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Productivity Improvement of Assembly Line of Cotton Ginning Machines

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Abstract: ***Problem-solving and ongoing procedure enhancements are key elements to obtaining quality improvement in business operations. Many process and machine improvement strategies have been suggested and implemented in organizations, where define, measure, analysis, improve and control is mostly applied. Here we aimed at improving the machine productivity of assembly line in a cotton ginning assembly line in an Industry. The tool which is used to improve the productivity of assembly line are time study and method study. Based on this, the study provides data of time required for each assembly processes, sequence of each operations and flow of the product in assembly line. The present study has been done at an industry, a leading manufacturer of cotton ginning machine. The aim of the study is to identify the various problems on the assembly line which causes unnecessary delay in the operations. The problem is found in the assembly line and is solved by work study techniques and it is found that cycle time of bottle neck operation was reduced by 40.08 % per trolley.***

Index Terms: Bottlenecks in the assembly line, side frame, crossbars and rails, imbalances at workstations, seed guard jumbo fitting.

I. INTRODUCTION

In the original assembly method, the product is assembled and passes through six workstations. All workstations has one or two workers for the assembly operation. The side frame, crossbars and rails are fitted at station 1 then it is passed to station 2 where fitting of side channels takes place. The product is passed to station 3 where back knife, knife holder, fix knife and seed guard jumbo are fitted and passed to the station 4 where ratchet, side plate and beater assembly fits. The unfinished product is passed to the station 5 where weight lever and gear box are fitted and then move the product to the station 6 where gear box plate cover is fixed. This finished product is now ready for the inspection.

II. OBJECTIVES:

- To identify the operations causing bottlenecks in the assembly line.
- By using the method study technique, identify the problem work stations in the assembly line.
- Develop a method to solve the problem which is causing unnecessary delay in the assembly line.
- Conduct time study in the assembly line after implementation of the new method for trial period of 10 days.
- Suggest new method to the concern personnel in the organisation.

Figure 1: Assembly line of cotton ginning machine

Observations and analysis:

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Table 1: Imbalances at workstations before implementation of the new method

SN	Operation sequence	Average time (seconds)	Work station	Workstation time (seconds)	Cycle time	Imbalance
1.	Side Frame	88.66	1	474.63	403.54	-71.09
2.	Cross bar fitting	21.8				
3.	Rail fitting	86.83				
4.	Seed channel loose fitting	278				
5.	Seed channel 1 tightening	99.63	2	373.83		29.71
6.	Seed channel 2 tightening	274.2				
7.	Back knife fitting	88.53	3	288.3		115.24
8.	Knife holder fitting	110.4				
9.	Fix knife fitting	9.67				
10.	Seed Guard Jumbo fitting	79.83				
11.	Ratchet fitting	18.5	4	417.47		-13.93
12.	Side plate fitting	82.33				
13.	Beater assembly fitting	316.63				
14.	Weight lever fitting	168.1	5	500.9		-97.36
15.	Gear box fitting	333.13				
16.	Gear box plate cover fitting	366.13	6	366.13		37.41

Table 2: Imbalances At Workstations After Implementation Of The New Method

SN	Operation sequence	Average time (seconds)	Work station	Workstation time (seconds)	Cycle time	Imbalance
1.	Side Frame	88.66	1	474.63		-71.09
2.	Cross bar fitting	21.8				
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4.	Seed channel loose fitting	278				
5.	Seed channel 1 tightening	99.63	2	373.83		29.71

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13.	Beater assembly fitting	316.63				
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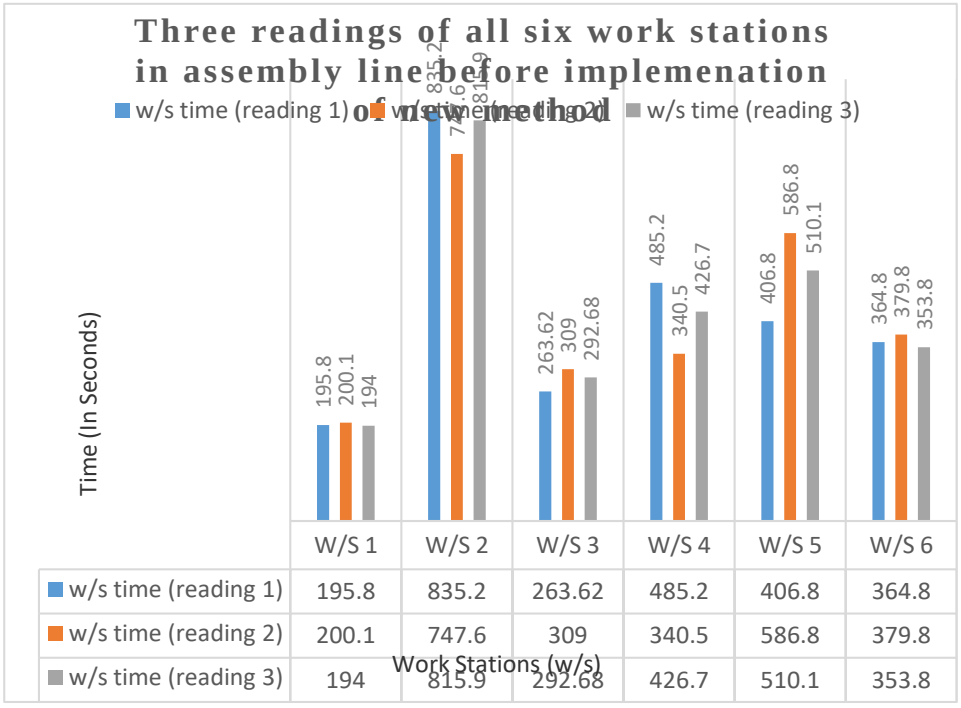
15.	Gear box fitting	333.13				
16.	Gear box plate cover fitting	366.13	6	366.13		37.41

After changing the operation sequence in the process sheet and by changing the wrench, we can see that the imbalances at all the workstations reduced.



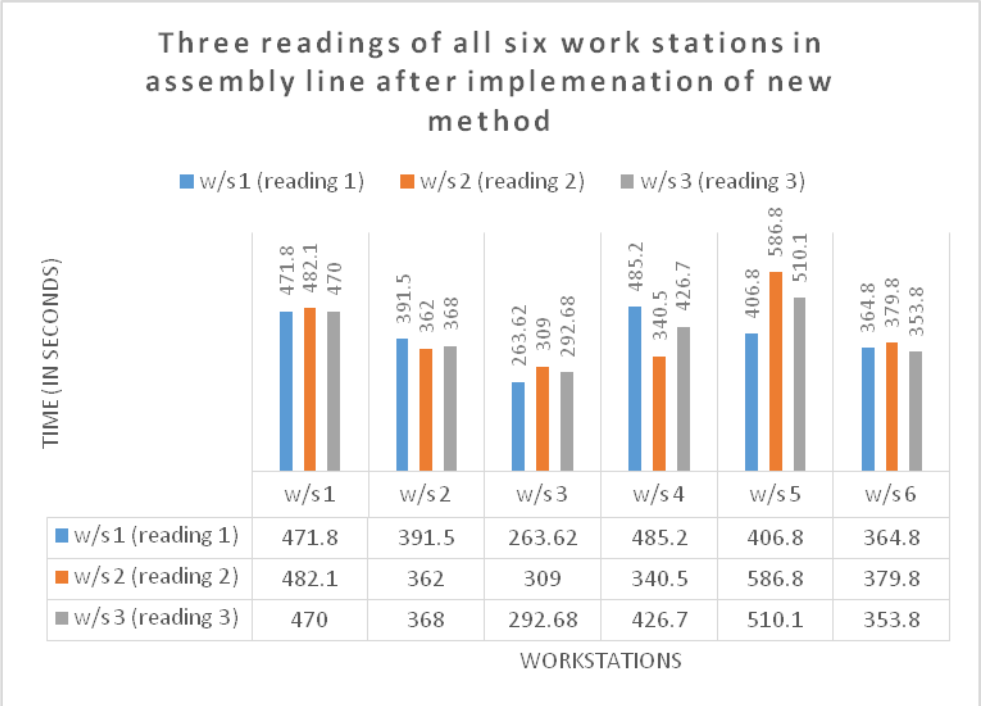


Figure 2: Comparison of workstation times of all workstations before and after implementation of new method for productivity improvement

I. CALCULATIONS:

Cycle time of each operations in the work stations and work station time are given above in the table. Thus by using the above table we can calculate line efficiency of the assembly line.

- Number of work stations = 6
- Capacity of assembly line = 40 units per shift per day
- Total shift time = 480 minutes
- Unproductive time or worker allowances = 60 minutes

- Actual production time = Total shift time - Unproductive time or worker allowances

  = 480-60
  = 420 minutes.

- For full capacity, time required by one workstation for one trolley

$$= \frac{\text{Actual production time}}{\text{Capacity of plant}}$$

$$= \frac{420}{40}$$

= 10.5 minutes

- Therefore, line efficiency before implementation of new method

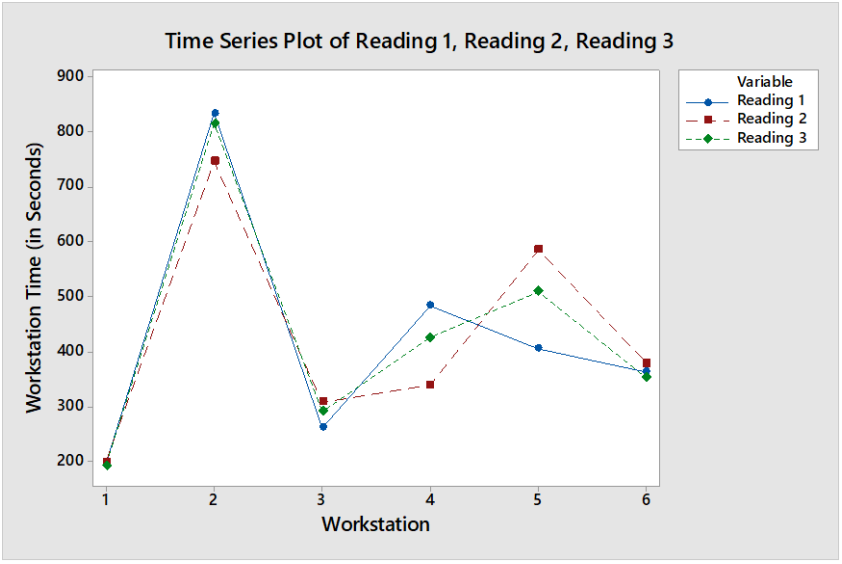
$$= \frac{\text{Actual production time}}{\text{number of workstations} \times \text{largest workstation time}}$$

$$= \frac{420}{6 \times 13.92} = 50.28\ \%$$

- Line efficiency after implementation of new method

$$= \frac{420}{6 \times 8.34} = 83.93\%$$

Thus by implementing new method, line efficiency increases from 50.28% to 83.93%.



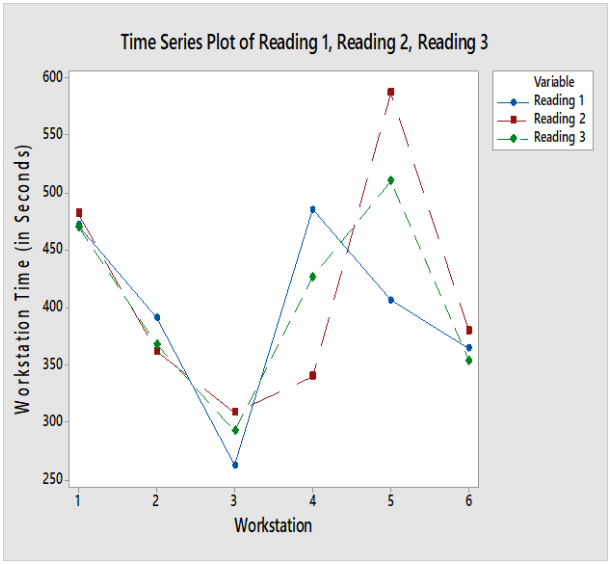


Figure 3: comparison of the workstation 1 and workstation 2 before and after implementation of new method

It can be seen and compared from the above two graphs that the workstation time of workstation 1 is increased and workstation time of w/s 2 is decreased by changing the operation in the process sheet and thus reducing w/s time of the workstation 2.

I. CONCLUSIONS

- The result can be concluded that the time required to complete the sub assembly of seed channel in the work station 2 is reduced to 8.34 minutes from 13.92 minutes.
- Percentage decrease in time by above study is

$$= \frac{13.92 - 8.34}{13.92} \times 100$$

= 40.08 %

- Thus the productivity of the assembly line of the cotton ginning machine is improved and the line efficiency are increased by the application of work study and change in operation in the process sheet.
- Thus by implementing new method, line efficiency increases from 50.28% to 83.93%.
- Thus the bottle neck between station 1 and station are eliminated.

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Dr. Ashok G. Matani is Ph.D. (Mech. Engg). MBA (Marketing) Having total (Academic, Research, Administrative & Industrial) = 28 Years. Areas of Interest included :

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