

Resolving Production-Demand Mismatch In A Batch Process Manufacturing Firm

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Abstract — This study is to identify and analyze the factors that has direct impact and influence on not meeting the demand in Aluminium Industries Limited, Kundara. Aluminium Industries Limited, Kundara is a small scale industry who manufactures Vacuum circuit breaker. There are 68 employees in the company in regular shift from 8:30am to 4:30pm. This paper aims to identify the various factors and problems affecting the productivity of the firm. In order to access and interpret the issues relevant to productivity the actual time for each operation was calculated. The various key factors affecting productivity, namely the cycle of operations, material handling and management of manpower are discussed. A questionnaire survey was conducted among the 68 workers in the firm. Hence, this study helps to identify the bottleneck and suggest appropriate system to improve productivity..

Keywords- Keywords: Production; Productivity improvement; Work study.

I. INTRODUCTION

Manufacturers face many challenges in determining what to make, how much to make, and when to make it. When the firm fails to meet these challenges effectively, they suffer from a multitude of consequences. Keeping the demand and supply in a balanced form is a constant struggle in many manufacturing industries. A batch process manufacturing firm has been chosen for the study. Aluminium Industries Limited (ALIND), Kundara, Kollam is one of the top Electric Relay dealers which manufactures Vacuum circuit breaker for Indian Railway. The company follows German technology for assembling the Vacuum circuit breaker (BLR system). There are 68 permanent workers in the company. The company has single shift from 8:30am to 4:30pm (regular shift). Initial discussions with the top manager of ALIND, Kundara has indicated that the company fails to meet the customer demand. Current monthly demand of the company range from 120-150 numbers of Vacuum circuit breaker. But the company is able to produce only 70-100 numbers of Vacuum circuit breaker per month.

II. METHODOLOGY

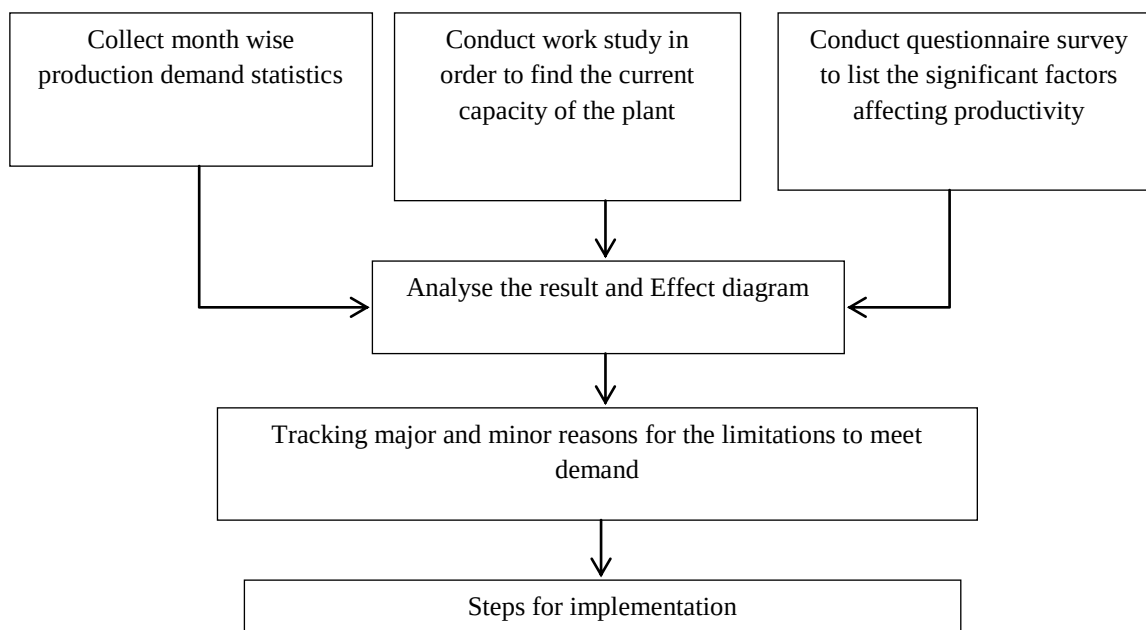


Figure 1. Methodology

III. DATA COLLECTION

The data were collected through work study. The major operations were divided into smaller elements/components by work breakdown method. The initial stage was to gather information about various activities in the operations. Information included details about machinery used, number of workers, time required for completing each activities or elements of the operations. After method study, time study was conducted to assess the time requirement of individual activity. Each operation was considered separately for work study. Work study helped to assess time required for completing one cycle of the operation. Initially the standard time required for each operation was taken for analysis. Time study of each section is given below.

Table 1. Time Study of Painting Section.

Sl.No	Operations	Standard time (min) (4 items)	Time available (min)	No. of Workers	Weekly production per worker (No.'s)	Total Weekly capacity (No.'s)
1	Primer coating (C-I items)	326.34	675	3	8	24
2	Painting (C-I items)	324.34	675	3	8	24
3	Primer coating (C-II items)	259.96	675	3	10	30
4	Painting (C-II items)	247.42	675	3	10	30

Table 2. Time Study of Galvanizing Section.

Sl.No	Items	Time required (min)
Section : 1		
1	Spring	87
2	Washer	55
3	Clamp	63
4	Pin	60
Section : 2		
1	Needle	96
2	Needle Cage	60
3	Nut	53
4	Screw	50
Section : 3		
1	Spacer	111
2	Rivet	78
3	Spindle	60
4	Protection Plate	60
TOTAL TIME = 87+96+111 = 294 min.		

Table 3. Time Study of Electrical Wiring Section.

Sl.No	Electrical wiring	Cycle Time in min	Standard time in min	Daily production (No.'s)	Weekly production capacity (No.'s)
1	Grey wiring	72	79.92	5.63	33
2	Black wiring	88	97.68	4	24
3	Green wiring	45	49.95	9	54

Table 4. Time Study of Welding Section.

Sl.No	Operation	Manpower required	Actual time (min)	Standard time (min)	Daily production (No.'s)	Weekly production capacity (No.'s)
1	Welding	3	280	324.8	4	24

Questionnaire survey.

A questionnaire survey was conducted among the workers of the Aluminum Industries Limited, Kundara. A total of 68 people responded to the survey. Since the sample size was less, the survey is only considered as quick response survey, to identify major factors affecting productivity in the firm and no statistical analysis was carried out.

IV. RESULTS

After analysing the data collected from the various sections through work study, improvements are made. Improved time study for each section is distributed as follows:

Table 5. Improved Time Study of Painting Section.

Sl.No	Process	Current Standard time (min) for 8 items	Improved Standard time (min)	Current Total Weekly capacity (No.'s)	Improved Total Weekly capacity (No.'s)
1	Primer coating (C-I items)	652.68	475.52	24	34
2	Painting (C-I items)	648.68	472.19	24	34
3	Primer coating (C-II items)	519.92	381.95	30	43
4	Painting (C-II items)	494.84	356.53	30	46

Table 6. Improved Time Study of Galvanizing Section.

Sl.no	Items	Total time required (min)
SECTION : 1		
1	Spacer	111
2	Needle	96
3	Spring	87
4	Rivet	78
SECTION : 2		
1	Clamp	63
2	Needle cage	60
3	Protection plate	60
4	Washer	55
SECTION : 3		
1	Spindle	60
2	Pin	60
3	Nut	53
4	Screw	50
TOTAL TIME = 111+63+60 =234 min.		

Table 7. Improved Time Study of Electrical Wiring Section.

Sl.No	Electrical wiring	Cycle Time in min	Standard time in min	Daily production (No.'s)	Weekly production capacity (No.'s)
1	Grey wiring	72	79.92	5.63	33
2	Black wiring	88	97.68	5	30
3	Green wiring	45	49.95	8	48

Table 8. Improved Time Study of Welding Section.

Sl.No	Operation	Manpower required	Actual time (min)	Standard time (min)	Daily production (No.'s)	Weekly production capacity (No.'s)
1	Welding	4	280	324.8	5	30

Questionnaire survey results.

Table 9. Major factors identified from the questionnaire survey

Sl.No	Factors
1	Improper work facilities
2	Setting of goals and targets
3	Nature of work given
4	Frequent changes in teams
5	Proper work allocations
6	Raw materials available on time
7	Delay of items from any section during production

The cause and effect diagram prepared from the quantitative aspects of quantitative and qualitative aspects of investigation of work environment is shown below.

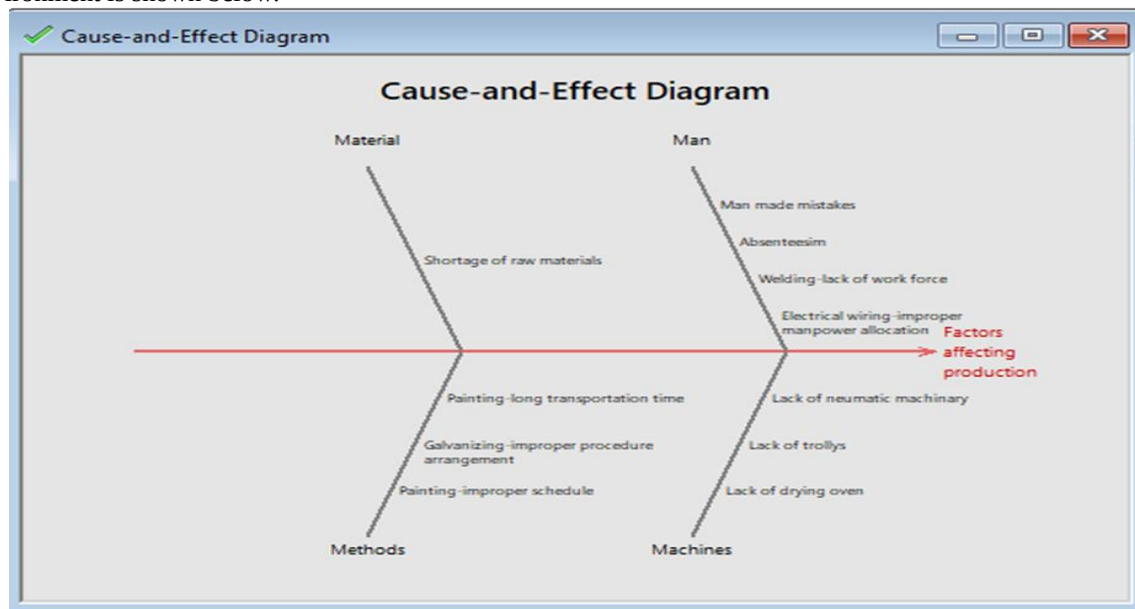


Figure 2. Cause and Effect diagram

4.1. Suggestions and recommendations

Table 10. Major issues identified and recommended improvements

Sl.No	Issues identified	Recommended improvements
1	Long transportation time in painting section	Increasing no. of items taken per cycle (from 4 to 8 no.). All items for drying are transported together for each cycle
2	Long cycle time due to improper arrangement of items in galvanizing section	Changing the arrangement of items in cycle according to the time required for galvanizing

3	Lack of manpower in welding section	Employing one more worker in the welding section.
4	Lack of manpower in black wiring section	Utilise idle worker from green wiring section
5	Lack of raw materials	Regular inspection of inventory levels.
6	Drying time and transportation time to drying area is high	Introduce drying oven near painting section
7	Man made mistakes in welding	Proper training should be provided for workers in welding section
8	Incompatible materials	Proper checking of specification of incoming materials

Table 11. Stages of Implementing Recommendation.

Painting Capacity : 24 No. to be produced : 24 Galvanising Capacity : 24 No. to be produced : 24 Electrical wiring Capacity : 24 No. to be produced : 24 Mechanical assembling Capacity : 33 No. to be produced : 24 Welding Capacity : 24 No. to be produced : 24 Total assembling Capacity : 32 No. to be produced : 24	Painting Capacity : 34 No. to be produced : 24 Galvanising Capacity : 30 No. to be produced : 24 Electrical wiring Capacity : 24 No. to be produced : 24 Mechanical assembling Capacity : 33 No. to be produced : 24 Welding Capacity : 24 No. to be produced : 24 Total assembling Capacity : 32 No. to be produced : 24	Painting Capacity : 34 No. to be produced : 30 Galvanising Capacity : 30 No. to be produced : 30 Electrical wiring Capacity : 33 No. to be produced : 30 Mechanical assembling Capacity : 33 No. to be produced : 30 Welding Capacity : 33 No. to be produced : 30 Total assembling Capacity : 32 No. to be produced : 30
INITIAL STAGE	TRAINING PERIOD	IMPROVED STAGE

Table 12. Overall Benefit to the Plant after Implementing Recommendations

Sl. No	Department	Current capacity per month	Improved capacity per month
1	Painting	96	136
2	Galvanizing	96	124
3	Electrical wiring	96	132

4	Mechanical Assembling	132	132
5	Welding	96	132
6	Total Assembly	128	128
	Maximum output possible	96	124
	Percentage of capacity	100.00%	129.17%

V. CONCLUSIONS

In this paper a simple, yet effective framework to enhance the productivity and efficiency in a small scale industry was proposed. This paper discusses the elements of a framework to deal with the aspects to be considered for identifying the factors and improving productivity. The framework then suggests further improvements as an extension of the field study, based on the steps described in the framework. Quantitative analyses of the measurements were performed in the next step, after the framework is defined. The current capacity of the plant in each section was found out.

In Aluminum Industries Limited, Kundara the performance standards based on production time for operations were fixed. A significant time difference between current operations cycle time and standardized time is observed for the production cycle of the various section was made. Painting sections, galvanization section, electrical wiring section and welding sections have low capacity for production. Various shortcomings that affect production in the firm were analyzed. Improvement recommendations are suggested for current short comings were provided. Improvement using recommendations given can increase the production capacity of overall plant by 29.7%

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