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Implementation of Industrial Engineering Techniques for Improving Productivity and Its Impact in Controlling Labour Cost in Garment Industry

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Abstract
The garment industry aspires to improve productivity in an effective way. Lead time, rework, absenteeism, lack of line balancing, lack of process standardization are a few reasons, which result in low productivity and higher labour cost. Industrial engineering concepts are used to monitor production in garment manufacturing and improve productivity. The main purpose of industrial engineering is to increase productivity by eliminating waste and unproductive operations. A planned schedule is better implemented by identifying manpower requirements and allocation of this manpower in various departments. In other words, Industrial engineering is all about utilising man, machines, materials and energy in an effective manner. This can be done by the IE (Industrial Engineering) department where new styles are analysed and the operation breakdown, line balancing, skills of the operator, and risk analysis are determined. This work involving industrial engineering technique(s) such as time study, work study, two-handed process chart and line balancing enhance the production process. In this study, observations are made in the existing method and a new method (two-handed process chart) has been proposed, which increases productivity and reduces labour cost.
Key words*: Productivity, Industrial Engineering Techniques, Labour Cost, two-handed process chart*

I. INTRODUCTION

It is essential to find the factors that affect productivity [1]. It plays a vital role in identifying the issues influencing productivity. The evaluation of productivity can be done based on relationships between input and output of industry [2,3]. Modern Engineering is concerned with the plan, improvement and establishment of coordinated arrangement of men, materials and hardware. To manage the ongoing issues and difficulties, enterprises need to improve creation effectiveness and efficiency, diminish lead time, and guarantee appropriate quality necessities [4]. Failure mode and effects analysis (FMEA) technique is one of the effective tools which can help prevent, identify, control and eliminate possible errors occurring in the Apparel industry [5]. Time study is the solid tool used for balancing the sewing line as well as solving the bottlenecks in the apparel industry [2]. To improve the current situation in the apparel industry, this time study can be utilised, which in turn, accomplishes upgrades in the sewing area; for example, SMV, labour bottleneck, limit feasible, generation/hr, execution rating, balance %, etc. The objective of this work is to study the existing methods that are followed in the apparel industry, identify the reasons for low productivity in apparel units, and identify suitable industrial engineering techniques to increase productivity with reduced labour cost.

II. MATERIALS

The material selected for this work is woven shirt (cotton/polyester). The other requirements include stopwatch, a study board, and time study forms.

III. METHODS

This study is predicated on the first information that was collected through the interview schedule form. Time study was conducted in the first stage of the process where the time taken for each and every operation in the existing method was recorded. The methodology followed for the execution of the process is as follows:

- Analysing the causes for low productivity in the apparel industry;
- Selection of an apparel unit and study of existing methods followed for production;
- Analysing the problems observed during the study;
- Identification of IE techniques for improving productivity.

3.1 Analysing the causes for low productivity in the Apparel Industry [5,6]

The causes for low productivity include:

1. Improper machine layout and space utilization.
2. Inadequate material handling.
3. Ineffective method of sewing operations.
4. Improper inventory control system.
5. Absence of technological upgradation.

3.2 Selection of apparel unit and study of existing production methods.

Name of the Firm: Kads Resources Garments
Company's Policy: Quality products, Zero error
Business Type: Manufacturer & Exporter
The process flow followed for production execution is as stated below:

- ∇ Collar preparation
- ∇ Pocket preparation
- ∇ Flap preparation
- ∇ Sleeve preparation
- ∇ Front yoke preparation
- ∇ Back yoke preparation
- ∇ Placket preparation
- ∇ Front yoke attachment
- ∇ Back yoke attachment
- ∇ Shoulder seam
- ∇ Pocket attachment
- ∇ Flap attachment
- ∇ Collar attachment
- ∇ Sleeve attachment
- ∇ Side seam
- ∇ Tape attachment
- ∇ Care label attachment
- ∇ Size label attachment
- ∇ Bottom hem

Number of operations in the existing method: 19.
By using the Industrial Engineering technique(s), the number of operations used were considerably reduced by combining some operations.
The following four operations were combined in the proposed method (these were separate operations in the existing method):

1. Pocket and flap preparation
2. Front and back yoke preparation
3. Front and back yoke attachment
4. Pocket and flap attachment
5. Tape and label attachments

As a whole, eleven operations are combined into five operations. It is obvious that when the number of operations decreases, it lowers the cost of wages.

3.3. Analysing the problems observed during the study [8,9]

To understand the existing method followed in the factory, it is important to gather information relating to the number of labourers employed, number of machines, manpower utilisation and factory layout. During the study, the following problems in the sewing department were observed:

1. Absenteeism
2. Poor workmanship
3. Ineffective usage of material and space
4. Poor supervision
5. No training

3.4. Identification of IE techniques for improving productivity [7]

IE techniques may be enforced in each and every department associated with the execution of the order. However, the focus area was the sewing department. Based on observations of the existing method, two-handed process chart has been chosen to execute the new method.

IV. RESULTS AND DISCUSSION

4.1.1 Type of Operation: Front Yoke

Existing		Proposed	
A	Picking bodice	**A**	Picking bodice and
B	Picking yoke for one side	**B**	yoke Positioning
C	Positioning	**C**	Stitching
D	Sewing	**D**	Disposing
E	Disposing	**E**	Picking bodice and
F	Picking bodice	**F**	yoke Positioning
G	Picking yoke for other side	**G**	Sewing
H	Positioning	**H**	Disposing
I	Sewing		
J	Disposing		

In 4.1.1, Type of operation(s) for front yoke in the existing and proposed methods are shown. In the existing method, picking yoke for each side has been considered as a separate operation. In the proposed method, picking yoke has been combined with bodice operation, were bodice and yoke are picked together and considered as a single operation. The number of operations is ten in the existing method; this has been reduced to 8 in the proposed method where both hands are used simultaneously for picking and transporting.

4.1.2. Type of Operation: Back Yoke

Existing		Proposed	
A	Picking bodice	**A**	Picking bodice and yoke Positioning
B	Picking yoke	**B**	Stitching Disposing
C	Positioning	**C**	
D	Sewing	**D**	
E	Disposing		

In 4.1.2 Type of operation(s) for back yoke in the existing and proposed methods are shown. In the existing method, picking yoke and bodice are considered as two separate operations. In the proposed method, picking yoke and bodice are combined and considered as a single operation. The number of operations is 5 in the existing method; this has been reduced to two in the proposed method where both hands are used simultaneously for picking and transporting.

4.1.3 Type of Operation: Placket Preparation

Existing		Proposed	
A	Picking bodice front	**A**	Picking front bodice and
B	Picking placket for one side		placket positioning
C	Positioning	**B**	Stitching
D	Sewing	**D**	Disposing
E	Disposing	**E**	Picking back bodice and
F	Picking bodice		placket Positioning
	back	**F**	Sewing
G	Picking placket for other side	**G**	Disposing
H	Positioning		
I	Sewing		
J	Disposing		

In 4.1.3 Type of operation(s) for placket preparation in the existing and proposed methods are shown. In the existing method, picking bodice (front and back) and placket for each side are considered as four separate operations. In the proposed method, picking bodice (front and back) and placket for each side are considered as two operations. The number of operations is ten in the existing method; this has been reduced to seven in the proposed method where both the hands are used simultaneously for picking and transporting.

4.1.4 Type of Operation: Shoulder Attachment

Existing		Proposed	
A	Picking front	**A**	Picking front and back
B	Picking back	**B**	Positioning
C	Positioning	**C**	Folding stitching trimming
D	Folding	**D**	Top stitching disposing
E	Stitching		
F	Trimming		
G	Topstitching		
H	Disposing		

In 4.1.4 Type of operation(s) for shoulder attachment in the existing and proposed methods are shown. In the existing method, picking front and back bodice are considered as two separate operations. In the proposed method, these two operations (picking front and back bodice) are considered as a single operation. The number of operations is eight in the existing method; this has been reduced to four in the proposed method where both the hands are used simultaneously for picking and transporting.

4.1.5. Type of Operation: Sleeve Attachment

Existing		Proposed	
A	Picking bodice	**A**	Picking bodice and sleeve
B	Picking sleeve	**B**	Positioning
C	Positioning	**C**	Folding stitching top stitch disposing
D	Folding		
E	Stitching		
F	Top stitch		
G	Disposing		

In 4.1.5, Type of operation(s) for sleeve attachment in the existing and proposed methods are shown. In the existing method, picking bodice and sleeve are considered as two separate operations. In the proposed method, these two operations (picking bodice and sleeve) are considered as a single operation. The number of operations is seven in the existing method; this has been reduced to three in the proposed method where both the hands are used simultaneously for picking and transporting.

4.1.6 Type of Operation: Collar Attachment

Existing		Proposed	
A	Picking bodice	**A**	Picking bodice and collar
B	Positioning	**B**	Positioning
C	Picking collar	**C**	Sewing
D	Positioning	**D**	Turning Topstitching Disposing
E	Sewing		
F	Turning		
G	Topstitching		
H	Disposing		

In 4.1.6, Type of operation(s) for collar attachment in the existing and proposed methods are shown. In the existing method, picking bodice and collar are considered as two separate operations. In the proposed method, these two operations (picking bodice and collar) are considered as a single operation. The number of operations is eight in the existing method; this has been reduced to four in the proposed method where both the hands are used simultaneously for picking and transporting.

4.1.7.Type of Operation : Side Seam Finishing

Existing		Proposed	
A	Picking	**A**	Picking Positioning Stitching
B	Positioning	**B**	Turning
C	Stitching	**C**	Stitching other side Disposing
D	Turning		
E	Stitching other side		
F	Disposing		

In 4.1.7, Type of operation(s) for side seam finishing in the existing and proposed methods are shown. There is no change in the type of operations. The number of operations is six in the existing method; this has been reduced to three in the proposed method.

4.1.8 Type of Operation: Label Attachment

Existing		Proposed	
A	Picking bodice	**A**	Picking bodice and care label
B	Positioning	**B**	Positioning
C	Picking care label	**C**	Stitching Turning
D	Positioning	**D**	Picking rms label Positioning
E	Sewing	**E**	Sewing
F	Turning	**F**	Disposing
G	Picking rms label		
H	Positioning		
I	Sewing		
J	Disposing		

In 4.1.8. Type of operation(s) for Label attachment in the existing and proposed methods are shown. In the existing method, picking bodice and care label are considered as two separate operations. In the proposed method, picking bodice and care label are considered as a single operation. The number of operations is ten in the existing method; this has been reduced to six in the proposed method where both the hands are used simultaneously for picking and transporting.

4.1.9 Type of Operation: Bottom Hem

Existing		Proposed	
A	Picking	**A**	Picking Positioning Sewing
B	Positioning	**B**	Trimming Disposing
C	Sewing		
D	Trimming		
E	Disposing		

In 4.1.9. Type of operation(s) for bottom hem in the existing and proposed methods are shown. There is no change in the type of operations. The number of operations is five in the existing method; this has been reduced to two in the proposed method.

4.1.10. Type of Operation: Pocket Attachment

Existing		Proposed	
A	Picking bodice	**A**	Picking bodice and
B	Positioning		pocket Positioning
C	Picking pocket	**B**	Sewing
D	Positioning	**C**	Disposing
E	Sewing		
F	Disposing		

In 4.1.10, Type of operation(s) for pocket attachment in the existing and proposed method are shown. In the existing method, picking bodice and pocket are considered as two separate operations. In the proposed method,

picking bodice and pocket are considered as a single operation. The number of operations is six in the existing method; this has been reduced to three in the proposed method where both the hands are used simultaneously for picking and transporting.

V. CONCLUSION

By implementing the two-handed process chart, there has been effective utilisation of both left and right hand of the operators to carry out the sewing operations. The movements of the hands are recorded and the best methods of carrying out the operations were identified. This helps in job simplification and results in decrease in operating time. The proposed method was carried out in the same line where the existing method was followed. The number of operations is considerably reduced from 19 to 13. This results in an increase in productivity. By reducing the number of operations, labour cost also reduces, which is a key aim of every manufacturer.

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