Assembly Line Balancing Method Vs Lean Manufacturing System- A Case Study

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Abstract- *In this paper study on freezer Manufacture Company implement Lean manufacturing tools for improves line efficiency. For this line improvement purpose, various Lean manufacturing tools were employed such as cycle time study, line imbalance calculation, Bottleneck operations identification,Kaizen,5`s implementation, and also Space utilization through layout change etc,.Line balancing efficiency was improved maximize the plant production rate, Productivity and idleness of line , Smoothness index were decreased. This paper presents the application of assembly line balancing methods namely Larger Candidate Rule [LCR], Rank Position Weight [RPW], and also Kill Bridge and Wester [KBW] methods. And importance of lean manufacturing system in manufacturing companies for improve line efficiency and improve production rate and productivity of plant.*

Keywords- Assembly line balance, Lean Manufacturing Tools, Line Balancing Efficiency, Larger Candidate Rule Method, Rank Position Weight Method, Kill Bridge and Wester method.

I. INTRODUCTION

The concept of assembly line was first introduced by Henry Ford in the early 1900`s.An assembly line balancing is how tasks are to be assigned to workstations, so that the demand of product is achieved. The main object of assembly line balancing is minimize the number of work stations through the improve production rate and decrease idle time. Naveen Kumar and Dalgobing Mahto [1] were studied on the main objective of line balancing is distribute the task evenly over work station so that idle time of man and machine can be minimized. Assembly line efficiency [2] is improved by lean manufacturing Tools Through this maximizes the productivity and production rate from that reaches the predetermined production rate was studied by Shram Sane,Varsha karamdika. In the line balancing problems [3] domain experts were facing each time with an intractable problem with an astronomic number of possible solutions and no real guidance on how to solve it in optimal way. In this line balancing domain some of the complicated issues were identifies like Do not balance but Rebalance, Work stations have identifies, Unmovable operations and zoning constrains, Cannot eliminate workstations, Need to equalize loads, Multiple operators, Multiple operations, Ergonomic constrains etc,. Studies by Emouhvel Falkenauer. Lim ChuanPei, MasineMd.Tap [4] were studied in line productivity improvement by simulation and evaluated using a 16 factorial ANOVA. Dr.Raju N.Panchal and Anant D.Awasare [5] were studied on how the Assembly line balancing Methods applicable for maximize line efficiency, Production rate and minimize the idle time and also smoothness index. Vrittika V Pachghase,R.S.Dalu were did the case study on how to maximize line efficiency, production rate, and productivity by minimize the cycle time by Line Balancing Methods namely as Largest Candidate Rule[LCR], Kilbridge and Wester Column[KWC] Method and Rack Positional Weight Method[RPW] .

II. CASE STUDY

Rockwell Industries Ltd is one of the manufacturing company of commercial Refrigerators like Freezers, Deep Freezers and Water Coolers. It was founded in the year 1986.Rockwell Industrial Ltd., was implement the lean manufacturing system in 2009.At that time production capacity of plant is 300 units/day. Today onwards plant capacity is 960 units/day. The case study was going at stating time of lean manufacturing system implementation. At that time manufacturing plant faced line imbalancing problem due to that plant implement the lean manufacturing system.

III. METHODOLOGY

A .Line diagram of the plant

In the plant to improve line balancing efficiency the Operations, Task time and Number of operators are identified.

TABLE 1.LIST OF OPERATIONS

S.NO.	Operation	Machine	Task time in minutes	No. of Operators
01.	Sheets Cutting	Shearing M/C	30	03
02.	Inner tank fabrication	Manual operations	30	05
03.	Sheet metal operations, Blanking	Transfer line Machine	05	02
04.	Sheet metal operations, Punching,dieing	Punching Machine	03	02
05.	V Bending operation	Hydraulic V Bending Machine	02	02
06.	U Bending operation	Pneumatic U Bending Machine	03	02
07.	Heat treatment Process	Heater	03	02
08.	Powder Coating Process	Powder coating Machine	03	02
09.	Body Assembling	Manually by taping	05	03
10.	Polyvinyl chloride puff filling	Injection Molding Process	05	02
11.	Door Assembling to Body	Pneumatic Screwing Machine	02	02
12.	Base Plate assembly with compressor, condenser	Pneumatic Screwing Machine	02	03
13.	Body to Base Plate assembly	Pneumatic Screwing Machine	05	03
14.	Wiring	Manually	03	02
15.	Vacuum Creation	Vacuum Machine	01	02
16.	Refrigerant charging process	Refrigerant Charger	01	02
17.	Final Testing Machine	Manual Testing	05	03
18.	Dispatch	Manually	03	02
		Total	111 min.	47

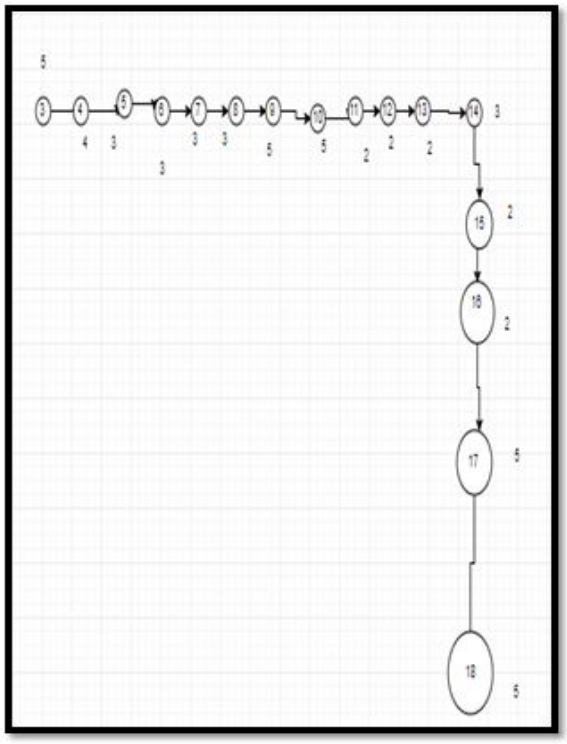

FIG.1.INITIAL STATE OF LINE DIAGRAM OF PLANT

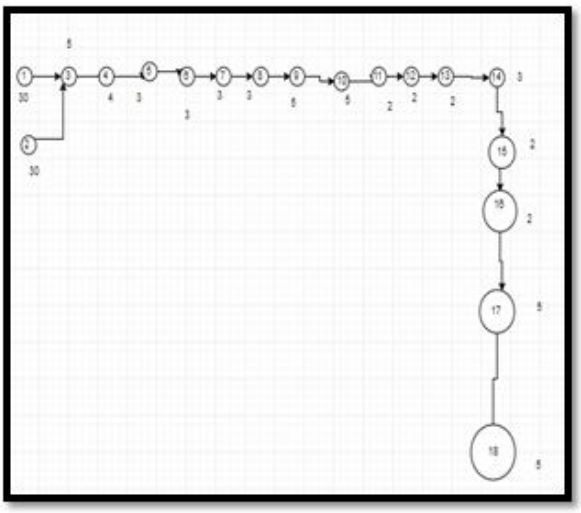

FIG 2. FINAL STATE OF LINE DIAGRAM OF PLANT

B. Lean Tools Implementation

Cycle Time Study

Before going to cycle time study we know the production capacity of plant, and identified the workstations. Then activities are sorted out which are Value Added VA, Non Value Added NVA, and Partially Non Value added PNVA.PNVA activities are focused to eliminate or reduce and NVA activities are focused to eliminated.

Line Imbalance Calculation

In this case study at all workstations Cycle time study carried out and 7 wastes were identify at each workstations. Also, Line balancing delay percentage was calculated as 11.71 and number of operators as 47.After line balancing implementation which workstations total cycle time more than target cycle time consider as bottleneck stations which should be considered for the improvement on priority.

TABLE 2.STATE OF LINE BEFORE LINE BALANCING

Maximum Cycle Time in min	5
Total tasks Time in min	111
No. Operators	47
Imbalance Ratio in %	11.7

Bottleneck Identification and Elimination

In the line work station had total cycle time more than the target were bottleneck station. So, Operations 1& 2 are consider as bottleneck operations. Operation 1 was cut the sheets so this preplanned work for before to production. Operation 2 Inner tank preparations give to subcontract by make or buy decision analysis.

IV. RESULT AND DISCUSSION

In lean Tools were like cycle time study, line imbalancing calculation,5'S,kaban,and kaizen, space utilization techniques were used.

TABLE 3.LINE BALANCING RESULTS AFTER LEAN TOOLS IMPLEMENTATION:

S.NO.	Improvement	Before	After	Saving	% Improvement
1	Manpower	46	38	8	17
2	Line Balancing efficiency	82.29	92	6.2	9
3	Production Rate/day	100	125	25	25
4	No.of work stations	27	12	15	55
5	Total Cycle time in minutes	115	55	60	52.17
6	Maximum Time in minutes	49	45	0.4	8.1

V. CONCLUSION

After implementation the lean manufacturing tools the existing line is balanced and efficiency increase and productivity and production rate improved. Lean manufacturing system is continuous improvement process and improve production rate step by step. Many industries are facing lot of problems like inability to meet production targets,imbalance of work content at work stations, discontinuity in material flow, manpower allotment. Those types of problem are solving by implementation of lean manufacturing system.

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