Performance Improvement in Apparel Industry by Reducing DHU%

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Abstract

In today's fast changing world each customer is expecting high quality garment with product variety. This project work deals with the productivity and quality enhancement in a garment manufacturing unit through practical study conducted in stitching department. The use of this project work will improve the efficiency of production line for bottle neck operations, shows better utilization of available resources, reduce process variations & maintains consistency in quality of the process output. The project result shows that an industry can achieve higher productivity and profitability with improved quality product by minimizing reworks activities. It also minimizes cost and improves internal throughput time. Initial reading before trail shows that DHU% is goes out of control due to various reasons after necessary corrective action, the DHU% is decreased from 16.66% to 15.33%.

Keywords- *Garment Defects, sewing defects, Productivity, Profitability, Reworks.*

I. Introduction

In every garment manufacturing, number of rejected garment found after product delivery. Some of the organizations considered these garments are rejected because those garments have no more use by any means. But by doing the Reworks in the garments industry for rejected pieces can hampers the smooth production rate and focus poor quality products having an impact on overall factory economy.There is no ready-made solution that can reduce rejection percentage overnight.[1] Each order is unique. But this rework suggests how to handle such problems and bring down rejection rate to minimum with quality production. Minimization of reworks is a must in quality and productivity improvement. But this project works is suggesting how to handle such types of issue and bring down rejection rate to minimum. Fabric defects is very important issue which affect both buyer and supplier so the basic needs for productivity and quality improvement are to control defects rate during various activities of sewing department. We have to control the productivity by supervising & strict operating conditions to be followed. [2,3]

Types of Defects:

1) Open/Delaminated Seam

At the time of stitching by negligence of worker or due to high work pressure on operator sometime Seam remains open during stitching known as open seam. And if a seam that starts to delaminated from edges is called delaminated seam. All open and delaminated seams should be considered as defective and garment gets rejected.

2) Broken stitch or Drop stitch or Skip Stitch

Some time such type of irregularities may appear due to stitching machine problem. Rework is possible for removing the defects and improves the product quality. [4]

3) Overrun Stitch

Multiple stitched at the same position shows overrun stitch that gives ugly appearance to garment so it should be considered as reworkable defects.

4) Stitch Construction not as per quality

In case of bottle neck operation sometimes the construction of garment differs from given specification request which shows incorrect placement of stitch which may appear as defects.

5) Twisted, Roping or Uneven Hem

Such type of defects may arise if the hem is exposed from opposite side of the garment around the bottom hem or leg opening, the garment should be considered defective.

6) **Raw Edge / Frayed Seam**

It is not the major defects only tail end remains with the seam. Any frayed seam that affects the appearance and function of the garment should be considered as defective.

7) Uneven Stitching

Stitching that is wavy, not straight, or loose. This may happen due to fabric properties, thread tension or machine failure shows uneven stitching. It affects the garment appearance and improper function of garment after wearing. [6]

Fig 1. Defects in Garment

8) Seam Puckering

Due to stitching machine problems or type of fabric Undesirable uneven surface or gathering of fabric on garment. Any puckering that affects appearance and function of the garment should be considered as defective. [9]

II. Material and Methods

Material:

For experimental work two styles was selected Levi's and NIKE
Fabric specifications are as fallows.

Table No. 1: Style Levi's

Line No	310
Buyer Name	Levi's
Style	Men's convectional
Supplied	Pratibha Syntax Ltd
Shade	Global white
Fabric Type	S/J knitted fabric
Size	S,M,XL,XXL
SAM	5 min
No. of Operators	25
Fabric GSM	240

Table No. 2: Style NIKE

Line No	324
Buyer Name	NIKE
Style	Round neck T-shirt
Supplied	Pratibha Syntax Ltd
Shade	Universal red
Fabric Type	S/J knitted fabric
Size	S,M,XL,XXL
SAM	5.5 min
No. of Operators	23
Fabric GSM	260

Method:

In this project we have collected 15 day DHU% to analysis before and after study. The standard method is to measure DHU of any process is to collect the data regarding total pieces checked and number of total defects are detected in the inspected garments. It is noted that it is number of defects not the defective garments. One defective garment may have more than one defect. At the time of inspection a checker found different defects like broken stitch, hole and raw edges etc. Once you have record of the following information of a lot you can measure DHU of that lot using formula. [10]
For the study we have select Line No. 310. Fifteen Days' data collected before Trail and after trail.
Style: - Round Neck t shirt

Table No. 3 Analysis of defects before and after Trail

Sr. No.	Total day	Before Trail			After Trail		
		Total no defects	Total check piece/shift	Total DHU%	Total no defects	Total check piece/shift	Total DHU%
1	1 Day	51	750	7.28 %	24	780	3.07
2	2 Day	46	750	6.13 %	26	800	3.25
3	3 Day	49	700	7 %	38	750	5.05
4	4 Day	45	650	6.9 %	33	700	4.71
5	5 Day	35	700	5 %	33	750	4.4
6	6 Day	41	750	6.6 %	32	800	4
7	7 Day	43	650	6.61 %	38	700	5.42
8	8 Day	56	650	8.61 %	33	750	4.4
9	9 Day	55	700	7.85 %	35	750	4.66

10	10 Day	58	720	8.05 %	34	820	4.14
11	11 Day	48	750	6.53 %	29	800	3.62
12	12 Day	47	650	7.23 %	30	650	4.61
13	13 Day	44	700	6.28 %	26	780	3.33
14	14 Day	51	630	8.09 %	33	750	4.4
15	15 Day	62	600	10.33 %	26	700	3.71
Average			690	6.75%		752	3.63%

Defects per hundred units (DHU)
Data:
Total no. of defects=731
Total no. of pieces=11650

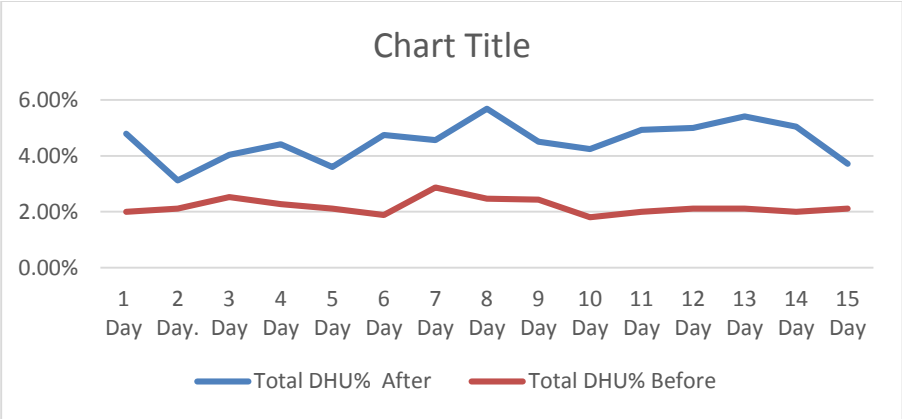
$$\textbf{DHU\%} = \frac{\textbf{Total no. of defects}}{\textbf{Total no. of pieces}} * 100$$

$$\text{DHU\%} = \frac{731}{11{,}650} \times 100$$

Before DHU%= 6.27%

After DHU%= 3.63%

Analysis of defects before and after trail



Graph 1 Analysis of DHU% before and after trail

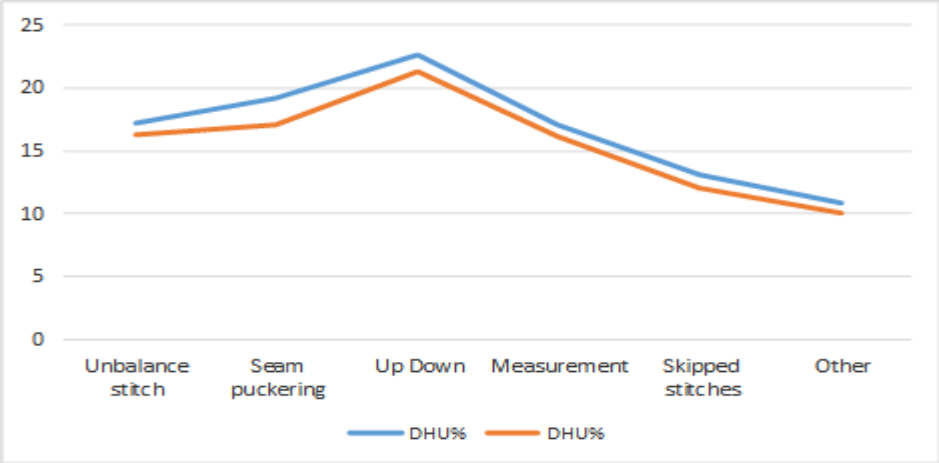
We change the sewing machine setting like reset tensioner, synchronization in loop formation during stitching , awareness in operators about physical properties of fabric which help to reduce DHU%.As per this graph all DHU% of before trail are 6.28% and after carried out experimental work it can be reduce by 3%. Overall DHU of after trail are 3.63%. During the study it is observed that some defects are very common and responsible for increasing DHU%

Table 4 Analysis of defects before and after Trail

Before trail DHU is 6.27% and out of total defects maximum rejection takes place due to few defects like unbalance stitch, seam puckering, up down, skipped stitches etc.After corrective action DHU% is reduced as shown in following table.

		Before Trail		After Trail	
Sr. no.	**Defects**	**Total Defects/15 days**	**DHU%**	**Total Defects/15 days**	**DHU%**
1	Unbalance stitch	126	17.23	95	15.21
2	Seam puckering	140	19.15	80	17.02
3	Up Down	165	22.57	100	21.27
4	Measurement	125	17.09	82	16.44

5	Skipped stitches	96	13.13	66	12.04
6	Other	79	10.80	47	10
	Total	731	16.66%	470	15.33%



Graph 2 Analysis of defects % before and after trail

Above graph analysis shows that mainly four factors are responsible for increasing DHU% Man, machine, material and method adopted for production. Carelessness during stitching insufficient teaching skill. Improper machine setting, sequence of steps fallows during stitching were the reasons for high DHU. After finding the root cause for defects DHU is reduced up to 1.33%

Root causes Analysis:

Cause and effect diagram is a chart that identifies potential cause for particular quality problem. [6]

This problem be related to the machine workers, measurement, supplier, material and many other aspect of the production process. This study has considered the causes. This study has considered the causes related '4 M' (man, machine, material, and methods) [11]

Table 5 Root causes analysis in '4M's.

Man	Machine	Method	Material
1. Carelessness. 2. Unskilled operators 3.Margin not followed properly during stitching. 4. Improper feeding. 5. Lake of understanding about the whole operation.	1. In properly threads tension. 2. Excessive pressure on pressure foot. 3. Machine is thread incorrectly. 4. Dull sewing m/c 5. Dull sewing machine needle made or beat needle.	1. Insufficient thread with respect to the length of the stitch. 2. Machine speed is too high. 3. The stitch is too long for the type of in work. 4. Thread break during the sewing. 5. Improper feeding.	1. Poor quality fabric. 2 Poor quality threads. 3 Poor quality needles.

III. Result and Discussion

The study analyse the performance of the apparel industry with respect to various garment defects. For improvement in the performance we have analysed the garment defects in stitching line. The defects which are responsible for the increase in DHU% were analysed during garment inspection. Maximum rejection takes place due to following defects, then analyse the root causes and remedies for these defects; which are mentioned in the following tables. The performances of the stitching line were improved by implementing the corrective action. It is found that DHU% of the stitching line was reduced by 1.33%.

Table 5.1: Skipped stitches [12]

Sr. No.	Causes	Remedies
1	Improper synchronisation between hook and needle for loop formation	Check the machine settings with proper timing between needle and hook
2	Loose or tight thread gives irregular thread tension	Adjust the tensioner during stitching
3	Due to needle deflection	Needle should be changed, use good quality needle
4	Improper needle size and thread	Used proper Needle size and thread

5	When flagging of fabric is happened during sewing	The pressure of pressure foot should be adjusted perfectly

Table 5.2: Unbalance stitch.

Sr. No.	Causes	Remedies
1	Incorrect tension of sewing thread	Setting of accurate tension to the thread
2	Used incorrect thread path	Keep accuracy in thread path
3	Snagging of needle with bobbin case and positioning finger	Bobbin case to be smooth and finger positioning to be set again
4	If sewing thread are not lubricated	Better quality threads must be used here

Table 5.3: Staggered Stitch

Sr. No.	Causes	Remedies
1	Due to needle deflection	Needle size should be increased
2	Due to wrong needle point	Needle should be changed
3	Incorrect adjustment of needle and thread size	Needle size and thread size should be changed
4	Due to defected motion of feed dog	Feed dog motion should be adjusted
5	If fabric not controlled properly in the feed mechanism	Accurate pressure of pressure foot should be adjusted

Table 5.4: Variable stitch density

Sr. No.	Causes	Remedies
1	Incorrect unwinding of thread from package during sewing	The position of thread guide should higher than the position of thread package
2	Twisting of needle thread in the bottom of thread package	Foam pad should use to the bottom of thread package.
3	Twisting of thread in thread guide	Correct heading of sewing thread during sewing.
4	Excessive tension of thread	Tension of thread should be less or use of higher strength threads
5	Using of broken check spring	Check spring should be used heavy needle.
6	Fraying of thread in the needle	Finer thread should be used or to be used heavy needle
7	Becoming more heated the needle	Needle lubricant and needle cooler should be used
8	Becoming more heated of hook	Lubricant should be available and test the distant between needle

Table 5.5 Seam puckering.

Sr. No.	Causes	Remedies
1	Incorrect winding of threads on to the bobbin	Proper winding of thread on to the bobbin
2	Improper thread balance	The tension should be adjusted to the bobbin threads
3	Incorrect thread types	Test the size and types of bobbin

Table 5.6 Bobbin or lopper threads breakage.

Sr. No.	Causes	Remedies
1	Incorrect winding of thread on to the bobbin	Proper winding of threads on to the bobbin
2	Excessive tension to the bobbin threads	The tension should be adjusted the bobbin thread
3	If the edges bobbin case lopper eye and so on are more sharpened	The edges should be smooth
4	Incorrect fitting of bobbin case	Test the size and types of bobbin

Table 5.7 Needle threads breakage.

Sr. No.	Causes	Remedies
1	Incorrect winding of thread on to the bobbin	Proper winding of thread on to the bobbin
2	Excessive tension to the bobbin threads	The tension should be adjusted to the bobbin threads
3	If the edges bobbin case, lopper eye and so on are more sharpened	The edges should be smooth
4	Incorrect fitting of bobbin case	Test the size and types of bobbin

Table 5.8 Thread fusing when sewing machine stops

Sr. No.	Causes	Remedies
1	Faulty sewing thread	Should be used better quality thread
2	Densely woven fabric which is poorly finished	Should be improved fabric finishing
3	Damaged needle after sewing thread breakage.	Should be change the needle

Recommendations

Evaluate Solutions For: [12]

- Effectiveness
- Ease of Implementation
- Return on Investment (not always applicable especially with Safety Incidents)
- Potential Negative Effects – you don't want your solution to cause other problems

To study the defect data

- Collecting defect data for the ongoing style to understand the defect rate.
- Collect data for new style.
- Analyse the data and suggest solutions for the defect that has high rate

Inspection and check points for each sewing line:–

Inspection: (SQC)

- To check the sample and to separate the patterns those are front side back side sleeve collar moon patch placket etc.
- First check point and Final inspection

IV. Conclusion

The identification of sewing defects with images would give clear idea that alter is a major issue in apparel manufacturing. But it must need to decrease the amount of fault by recommending several solutions. Otherwise it increases the possibility of shipment failure. Most of the defect occurs due to improper maintenances, machine adjustment, improper needle and pressure foot adjustment. So this paper represents number of different defects and its possible way to retain standard of products. With maintaining proper quality it would possible to add value and build a good relation with client. If sewing processes can be improved the ultimate result is to deliver products with better quality. Before experimental work two different style overall DHU are 16.66% and after the changing roller setting in machine which was responsible for more no. of faults in garment. After corrective action overall DHU are 15.33%. The performance of the stitching line of the apparel industry were improved by reducing 1.33% DHU.

References:

[1]. N.S. Patil, S.S.Rajkumar, P.W.Chandurkar, P.P.Kolte, Minimization of Defects in Garment during Stitching, International Journal on Textile Engineering and Processes, Vol. 3(1), 2017, 24-29.
[2]. Pritesh Kankariya, KeshavValase, Performance improvement in Garment industries by reducing defects using six sigma methodologies, International Journal of Scientific Research Engineering & Technology Vol. 6(3), 2017, 228-236.
[3]. Juran J.M., Gryna F.M., Quality Planning & Analysis: For Enterprise Quality, Edition 2008, and Tata McGraw-Hill Publication.
[4]. Pranjali Chandurkar, Madhuri Kakde, Chitra Patil, Minimization of Defects in Knitted Fabric, International Journal on Textile Engineering and Processes, Vol. 2(3), 2016, 13-18.
[5]. Montgomery D.C., Introduction to Statistical Quality Control, Edition 2009, John Wiley and Sons, Inc. Publication
[6]. Dean J.W. and Bowen D.E., Management Theory and Total Quality: Improving Research and Practice and Theory Development, The Academy of Management Review, Vol. 19(3), 1994, 392-418.
[7]. Glock R.E., Kunz G.I., Apparel Manufacturing: Sewn Product analysis, 4th Edition, Pearson Publication.
[8]. Mehta P.V., Bhardwaj S.K., Managing Quality in the apparel industry, Edition 1998, New Age International Publication.

[9]. Md. Islam M., Khan A.M., Md. Khan M.R., Minimization of Reworks in Quality and Productivity Improvement, The Apparel Industry, International Journal of Engineering and Applied Sciences, Vol. 1(4), 2013, 147-164.
[10]. Gayatri G.Patil, Randhir Yadav, Vinay G.Nadiger, P.P.Raichurkar, Karan Chandrakar, Pranjali Chandurkar, Textile Apparel industry: A responsibilty towards manpower, Colourage, Vol. LXIV, No.06 2017, 38- 46.
[11]. Harshada Upasani, Pranjali Chandurkar, Dipaksingh Girase, Vishnu Dorugade, Productivity Improvement with Sewing Machine Attachment, International journal of Applied Engineering Research Vol.10(11), 2015, 10624-10648.
[12]. Spenser D.J., Knitting technology a comprehensive handbook and practical guide, Third edition, 2001, Wood Head Publishing Limited, Ambridge England.
[13]. Islam Md Monirul, A. T. M. Adnan, Improving Ready-Made Garment Productivity by Changing Worker Attitude, European Scientific Journal, Vol. 12(4), 2016, 436-444.
[14]. Kincade Doris H., and Kalavagunta S. Kanakadurga, An empirical investigation of apparel production systems and product line groups through the use of collar designs, Journal of Textile and Apparel, Technology and Management, Vol. 8(1), 2013, 1-15.
[15]. Khatun, Murshida. Application of Industrial Engineering Technique for Better Productivity in Garments Production, International Journal of Science, Environment and Technology, Vol. 2, No 6, 2013, 1361 – 1369.
[16]. Kader Shahidul, and Maeen Md Khairul Akter, Analysis of the factors affecting the lead time for export of readymade apparels from Bangladesh; proposals for strategic reduction of lead time, European Scientific Journal, Vol.10, No. 33, 2014, 268-283.