2 and 7 cost is 8399.371)

Step 4. Update the layout according to exchanged department in CRAFT Analysis.

Figure 3. updated layout

IV. RESULT AND DESCUTION

Activity	Distance travelled (m)
Raw Material – LCM	13.6
LCM – BM	6.8
BM - Bolting & Tagging	6.8
Bolting & Tagging - WS1	20.4
WS1 - WS2	6.8
WS2 - WS3	6.8
WS3 - WS4	6.8
WS4 - WS5	6.8
WS5 – Cleaning	6.8
Cleaning - Sub-assembly	10.9
Padding - Sub-assembly	7.8
Pipe fittings - Sub-assembly	7.8
Grill sections - Sub-assembly	7.8
Sub-assembly – Assembly	11.94
Raw Materials – SM	14.8
SM – LCM	3.4
Raw Materials - Luggage Racks	30.96
Raw Materials – Toilets	43.4
Raw Materials – Boxes	40.8
Raw Materials - LCM – Frames	82.8
Raw Materials – Berth	37.08
Raw Materials – Windows	25.2
TOTAL	414.74

Table 6. Traveling distance of each component after layout optimization

Travelling distance before layout optimization = 528 m
Travelling distance after layout optimization = 414.74 m
Reduced travelling distance due to layout optimization is 113.26 m.

V. CONCLUSION

The goal of this study is to develop a new productionlayout for a meat processing company in view of the need toincrease the production capacity using facility planning anddesign techniques. The first step is to generate several layoutsto raise the probability of finding the sustainable layout withhigher efficiency, and the second step is to select the bestlayout and improve it.

Calculating the Travelling distance for improved layoutshows that the score of the best layout increased from 528 m to 414.74 after optimization. Based on this study, it is foundthat even the best selected layout could be improved.Therefore, the result indicates that it is necessary to conductfacility and layout planning before any factory set up toensure sustainable process and reduce losses.

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