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LEAN MANUFACTURING IMPLEMENTATION IN TEXTILE INDUSTRIES FOR WASTE ELIMINATION

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Abstract

Due to the increasing labor wage in developed countries, the garment manufacturing has been migrating from the high wage developed world to low wage developing countries. Even though the labor cost is cheaper than in developed countries; due to the specific market nature of the garment industries for example: the short production life cycle, high volatility, low predictability, high level of impulse purchase, the quick market response; garment industries are facing the many of the greatest challenges these. Keeping all this in mind the Lean manufacturing tools are implemented in the selected company. Data is collected from different section like stitching, finishing, cutting etc. in the given time the productivity is measured and compared. Due to the corrective measure taken against the bottlenecks identified and finally the improvement has been observed.

Key Words: Garment Industries, Lean Manufacturing, Performance Improvement

I. INTRODUCTION

Garment industries in developing countries are more focused on sourcing of raw material and minimizing delivery cost than labor productivity because of the availability of cheap labor. Due to this, labor productivity is lower in developing countries like India than in the developed ones. For example, labour is very cheap in India but the productivity is poor among other developing countries (Shahidul and Syed Shazali, 2011). Similarly, the cost of fabric is a major part of the garment so there seems to be great need for improvement in this sector. Even in developing countries the CAD and CAM system for fabric cutting has been implemented to save fabric and for increasing the flawless production. Now the worry is about labor productivity and making production flexible; because the fashion industry is highly volatile and if the orders are not fulfilled on time, the fear for losing business is real.

Even today, industries are getting the same or more volumes (orders), but the number of styles they have to handle has increased drastically. Earlier industries were getting bulk order so there is no need to worry; if the production line was set for the first time it would run for a month or at least a week or two. But nowadays due to small order quantities and complex designs, the garment industry has to produce multiple styleseven within a day; this needs higher flexibility in volume and style change over time (Shahram and Cristian, 2011).In some cases it has been observed that, in developing countries the garment industries are run as family business lacking skilled personnel as well as capital to implement new technologies for improving productivity and flexibility. Because of this, industries have been running in a traditional way for years and are rigid to change. They are happy as long as they are sustaining their business. They don't have much confidence and will towards innovation over old processes. Now the time has come to struggle with global market demand and niche market in garment industries if they want to run it further (Gao, Norton, Zhang and Kin-man To, 2009).

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II. RESEARCH OBJECTIVE

Objective of this research is to find out how we can use lean manufacturing to achieve the following:

a. To meet customer demand on time by eliminating non value added work from the process
b. To minimize the work in process inventory
c. To create flexibility of style changeover
d. To reduce rework percentage
e. To create a pool of multi-skilled operators who can respond quickly for changing style

III. LEAN PRINCIPLES

The major five principles of Lean are as follows (Burton T. and Boeder, 2003):
Principle 1: Accurately specify value from customer perspective for both products and services.
Principle 2: Identify the value stream for products and services and remove non-value-adding waste along the value stream.
Principle 3: Make the product and services flow without interruption across the value stream.
Principle 4: Authorize production of products and services based on the pull by the customer.
Principle 5: Strive for perfection by constantly removing layers of waste.

IV. KIND OF WASTES

According to David Magee, (Magee, 2007) different kinds of wastes in a process can be categorized in following categories. These wastes reduce production efficiency, quality of work as well as increase production lead time.

1. Overproduction – Producing items more than required at given point of timei.e. producing items without actual orders creating the excess of inventories which needs excess staffs, storage area as well as transportation etc.
2. Waiting – Workers waiting for raw material, the machine or information etc. isknown as waiting and is the waste of productive time. The waiting can occur in various ways for example; due to unmatched worker/machine performance, machine breakdowns, lack of work knowledge, stock outs etc.
3. Unnecessary Transport – Carrying of work in process (WIP) a long distance,insufficient transport, moving material from one place to another place is known as the unnecessary transport.
4. Over processing – Working on a product more than the actual requirements are termed as over processing. The over processing may be due to improper tools or improper procedures etc. The over processing is the waste of time and machines which does not add any value to the final product.
5. Excess Raw Material - This includes excess raw material, WIP, or finishedgoods causing longer lead times, obsolescence, damaged goods, transportation and storage costs, and delay. Also, the extra inventory hides problems such as production imbalances, late deliveries from suppliers, defects, equipment downtime, and long setup times.
6. Unnecessary Movement – Any wasted motion that the workers have to performduring their work is termed as unnecessary movement. For example movement during searching for tools, shifting WIP etc.
7. Defects – Defects in the processed parts is termed as waste. Repairing defectiveparts or producing defective parts or replacing the parts due to poor quality etc. is the waste of time and effort.
8. Unused Employee Creativity – Loosing of getting better ideas, improvement,skills and learning opportunities by avoiding the presence of employee is termed as unused employee creativity (Liker, 2003).

V. INDUSTRY BACKGROUND

The research is being conducted in a selected garment manufacturing industry nearby Bhopal. It is one of the renowned textile industry that manufacture various kind of garments. It has more than 20 sections. For the present research work one of the newly developed section whose products are Men's formal shirt in various order size. The factory consists of central cutting department, 3 independent stitching lines and central finishing (packing) section. Generally, the individual operators are responsible for the quality of individual work piece, even after that there is quality check (audit) at the end of each section (department) so that there should not be any defective

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parts transferred from one section to another section. The overall production flow chart of the shop floor is shown in the below Figure 1.

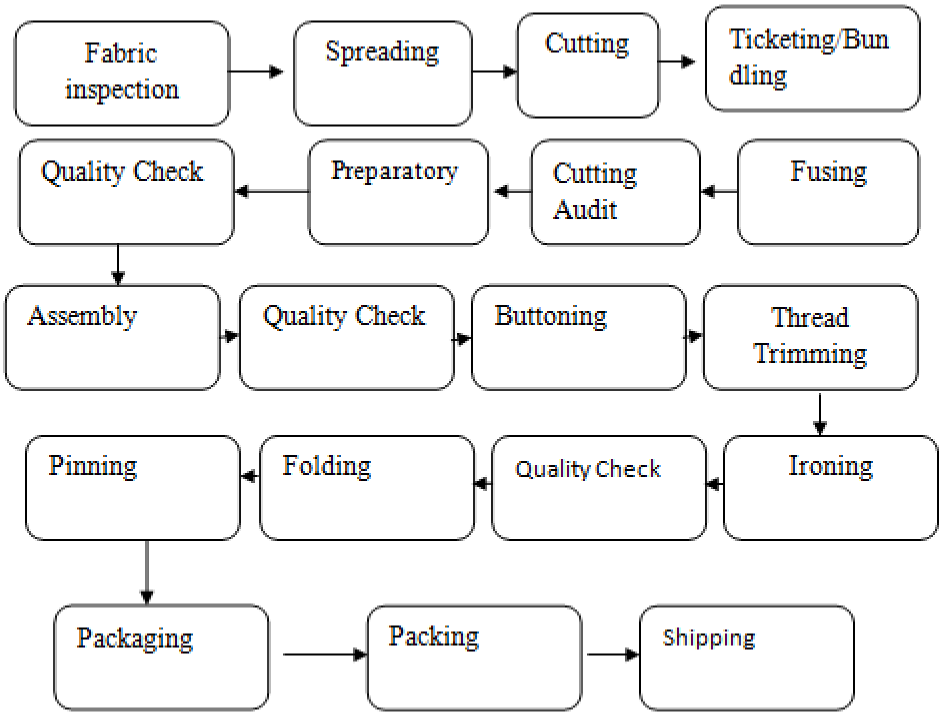

Figure 3.1: Garment production process flow chart

VI. EXISTING PRODUCTION LAYOUT

Existing layout of the sewing section (preparatory and assembly) is given in Figure 2, below. In this layout, the individual parts are made in preparatory sections and these parts are then transported manually to the assembly section. In the assembly section, these parts are assembled to shape a final garment. There is quality check at the end of each section to avoid defective parts to the next step. WIP movement in preparatory section is made with the help of the long table along with machines, whereas work aids attached with each machine serves this purpose in the assembly section.

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Feeding from Cutting	Cuff Hem		Cuff Run Stitch	
	Cuff Run Stitch		Cuff Trimming	
	Cuff top Stitch		Cuff Turning & Blocking	
	Cuff top Stitch		Cuff Button Hole	
Feeding from Cutting	Collar Run Stitch		Collar Trimming	
	Collar Top Stitch		Collar Blocking	
	Collar Band Hem		Collar Top Stitch	
	Collar Band Attach		Collar Band Attach	
	Collar Band Top Stitch	Table for WIP Movement	Collar Notch Making	
Feeding from Cutting	Pocket Marking		Pocket Hem	
	Pocket Attach		Pocket Iron	
	Pocket Attach		Extra Machine	
	Left Front Placket		Right Front	
	Front Button Hole		Back Yoke Label Attach	
Feeding from Cutting	Sleeve Placket Attach		Sleeve Diamond	
	Sleeve Placket Attach		Sleeve Diamond	
	Sleeve Pleats		Sleeve Button Hole	
	Collar, Cuff, Front, Sleeve Storage Rack			
Yoke Feeding	Yoke Attach		Yoke Attach	Yoke Feeding
Front Feeding	Shoulder Attach		Shoulder Attach	Front Feeding

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Sleeve Feeding	Sleeve Tacking	Sleeve Tacking	Sleeve Feeding
	Sleeve Attach	Sleeve Attach	
	Sleeve Top Stitch	Sleeve Top Stitch	
	Side Seam	Side Seam	
Collar Feeding	Collar Attach	Collar Attach	Collar Feeding
	Collar Close	Collar Close	
Cuff Feeding	Cuff Attach	Cuff Attach	Cuff Feeding
	Bottom Hem	Bottom Hem	

VII. CONDUCTING TIME STUDY

To calculate standard time for each operation, time study is conducted in the shop floor. To do this, the standard formal shirt is selected as a base line because operations differ from style to style and it is difficult to correlate all these operations of individual styles. After that, at least two operators were selected for each operation so that the difference in timing can be cross checked from the observed data of these two operators. To get better results, each operation time is taken for at least 15 cycles. Once time study is made by collecting raw data the performance rating is given to each operator and actual time is calculated for particular operation. Finally the Personal Fatigue and Delay (PFD) component is added on the calculated time and the operation time is standardized. The format of time study data collection sheet is as given.

While conducting time study some parameters are kept fixed (for example machine speed, stitches per inch, type of machine used etc.) to get consistent results. The PFD factor is taken as 15% of total time. This PFD is a little bit higher than normal industry standard; it is taken higher considering the standing operation and operator's movement inside the cell. Similarly the average performance rating is taken 100% for the ease of calculation only. This rating is adjusted average of actual ratings. The calculated SAM value for each section is attached in appendices.

Table 1: Cuff Section Operation SAM

Stitching Section	Stitching Operations	Observed Time (Sec)	PFD Allowance	Performance Rating	Calculated Time (Sec)
Cuff Section	Cuff Hem	24	15%	100%	27.6
	Cuff Run Stitch	35	15%	100%	40.3
	Cuff Trimming	23	15%	100%	26.5
	Cuff Blocking	20	15%	100%	23.0
	Cuff Top Stitch	33	15%	100%	38.0
	Cuff Button Hole	23	15%	100%	26.5
	Cuff Press	18	15%	100%	20.7
Total Cuff Section		176			202.4

Table 2: Collar Section Operation SAM

Stitching Section	Stitching Operations	Observed Time (Sec)	PFD Allowance	Performance Rating	Calculated Time (Sec)
Collar Section	Collar Run Stitch	24	0.15	1	27.6
	Collar Trimming	16	0.15	1	18.4
	Collar Turning & Blocking	16	0.15	1	18.4
	Collar Top Stitch	31	0.15	1	35.65
	Collar Band Hem	15	0.15	1	17.25
	Collar Band Attach	34	0.15	1	39.1
	Collar Peak Ironing	15	0.15	1	17.25
	Collar Band Top Stitch	18	0.15	1	20.7
	Collar Notching	12	0.15	1	13.8
Total Collar Section		181			208.2

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Table 3: Front Section Operation SAM

Stitching Section	Stitching Operations	Observed Time (Sec)	PFD Allowance	Performance Rating	Calculated Time (Sec)
Front Section	Pocket Marking	13	15%	100%	15.0
	Pocket Hem	15	15%	100%	17.3
	Pocket Iron	35	15%	100%	40.3
	Pocket Attach	45	15%	100%	51.8
	Left Front Placket	25	15%	100%	28.8
	Right Front	32	15%	100%	36.8
	Front Button Hole	36	15%	100%	41.4
	Back Yoke Label Attach	33	15%	100%	38.0
Total Front Section		**234**			**269.1**

Table 4: Sleeve Section Operation SAM

Stitching Section	Stitching Operations	Observed Time (Sec)	PFD Allowance	Performance Rating	Calculated Time (Sec)
Sleeve Section	Sleeve Placket Attach - continuous placket	40	15%	100%	46.0
	Sleeve Diamond	49	15%	100%	56.4
	Sleeve Pleats	11	15%	100%	12.7
	Sleeve Button Hole	15	15%	100%	17.3
Total Sleeve Section		**115**			**132.3**

VIII. TRIAL PRODUCTION ON NEW LAYOUT

There are a few challenges in this process because this layout is new to the people who have been working for years. The first difficulty is because of conversion of sitting operations to standing. Because operators were habitual of operating sitting machines and when these sitting machines were converted into standing they lost their control on pedal and it took some time to train them. Secondly, for work balancing purpose one operator has to perform multiple operations by changing machines, whereas operators don't like to work on multiple machines because they feel that management is overloading work on them.

The operators were convinced by saying that if people move around the machine they will not tire of the same operation and can work more effectively as well as feel less tired. At the same time they will learn multiple operations within their cell, which increases their skill and confidence. Similarly, the balancing of a cell is as per standard allocated minutes; so all the operators were given equal work load within their cell. Earlier to this, the critical operators were blaming

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management and supervisors for allocating them in difficult operations. Now by the implementation of SAM for work balancing the problem of uneven work load is solved.

IX. COMPARISON OF PRODUCTION TIME

Production time of the garment has been reduced by 1.65 minutes (i.e. approximately 8%). This has been achieved by combining 3 operations with other operations (cuff trimming combined with cuff run stitch, collar trimming combined with collar run stitch and sleeve tacking combined with sleeve attach) and by eliminating one operation (collar peak ironing removed by changing the shape of fusing) . The time needed to complete the work on different sections is shown in Figure 3.

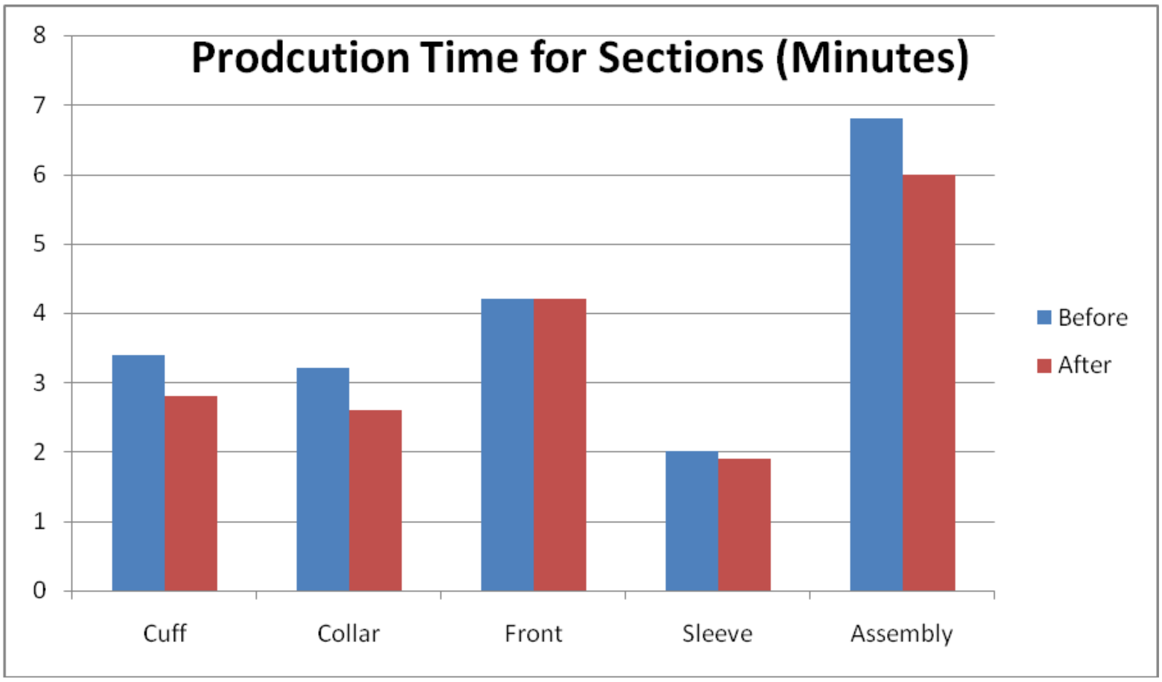

Figure 3: Comparison of production time for different stitching sections

X. CONCLUSION

In this study the lean manufacturing tools and techniques were studied and used in a selected case company (garment manufacturing industry). The problem of batch processing of existing company is addressed by using single piece movement of WIP. All stitching operations were standardized by means of time and working procedures, this will help management to know the production target per line and can make the production plan before loading actual products in the shop floor. This advance knowledge of the production target helps to allocate production operators on different styles according to the delivery schedule.

Similarly, allocation of workers in different work cells is as per the standard operation time. This motivates operators towards their work, because everybody is given equal work load by this system. At the same time each operator inside the cell should have to work on multiple operations. This eliminates accusing to supervisors for inappropriate allocations of operators in difficult operations.

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The other benefit of using cellular manufacturing is consistent output. In existing batch processing, if the critical operators were absent or there is any problem in machines of critical operations, the final output may drop drastically because there are few operators who can work on multiple jobs. Whereas, there is no such problem in case of cellular layout, because there are lots of operators who can do multiple operations. This eliminates the problem of production hikes and lows. In this way, consistent output can be achieved in cellular manufacturing.

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