APPLICATION OF CIMFACTORY SOFTWARE TOWARDS IMPROVEMENT OF THE PRODUCTION FLOOR LAYOUT IN A MANUFACTURING COMPANY

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ABSTRACT

The aim of this study is to help in improving the plant layout of a manufacturing company. The objective is to redesign a new layout in order to improve the productivity. Industrial Engineering techniques will be implemented to identify the entire problem, which occurs in the production floor. After the main problem has been identified, CIMFactory simulation software that includes FactoryCAD and FactoryFLOW will be used to generate result reports. Critical analysis will be done based on the reports and the best alternative layout will be suggested to the company's management for future development.

1.0 INTRODUCTION

In this competitive world, no matter which sectors, the challenge to gain demand from customers become more and more important. Manufacturing sector is not excluded from this trend. Dealing with continuous competition, companies not only need to produce quality products but excellence production system and management also plays an important role [1]. Excellently will bring towards productivity improvement and at the same time reduced production and overall cost to as minimum as possible.

Companies at this moment compete among each other for global recognition so they can be part of the World Class Manufacturer [2]. For the dream to come true, continual improvement from the aspect of cost, lead time, quality, time management and customer service must be the first priority. As a result, productivity plays a big role for the success or failure of a company [3].

2.0 PROBLEM IDENTIFICATION

2.1 Background

First of all a general overall observation will be carried out in the production floor to identify the general problem. Related data will be collected for comprehensive analysis. After that Industrial Engineering technique such as Cause and Effect Diagram and Pareto Diagram will be plotted to give a clearer picture. The most critical problem will be the major problem and suitable countermeasure approach will be applied to overcome it. Figure 1 shows the Cause and Effect Diagram for the related problem, which occurs, in the production floor.

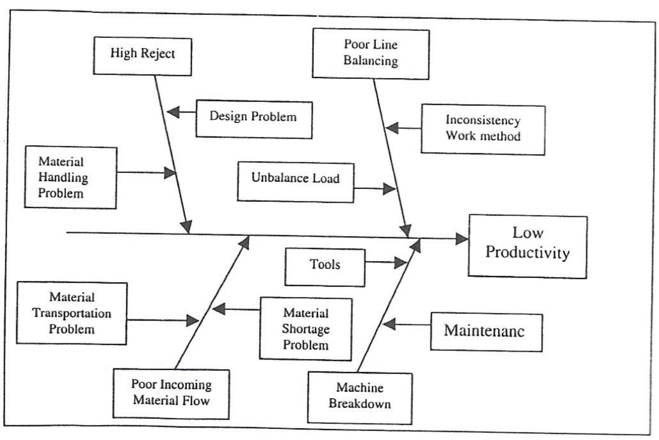

Fig. 1 Cause and Effect Diagram of Low Productivity

2.2 High Reject Analysis

A study has been carried out and data on the failure unit for four months has been collected for analysis. Table 1 shows the total output and failure units. Based on the table, percentage of time loss due to the rejection can be calculated by using the formula below. Some assumptions also need to be taken into consideration for a valid result.

Assumptions:

i. The defect rate is based on test station failure and rework is not taken into consideration.

ii. Only one defect on each rejected product or component.

Table 1: Production Reject Rate

Month	Total Output	Total Failed
Sep-98	3158	79
Oct-98	3125	60
Nov-98	3283	90
Dec-98	2202	120

$$\text{Percentage of time loss} = \frac{\text{Number of defect} * \text{cycle time}}{\text{Total output} * \text{cycle time}}$$

$$= \frac{\text{Number of defect}}{\text{Total output}}$$

$$= \frac{79 + 60 + 90 + 120}{3158 + 3125 + 3283 + 2202}$$

$$= \frac{349}{11,768}$$

$$= 0.02965$$

$$\approx 0.03$$

$$\approx \mathbf{3.0\ \%}$$

2.3 Machine Breakdown Analysis

A study has been carried out and from the daily maintenance record book. Data on the machine failure for four months has been collected for analysis. Table 2 shows the total down time for each line. Total production time per day is 450 minutes. Based on Table 2, percentage of time loss due to the machine breakdown can be calculated by using the formula below.

Table 2 Machine Breakdown Rate

Month	Total Production Time (minutes)	Total Breakdown Time (minutes)
Sep-98	35,100	493
Oct-98		678
Nov-98		579
Dec-98		35

$$\text{Percentage of time loss} = \frac{\text{Total Breakdown Time}}{\text{Total Production Time}}$$

$$= \frac{1785}{35{,}100}$$

$$= 0.05085$$

$$\approx 0.051$$

$$\approx \mathbf{5.1\ \%}$$

2.4 Poor Line Balancing

A time study has been carried out for the critical workstations in the production floor to determine the cycle time. This selected assembly line contains the most work in process (WIP) which decrease the productivity. Table 3 shows the cycle time for the assembly line, which contain seven stations.

Table 3 Average cycle time for selected assembly line workstation.

Stations	**Average Cycle Time (seconds)**
Station FV-34	124
Station FV-14	133
Station FV-15	129
Station FV-16 (High Pot Test)	80
Station FV-17	164
Station FV-18,19 (Final Test)	191
Station FV-20	157
Total	978

From table 3, the Line Balancing Loss (LBL) percentage can be calculated.

$$\text{LBL \%} = \frac{(191 * 7) - 978}{(191 * 7)} = \frac{359}{1337} = 0.2685 = 26.85\ \% \approx \mathbf{26.9\ \%}$$

2.5 Poor Incoming Material Flow Analysis

After direct observation in the production floor has been done, another cause for the low productivity is the inefficiency of the incoming material flow. Table 4 shows the total idling duration for each line. Data taken into consideration is from September 1998 to December 1998. Total production time per day is 450 minutes.

Table 4 Machine Idling Duration

Month	Total Production Time (minutes)	Machine Idling Time (minutes)
Sep-98	35,100	3,321
Oct-98		3,366
Nov-98		3,439
Dec-98		2,880

Based on table 4 percentage of time loss due to the machine idling can be calculated by using the formula below.

$$\text{Percentage of time loss} = \frac{\text{Total Idling Time}}{\text{Total Production Time}}$$

$$= \frac{13{,}006}{35{,}100}$$

$$= 0.3705$$

$$= 37.05\ \%$$

$$\approx \mathbf{37.1\ \%}$$

2.6 Justification

Based on the analysis which has been done, we can conclude that the highest percentage goes to the Poor Incoming Material Flow. For a clearer picture please refer to Figure 2. This means that the main problems that affect the production floor are poor incoming material flow and poor line balancing. Both add up to a total of 64 % of causing low productivity in the production floor. This proves that the current production floor layout is not in a good condition to provide smooth production flow. Therefore CIMFactory software will be apply to redesign a better production floor layout.

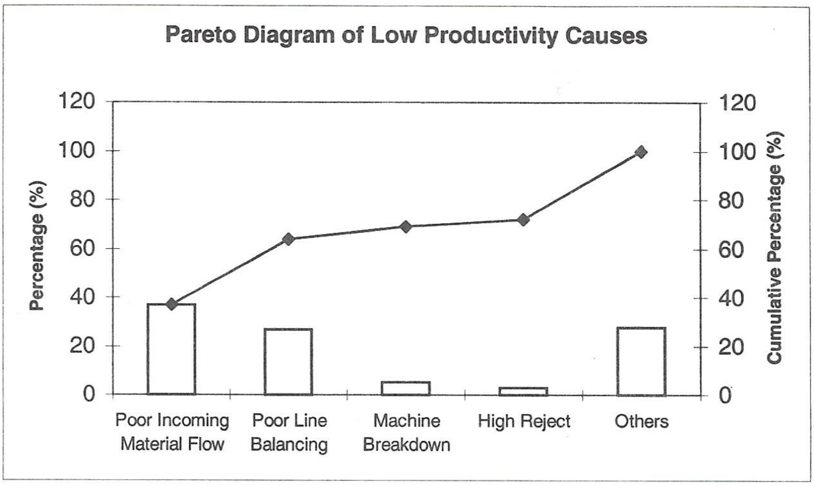

Fig. 2 Pareto Diagram of Low productivity.

3.0 MODEL BUILDING PROCESS

3.1 Production Floor Layout Development

Production Floor Layout drawing can be produced by using FactoryCAD software. In order to use FactoryCAD successfully, user need to familiarised with AutoCAD software. This is because FactoryCAD customize AutoCAD to create a powerful drawing and planning tool. FactoryCAD makes drafting easier with additional tools such as Architectural Menu for wall development. Furniture Menu and Me/El Menu provides user with variety types of utilities to choose for the production floor. User just need to determine the utility intersection point, width and depth when drafting is in process. Appendix A shows the production floor layout drawings.

3.2 Simulation and Report Result Development

Using FactoryFLOW software enables simulation work to be done. Before it can be done, there are a few input data which needs to be inserted into the FactoryFLOW Data Input Menu. The input data are such as part name, activity area, material handling equipment, investment cost and the production floor layout drawing itself.

Using the Diagram and Calculate Menu enables simulation to be done. Then user can view the simulated result through Result Menu.

4.0 RESULT ANALYSIS AND DISCUSSION

The main concern is selecting the best production floor alternative. It will base on the result provided by FactoryFLOW through simulation process. There are a few factors, which will be taken into consideration when selection is made. The factors are such as time, cost and parts movement. In other word the best alternative is it should be able to run and produce highest productivity with lowest investment capital.

4.1 Distance Move Consideration Analysis

If the movement distance of the entire assembly parts can be reduced as minimum as possible, then it can be assumed that productivity will increase. This is based on the same amount of the production volume for each alternative layout. In the simulation process, the production volume use as benchmark is four thousand (4000) unit per month. As we can see from Table 5, which shows the cumulative value of total distance in meter per month the original layout recorded a total of 309,342.91 meter. There was reduction in the move distance for each alternative and alternative 3 recorded the lowest value that was 213,742.84 meter per month.

Table 5 Cumulative Move Distance

From-To	Original Layout	Alternative 1 Layout	Alternative 2 Layout	Alternative 3 Layout
Cumulative Value	309,342.91 m	229,596.63 m	216,828.55 m	213,742.84 m

That means a reduction of 95,600.07 meter per month. So we can assume that alternative 3 layout is the best layout in term of the most minimum total distance movement for the product from inventory area to packing area.

4.2 Time Consideration Analysis

In this part, analysis will base on the time usage in the production floor. As stated in the earlier part, the objective of this project is to increase the production floor productivity. So this section will focus on the selection of the alternative layout, which gives the most minimum value in term of time usage.

Table 6 Cumulative Time Usage (Minutes/month)

From-To	Original Layout	Alternative 1 Layout	Alternative 2 Layout	Alternative 3 Layout
Cumulative Value	82,737.92	77,749.74	76,951.77	76,758.91

If we refer to table 6 which gives the overall path flow total time, we can see that the original layout recorded the highest total time usage and there is a decrease in term of total time usage for each alternative. Alternative 3 provides the lowest value, which is 76,758.91 minutes per month. The reduction value between original layout and alternative 3 layout is 5,979.01 minutes per month. Thus we can consider that alternative 3 also is the best layout in term of most minimum total time usage for the product flow path from inventory area to packing area.

4.3 Cost Consideration Analysis

This is the most important section, which the company's manager most concerns about if any changeable regarding the production floor need to be made. Cost involved or the investment capital required for month need to be as minimum as possible so that it will provide maximum productivity.

Table 7 Cumulative Investment cost (dollars/month)

From-To	Original Layout	Alternative 1 Layout	Alternative 2 Layout	Alternative 3 Layout
Cumulative Value	13,829.01	12,998.29	12,865.28	12,833.14

Table 7 gives the cumulative value for the investment cost. As we can see from the table, the original layout which is running the production currently needs a total of 13,829.01 dollars per month as the investment cost. However, alternative 3 provides a better bargain, which only needs a total of 12,833.14 dollars per month. Therefore a total of 995.87 dollars per month can be saved if alternative 3 was adopted.

5.0 CONCLUSION

As a conclusion, we can say that CIMFactory software has been successfully used to achieve the desired objective, which improves the production floor layout towards higher productivity. It has covered all the result analysis which base on the distance move, time usage and investment cost. From the analysis, which has been done for all the alternatives, a final selection that was alternative 3 has been made and was proposed to the factory's management for further consideration.

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