MINIMIZATION OF REWORKS IN QUALITY AND PRODUCTIVITY IMPROVEMENT IN THE APPAREL INDUSTRY

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Abstract

The fast changing economic conditions such as global competition, declining profit margin, customer demand for high quality product, product variety and reduced lead–time etc. had a major impact on manufacturing industries. The demand for higher value at lower price is increasing and to survive, apparel manufacturers need to improve their operations through–Producing right first time quality and waste reduction. This paper discusses the quality and productivity improvement in a manufacturing enterprise through practical study. The paper deals with an application of methodology in an industry which provides a framework to identify quantify and eliminate sources of variation in an operational process, to optimize the operation variables, improve and sustain process performance with well-executed control plans. The application of this paper improves the process performance of the critical operational process, leading to better utilization of resources, decreases variations & maintains consistent quality of the process output. The outcome of this observation reflected that an industry may gain higher productivity and profitability with improved quality product by minimizing reworks activities. It also minimizes cost and improves internal throughput time. A general overview over this development is given in this paper.

Keywords— Costs, Operation, Productivity, Profitability, product Quality, Reworks.

I. Introduction

As the global economic condition changing in a rapid motion, generally in an industry more focus is given on profit margin, customer demand for high quality product and improved productivity. In garment manufacturing, it is usual few rejected garments after shipment. Reason, most of the manufacturers believe that garments are soft goods and non-repairable defect may occur due to low quality raw materials or faulty process or employee casual behavior. However, factory must have check points to control over this issue. There is no ready-made solution that can reduce rejection percentage overnight. Each order is unique. But this paper works suggest how to handle this issue and bring down rejection rate to minimum. We see a lot of rejected garment after shipment. Most of the organization termed these garments as rejected because those garments can’t be repaired by any means. Reworks in the garments industry is a common works that hampers the smooth production rate and focus poor quality products having an impact on overall factory economy. Minimization of reworks is a must in quality and productivity improvement. Rework is a vital issue for poor quality product and low production rate. Reworks are the non-productive activities focusing on any activity that customer are not willing to pay for. Non-productive activities describe that the customer does not consider as adding value to his product. By reacting quicker in minimization of reworks to make a product as per customer demand with expected quality, the company can invest less money and more costs savings. Therefore, a study was carried out in the garment industry named Opex & Sinha Textile Group located at Mirpur, Dhaka,
Bangladesh at cutting, sewing and finishing section to identify reworks so as to eliminate them for saving time, cost and improved product quality.

2. Problem Definition and Methodology

In the Apparel Manufacturing Industry, main raw material is fabric; others are different types of trimming and accessories. Operational wastages in the Apparel manufacturing process are- top surface rework, printed label rework, sewing fault rework, pinhole rework, fabric rework Improper fly shape, and other reworks. The general methodology followed to minimize reworks is given below.

1. Review of the existing quality system in the company
2. Identification of defects in the various departments by collecting data from old records
3. Analysis of data collected in order to identify majorly occurring defects
4. Categorization of defects
5. Development of a model Quality Inspection System

2.1. Review of factory existing Quality System

![Diagram of Quality System]

Fig. 1 Review of Existing Quality System
2.1. Identification of Defects
The reports of quality inspections in various departments were studied for the period of January – April- 2012.

2.1.1 Cutting Department:

2.1.2 Sewing Department

Fig. 2 Lots percentages overview of cutting departments

Fig. 3 Defect categories wise D.H.U in the sewing department
2.1.3 Categorizations of Defects

Sewing Defects: These defects are usually caused by errors arising from wrong functioning of sewing machines.

Seaming defects: These defects are usually caused by errors arising from the interaction of the operator and machine in the handling of garment.

Placement Defects: These defects are usually caused by errors arising in marking and cutting as well as sewing operations in the sewing room or a combination of these.

Fabric defects: These defects are usually caused by errors arising from the fabric processing like knitting and dyeing.

Embroidery defects: These defects are usually caused by errors arising from the embroidery processing of the garments.

2.1.4 Sewing Department Defects categories wise

![Defect categories wise D.H.U. (Defects per Hundred Unit)](image)

<table>
<thead>
<tr>
<th>Defect Categories</th>
<th>D.H.U.</th>
</tr>
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<tbody>
<tr>
<td>Seaming Defects</td>
<td>20.73</td>
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<tr>
<td>Sewing Defects</td>
<td>14.00</td>
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<tr>
<td>Placement Defects</td>
<td>3.37</td>
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<tr>
<td>Fabric Defects</td>
<td>1.02</td>
</tr>
<tr>
<td>Embroidery defects</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Total pieces inspected: 30030
Defects encountered: 11778
D.H.U.: 39.22

Where,
Seaming defects: 6224
Sewing defects: 4204
Placement defects: 1012
Fabric defects: 307
Embroidery defects: 31

Fig. 4 Defect categories wise D.H.U in the sewing department
2.2 Stages of Model Development

Identification of various options at the check points to capture defects

Selection of various tools to be used the model

Developments of model

2.3 Development of Model

2.4 Formats introduced in various departments.

1. Cutting audit format  2. Cutting pattern check format  3. Sewing in-line inspection format  
4. Sewing end-line inspection format  5. Sewing cause & effect analysis format  6. Finishing initial inspection format
3.0 Experimental Sewing Data

<table>
<thead>
<tr>
<th>DATE</th>
<th>Thread Tension</th>
<th>Slip stitch</th>
<th>Broken stitch</th>
<th>Roping</th>
<th>Puckering</th>
<th>Uneven fly shape</th>
<th>Uneven Top Stitch</th>
<th>Uneven Raw Margin</th>
<th>Exposed Raw stitch</th>
<th>Label Attachment</th>
<th>Measurement out</th>
<th>Total Checked Pieces</th>
<th>Total Defective Pieces</th>
<th>Percentage Defective</th>
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<td>134</td>
<td>2000</td>
<td>339</td>
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</tbody>
</table>

Table.1 Defect categories wise and percentage defectives in the sewing department
4.0 Cause & Effect diagram for major occurring defects and their implemented solutions

4.1 Measurement out of tolerance

<table>
<thead>
<tr>
<th>Method</th>
<th>Material</th>
<th>Communication</th>
<th>Man</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper sweep shape after panel attachment</td>
<td>Wrong size label attached</td>
<td>How to measure is not clear</td>
<td>Carelessness of operator</td>
</tr>
<tr>
<td>Puckering (handling)</td>
<td>Allowance not followed</td>
<td></td>
<td>Puckering due to machine</td>
</tr>
<tr>
<td>Improper sweep shape after panel attachment</td>
<td>Wrong type of fusing used</td>
<td>Notches not proper</td>
<td>Wrong pattern</td>
</tr>
<tr>
<td></td>
<td>Incompatible thread used</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Solutions Provided

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notches improper at pleats</td>
<td>Cutting Department was informed about the cause and the reason identified was misalignment of plies during cutting. This being a major defect causing activity was asked to be checked 100% in the audit before sending the bundles to sewing. A template was provided against which the pieces were checked and in case of any deviation, white pencil was used to mark pleat positions.</td>
</tr>
<tr>
<td>Improper sweep shape after panel attachment</td>
<td>Bottom trimming was done to make the sweep uniform.</td>
</tr>
</tbody>
</table>
4.2 Puckering at waistband

<table>
<thead>
<tr>
<th>Causes</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper pre-setting of waistband after thumb pressing</td>
<td>Pressing was done by steam iron with a spray of starch over it. This made the handling of the waistband easier while stitching and thus reduced puckering at the waistband.</td>
</tr>
</tbody>
</table>
4.3 Roping

**MAN**
- Unskilled operator

**METHOD**
- Improper handling

**MACHINE**
- Folder not set in the machine
- Garment component cut in bias

**MATERIAL**

**ROPING**

4.4 Waistband extension uneven

**MAN**
- Unskilled operator
- Margin not followed while attaching waistband

**METHOD**
- Waistband edge not finished properly

**MACHINE**
- Waistband edge point shape not proper
- Zipper not attached properly which led to mismatch in left and right front of the garment.

**MATERIAL**

**WAISTBAND EXTENSION UNEVEN**

<table>
<thead>
<tr>
<th>Causes</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper folder setting on machine</td>
<td>The folder guide was adjusted and improper materials handling avoided</td>
</tr>
</tbody>
</table>
4.5 Improper fly shape

<table>
<thead>
<tr>
<th>Causes</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margin not followed while attaching waistband and waistband edge not finished properly</td>
<td>The operator was instructed to be careful while feeding and following the margins strictly</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Causes</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top stitch is being inhibited by zipper lock underneath</td>
<td>A template was provided to the operator and the stitch was shifted a little below, altering the fly shape within tolerance level</td>
</tr>
</tbody>
</table>
4.6 Fusing shining marks

<table>
<thead>
<tr>
<th>Causes</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor quality fusing used</td>
<td>Fusing was changed and skilled operator required</td>
</tr>
</tbody>
</table>

5.0 Trend chart showing reduction in defect levels after implemented solutions

![Trend chart showing reduction in defect levels](image)

Fig. 5 Defects level Reduction in Measurements Out
Fig. 6 Defects levels Reduction in Puckering

Fig. 7 Defects levels Reduction in Roping
Fig. 8 Defects levels Reduction in Uneven Fly Shape

![Graph showing Defects levels in Label Attachment](image)

Fig. 9 Defects levels Reduction in Label Attachment

![Graph showing Defects levels in Uneven Top Stitch](image)

Fig. 10 Defects levels Reduction in Uneven top Stitch

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6.0 Defects analysis in finishing department

![Defects analysis in finishing department](image)

Fig. 11 Defects analysis in finishing department

6.1 Recommended Suggestions Implemented to Reduce Defects in finishing section

1. Oil spots: Application of a scrap paper under the presser feet of sewing machines after the day’s work so that the machines which are leaking oil can be tracked.
2. Proper oiling level to be maintained in order to prevent leakage of extra oil
3. Operator to take responsibility of cleaning the machine after lubrication
4. Immediate reporting of oil leakage

Ink/ chalk marks: Usage of good quality markers, the marks of which are easily washable
2. Avoid using pencils for marking.
3. Usage of chalks on white and light colored fabrics.

Soil and dust: 1. Usage of plastic bags for storing and transportation of pieces.
2. Cleaning of checking tables and machines before the start of day’s work
3. Avoid keeping garments on the floor, using trolleys for storage.
4. Creating a polyethylene sheet partition between sewing and finishing departments so that fabric dust doesn’t come over to the finishing unit and settle down on the washed fabric.

Suggestions implemented to reduce no. of uncut & loose thread:
1. Thread cutting operation to be carried out after washing in order to counteract unraveling of threads after washing.
2. Use of thread sucking machine to prevent any loose threads to reach the checkpoint.
7.0 Department wise results and discussion (Sewing, Finishing and Cutting department)

7.1 Cutting Department

![Graph showing overall reductions in defect levels for cutting department]

Fig. 12 Overall reductions in defect levels for cutting department

7.2 Sewing Department

![Graph showing overall percent defective trend]

Fig. 13 Overall reductions in defect levels for sewing department
7.4 Finishing Department

Cutting lot failure rate reduced to zero percent generally. Sewing percent defective reduced to approximately 40%. In finishing, stitching D.H.U. came down to approximately 8% from 16% as earlier, uncut thread D.H.U. came down to approximately 10% from 22% as earlier. Rework increased the cost of the different work categories between 2% to 30%. However, some best practices to control defect generation within the factory were suggested as- Make the workplace clean – from fabric store to cutting to sewing to washing and finishing. Place quality control system in proper place. Implies that sufficient no. of checkers, trained checkers, checkers making report while checking, analysis of reports and take action based on the quality check reports. Conduct training program for the checkers on how to check piece correctly to capture defective pieces. Train them to make garment checking reports. Run quality awareness program for your employees. Quality standard must be understood by each employee and everybody have to work to meet quality goal. No low standard work should be accepted by the following department. In sewing line don’t allow operators to keep bundles open and each bundle must be completed before forwarding to the next. It will help you track missing pieces. It is usual experience that operators throw pieces under tables when they make mistake or receive defective (incomplete) garments from previous operator. Nobody keeps track of these missing pieces until you found shortage of garments in finishing. Set standard operating procedures (SOP) for each task performed by your employees. SOP for quality control system for each department. Set audit team to audit your quality system in a regular interval. These
recommendations were suggested to the individual department.

8. Conclusion

The suggestive tools developed in this article cover a comprehensive series of aspects in minimizing reworks in the sewing section of apparel industries by ensuring quality production. The importance of the textile industry in the economy of Bangladesh is very high. The explosive growth of the RMG industry in the country, however, has not been enough supported by the growth of backward linkage facilities. So manufacturing the quality product is mandatory to sustain in this global competitive market. Quality is ultimately a question of customer satisfaction. Good quality increases the value of a product or service, establishes brand name, and builds up good reputation for the garment exporter, which in turn results into consumer satisfaction, high sales and foreign exchange for the country. The perceived quality of a garment is the result of a number of aspects, which together help achieve the desired level of satisfaction for the customer. However, we should bear in mind that 1% defective product for an organization is 100% defective for the customer who buys that defective product. The study clearly indicates that by eliminating non-productive activities like reworks in the apparel industries time as well as cost are saved by ensuring quality production which have an important impact on overall factory economy.

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