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IMPACT OF WORKING ENVIRONMENT AND PRODUCTIVITY IMPROVEMENT ON ASSEMBLY LINE THROUGH REDUCTION OF DOWN TIME- A LEAN APPROACH

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ABSTRACT

Lean manufacturing is a management philosophy derived mostly from the Toyota production system. It is an applied methodology of scientific, objective technique that cause work tasks in a process to be performed with a minimum of non-value adding activities resulting in greatly reduced wait time, queue time, move time, administrative time, and other delays. The prime objective is to evolve and test few strategies to eliminate waste on the shop floor. This work is focused on improving the productivity of the seat welding and assembly plant by reducing the down time using lean tools. The non-value added activities, which are identified in the assembly line will be eliminated using lean tools. The paper addresses the productivity improvement of a seat welding and assembly line. The goal of this paper is to identify and reduce the downtimes. An attempt has been made in this paper to present some experiences of implementing new productivity improvement strategies in a small company. The project has taken place at Faurecia Automotive Seating India located in Pune producing seat frames for Volkswagen India. In this paper, experiences with implementation of productivity improvement strategies are presented.

Key words: Lean manufacturing, Productivity improvement, Assembly line.

INTRODUCTION

Assembly line balancing is the term commonly used to refer to the decision process of assigning tasks to workstations in a serial production system. The task consists of elemental operations required to convert raw material into finished goods. Line balancing is a classic operations research optimization technique, which has significant industrial

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importance in lean system. The concept of mass production essentially involves the line balancing in assembly of identical or interchangeable parts or components into the final product in various stages at different workstations. With the improvement in knowledge, the refinement in the application of line balancing procedure is also a must. Task allocation of each worker was achieved by assembly line balancing to increase an assembly efficiency and productivity.

For balancing an assembly line, one has to take into consideration the following issues such as number of products or models, deterministic or stochastic nature of task durations, line-layout, flow of work pieces, and level of automation. Accordingly, one can think of different classes of assembly line.[1] For a detailed review of the related literature on generalized assembly line balancing, one may refer to Scholl[2] and Becker and Scholl.[3] There are three ways of handling an optimization problem involved in assembly line balancing. These are heuristic approach,[3-5] programming approach[6-8] and knowledge based approach.[9,10]

This work deals with end to end perspective of reducing the down times at the seat manufacturing assembly line. The aim of the paper is to improve productivity of the seat manufacturing assembly line by reduction of down times using lean techniques. Productivity is one of the keys to financial success of the enterprise. Productivity is defined as the ratio of what is produced to what is required to produce it? Productivity improvement is wide, vague, and open to different interpretations. It's often troubling, undesirable, and less than productive to invest an endless amount of time and effort into trying to improve productivity. Yet, it is invariably important to be able and identify the organizational constraints, which are preventing the organization from becoming more efficient and competitive. Utilizing engineering tools will map and identify the main non-productive segments in productivity line and draft a plan to address and remedy the issues. This paper focuses on cells doing manual assembly and robotic welding. Also, a range of productivity improvement techniques have been implemented.

Methodology

The most common methodology is to improve operational performance of the assembly line.

The approach started with identification of the seven wastes of production (MUDA Category).

Table 1: Data collection for identifying major repeating factor in the 7 wastes of production

Observation	Muda category (7 wastes)						Defects	Dept.				Time taken
	Trans-port	Inven-tory	Motion	Waiting	Over production	Over processing		PC & L	Mainte-nance	Quality	UAP	In sec
11/11/2013 from 6:57 am												
Operator in-efficiency											…	68
LH HA			…					…				73
LH HA			…									61
Operator waiting				…	…							120
RH HA				…								85
RH HA			…									61
Waiting for succeeding station				…								67
Preceding station slow				…								86
Next station slow				…								90
Operator negligence and next station slow				…								76
RH HA											…	67
Preceding station slow				…								77

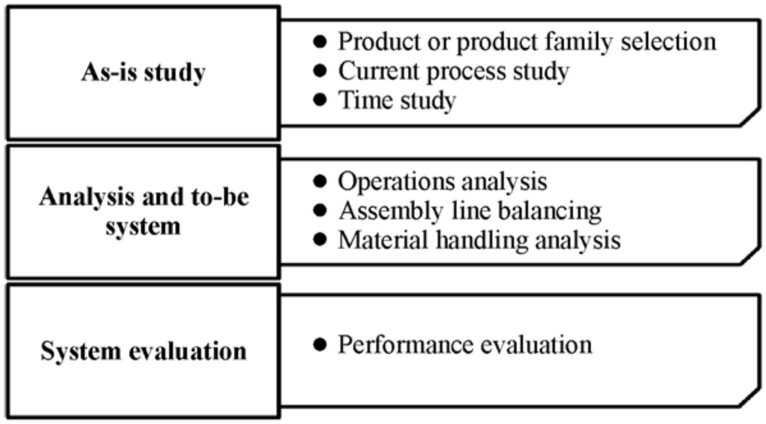

Fig. 1: Operational performance of the assembly line

The inference from data collection was as depicted in the pie chart :

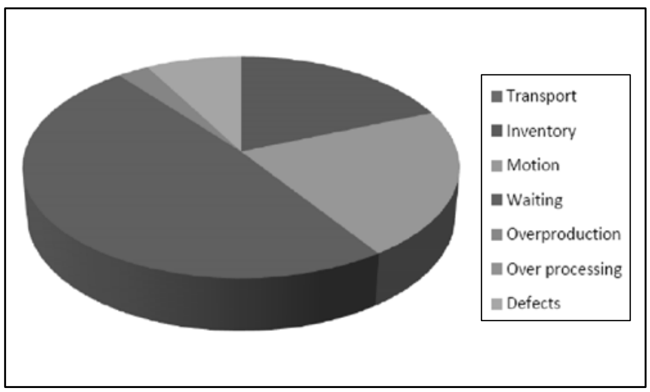

Fig. 2: Pie chart indication-distribution of the 7 wastes of production

The next step was to identify the bottleneck station as operator waiting was found to be the major repeating factor.

C.T on Station 1 in average time 69.1 s

68	**70**	**66**	**72**	**65**	**69**	**68**	**70**	**73**	**70**	sec

C.T on Station 2 inaverage time 71.7 s

70	**75**	**74**	**71**	**69**	**73**	**71**	**70**	**74**	**70**	sec

C.T on Station 3 in average time 65.1s

63	**66**	**64**	**62**	**65**	**66**	**61**	**67**	**63**	**64**	sec

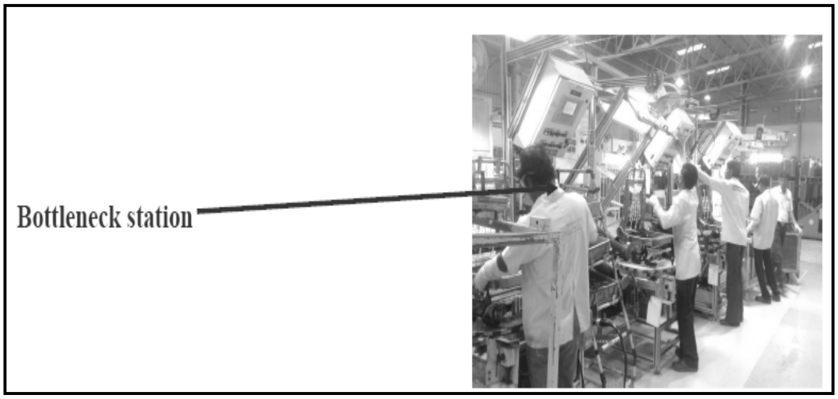

Fig. 3: Image indicating the bottleneck station

The 7 deadly wastes of production were first identified to develop a kaizen state of mind to ensure continuous progressing towards standardization. For this purpose, a team was formed and an active participation resulted in solutions to remove non-value added activities. Major actions implemented were:

- Burnishing cycles on station three is reduced from 10 to 5
- Polyvalence level of operators improved by rotation plan

One End stopper fitment and manual tightening shifted to station three

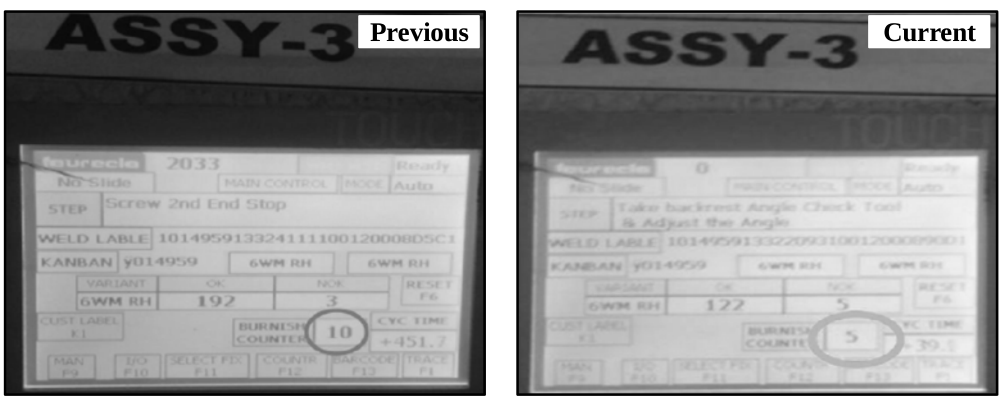

Fig. 4: PLC on station two prior to and after the activity

RESULTS AND DISCUSSION

After successful completion of Hoshin activities at height adjustment assembly line cycle time was reduced from 71.7 sec to 65.1 sec. Work content of all the workstations are equalized. The parts board turned green and the operators were motivated to suggest improvement ideas.

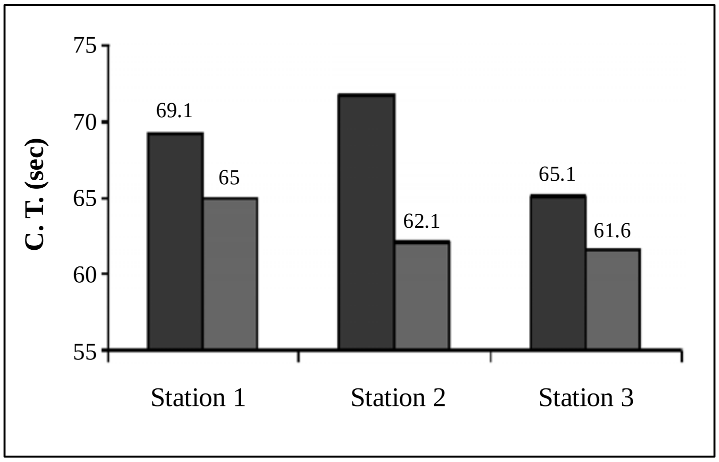

Fig. 5: Graphical comparisons on cycle time

The cycle time readings were again validated

C.T on Station 1 in sec average time 65 s

66	**65**	**67**	**69**	**60**	**64**	**63**	**64**	**62**	**65**

C.T on Station 2 in sec average time 62.1 s

60	**63**	**64**	**58**	**62**	**63**	**62**	**64**	**62**	**63**

C.T on Station 3 in sec and average time 61.6 s

65	**55**	**57**	**62**	**62**	**63**	**62**	**63**	**64**	**63**

The company achieved an average profit of Rs. 1.23 lacs per day over the last four months after the hoshin activity of improving the line productivity.

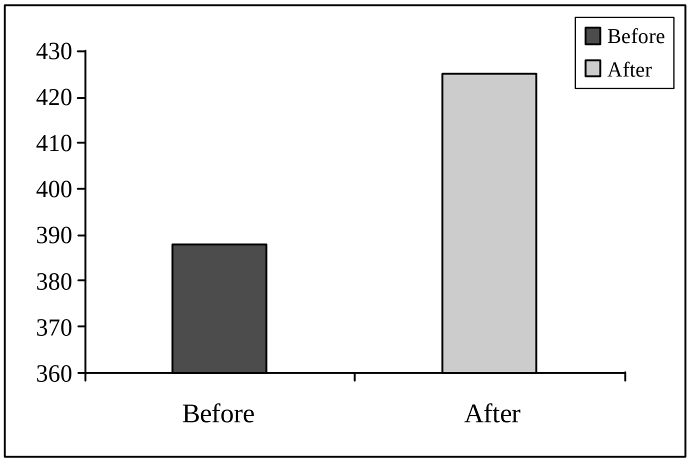

Fig. 6: Graphical comparison on the no. of seats

CONCLUSION

In this paper, the productivity improvement technique has been implemented resulting in effective outputs. Several tools were used to improve the productivity of the plant. These tools include assembly line balancing and hoshin exercise. The details of the productivity problems, the strategies and steps of implementation have been clearly discussed. This paper helped to determine the key elements of successful implementation of any technique. The essential one was top management support, the key element for continuous improvement as there should be a continuous expectation for improvement. Consistent and accurate data collections are the key in evaluating the actual production capabilities. Any improvement should be business driven as the aim is to be more competitive, to improve on areas, which are useful to the company. With successful implementation of these tools it has improved the productivity of the two assembly lines thereby adding to the profit.

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