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STATISTICAL ANALYSIS ON GARMENTS FINISHING PROCESS FOR MINIMIZATION OF PRODUCTION GAP

*Mst. Murshida Khatun[1], Sharmin Akter[1], Nusrat Jahan[2]

[1]Department of Textile Engineering, Daffodil International University
[2]Department of Dyes & Chemicals Engineering, Bangladesh University of Textiles

Email: murshida@daffodilvarsity.edu.bd

Abstract: This article represents the statistical analysis of the knit garments finishing process. In this work, quality check report of a Knit T-Shirt was analyzed for 7 days by SPSS analysis to find out the alter percentage of total quality passes of 7 line knit garments. After analysis, it is found that the alter percentage from day 1 to day 7 is 5.78, 7.26, 6.38, 6.60, 6.07, 5.99, 5.44 accordingly. The analysis is carried out in 95% tolerance limit. This research helps to get an idea about correlation between quality control (QC) pass and alter garments percentage. Through continuous analysis manufacturer will be able to find out the optimum workload of worker in finishing section as well as find out the reason of production gap.

Keywords: *quality control, apparel industry, SPPSS analysis.*

1. INTRODUCTION

Apparel industry and ready-made garments considered as great sector to obtain economic prosperity. Our economic growth is promoted by this industry. The role of this industry is vital for employment potential and earning foreign currency [1]. At present, Bangladesh exports a variety of garments products all over the world. Now-a- days RMG sector is considered as 100 percent export-oriented sector. In 1992 and 1993 it was the largest exporter of T-shirt to the European Union. In garments manufacturing Bangladesh is also considered as the economic competitor by the other countries. The continuing success of the RMG sector depends on the socio-economic development of our country [2]. Now-a-days more than 70% of foreign earnings of our country depend on RMG sectors. One of the great advantages of RMG sectors is that they can produce goods at low labor cost [3]. Customers are now demanding a wide variety of products at a lower cost but with fast delivery. They also expect more innovative products at a competitive price [4] as customers have more opportunities to choose from a variety of options [5]. To compete with the global economic condition and rapidly changed economic conditions, apparel manufacturers pay their attention to improve productivity as well as the quality of the product [6]. On the other hand, in garment manufacturing, it is usual that a few garments are rejected after each shipment. This may be repairable or non-repairable. The non-repairable defect is owing to poor quality of the raw materials or faulty process or workers casual behavior. Moreover, to control this matter factory, must set a check point. Reworks is quite common in the garments industry which interferes the regular production rate and these low-quality products have a great impact on overall factory economy. [7-10]. To fulfill the customer demand and obtain higher productivity at shortest time, Apparel manufacturers must give more attention on minimizing the reworks or alter activities. It also helps to minimize the cost [11].

In this work, hourly quality check report of a Knit T-Shirt was analyzed for 7 days by SPSS analysis to find out the alter percentage of total quality passes of 7 line knit composite. This investigation gives a clear idea about the alter percentage of readymade garments and helps to do further research on minimization of this alter percentage.

2. LITERATURE REVIEW

Ferdousi and Ahmed [11] investigated the improvement of manufacturing performance through lean practice in the Bangladeshi garment industry. Improvement in quality assurance system can play a vital role for improving productivity of the industries as well as economic development for the country. Ahmed and Chowdhury [12] applied eight wastes of lean methodology to increase the efficiency and productivity of an apparel sewing section. Beyene [13] applied DMAIC methodology of six sigma to reduce the defect rate in sewing section. He found that the result of the proposed solutions of the defect level in the section has been reduced as well as the result found to be significant. Asif et al. [14] evaluated various types of problems related to waste and weaknesses of sewing section by using specific lean manufacturing tools. They also evaluated sewing performance in terms of effectiveness, time and quality. Hossain et al. [15] applied different statistical tools for selected garment factory on

quality assurance. Improved quality assurance system can add strength in global competitiveness in the global textile market through improving quality as low quality means high cost and loss of competitive position [15]. Abtew et al. [16] applied statistical process control in the sewing section of the garment industry for quality control. They found that rejection percentage was reduced to 2.741%. Tahiduzzaman et al. [17] worked for the minimization of sewing defects in Bangladesh with 5S and PDCA. They have performed pareto analysis to identify top position from all the defects and found seven position where 80% defects occur. Alam and Huda [18] considered quality and productivity enhancement in manufacturing process. The outcome of their study was reason, effect and remedies of garments sewing defects.

3. EXPERIMENTS

In this work, quality check report (Table 1) of a Knit T-Shirt was analyzed for 7 days (8 Hours) by SPSS analysis to find out the alter percentage of total quality passes of 7 line knit composite. As Knit T-shirt is widely export apparel from Bangladesh all over the world. That is why knit T-shirt is selected for the analysis. The minimum value of QC passes garments is 140 and maximum value is 3690. Total QC passed garments is 92904 pieces. So, the average value is 1896 pieces. The minimum value of alter garments is 34 and maximum is 203 pieces. Total alter garments are 6067 pieces. The SPSS analysis is carried out in 95% tolerance limit. After analysis it is found that the average alter percentage from day 1 to day 7 is 5.78, 7.26, 6.38, 6.60, 6.07, 5.99, and 5.44 accordingly.

TABLE 1: **Data of Quality Check Report for 7 Days**

line	Type	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
A	*QC pass*	1445	1210	1385	1870	2340	1970	3385
	Alter	83	99	85	107	116	95	148
	%	5.43	7.56	5.78	5.41	4.72	4.60	4.18
B	*QC pass*	2425	1380	1805	1325	1975	2060	1565
	Alter	141	137	154	108	164	153	119
	%	5.49	9.03	7.86	7.53	7.66	6.91	7.04
C	*QC pass*	140	435	606	895	1172	630	1325
	Alter	34	68	80	135	93	55	116
	%	19.54	13.51	10.17	13.10	7.35	8.02	3.04
D	*QC pass*	1370	1720	1185	1560	2890	1970	3230
	Alter	105	130	92	94	175	131	156
	%	7.11	7.02	7.20	5.68	5.70	6.23	4.60
E	*QC pass*	2310	1880	2320	2620	2690	2325	2570
	Alter	134	139	124	107	164	142	148
	%	5.48	6.88	5.07	5.65	5.74	5.75	5.44
F	*Qc pass*	2370	2400	3205	2435	1735	2520	1840
	Alter	145	175	196	174	126	141	117
	%	5.76	6.79	5.76	6.66	6.77	5.29	5.97
G	*QC pass*	3690	2145	1720	1890	1060	1375	2545
	Alter	203	127	110	116	59	103	144
	%	5.21	5.58	6.01	5.78	5.27	6.84	5.35

4. RESULT AND ANALYSIS

In statistics, a Q–Q (quantile-quantile) plot is a probability plot. It is a graphical method for comparing two probability distributions by plotting their quantiles against each other. It is often referred to as percentiles. If the two sets come from a population with the same distribution, the point fall approximately along a 45^0 referred line. Straight line Q-Q plot indicates that the data is approximately normal. In this plot 50% lie below the line and 50% lie above the line. From the graph (Fig. 1) we can see that Q-Q plot is almost straight line. So, the data is approximately normal. It also means that the total QC passed garments in finishing section is in optimum level with workers. So, there is a balance between total worker and workload. So, the backlog will not create in this situation.

For this plot (fig. 2) we can see that 50% lie below the line and 50% lie above the line. The point fall approximately along a 45^0 referred line, which means two sets come from a population with the same distribution. From the above graph we can also see that Q-Q plot is almost straight line. So, the data is approximately normal.

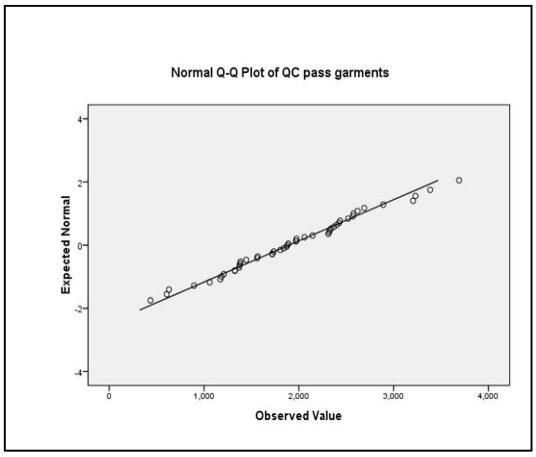

Figure 1: Normal Q-Q plot of QC pass garments

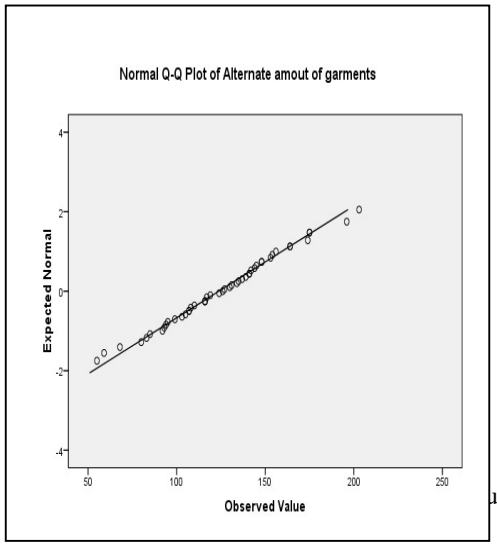

Figure 2: Normal Q-Q Plot of Alternative amount of garments

Fig 3 shows the Scatter Plot of QC Pass and Alter Garments for Seven Days. From top left to bottom right the variables are written in both axes. Then each variable is plotted against each other. For example, the middle square in the first column is an individual scatterplot of Pass and Day, with Day as the X-axis and Pass as the Y-axis. This same plot is replicated in the middle of the top row. The boxes on the upper right-hand side of the whole scatterplot are mirror images of the plots on the lower left hand. In this scatterplot, it is probably safe to say that there is a correlation between Pass and Alter because the plot looks like a line. There is probably less of a correlation between Day and Pass in addition to Day and Alter. It can also be said that the acceptable quality level (AQL) chart is also maintained by the manufacturer. If AQL chart is followed by the manufacturer properly, then rejection percentage will be reduced.

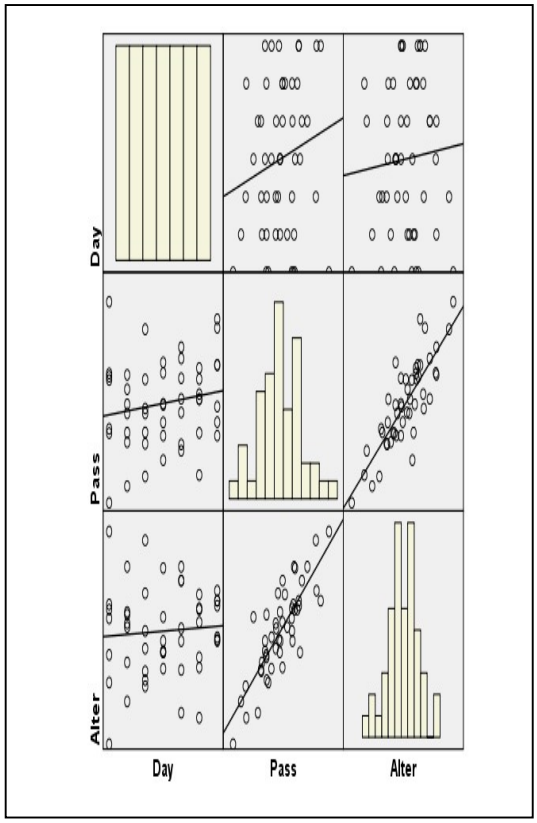

Figure 3: Scatter Plot of QC Pass and Alter Garments for Seven Days

In graphs in fig. 4 and fig. 5 show, high low value of QC pass and alter garments is shown for seven days. The total number of lines is seven (A-G). In case of QC pass plot line G represents the high value of QC pass garments and line E represents the low value of QC pass garments. In case of alter garments, plot line G represents the high value of alter garments and line B, E represents the low value of alter garments. In some lines the QC pass garments is lower than other. So, the motivation is really needed for the sewing operators to improve the garments quality. If needed training can also be arranged for the operator to increase performance rating.

Control chart monitors the process changes over time. It tells the constancy or inconsistency of the process. It comprises by an upper control limit (UCL), mean and lower control limit (LCL). If the process is operated within acceptable limit, and then the process is in under control. If there are no points outside the control limit (UCL, LCL), Points appears randomly distributed and there is no unusual behavior the process is under control. If a

point is outer the control limit then, there is an increasing variation and positive change occurs the process is out of control. From the control chart fig 6 (a) we see that all the point is within the control limit and they are randomly distributed.so the process is under control. From the control chart (b) we see that all the point is within the control limit and they are randomly distributed.so the process is under control.

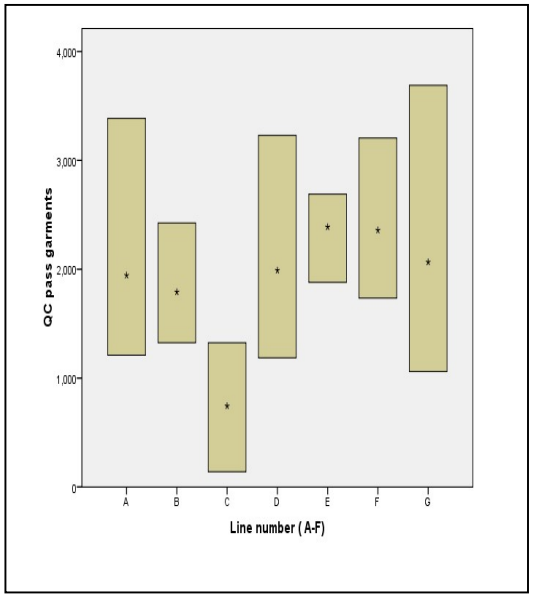

Figure 4: High-Low Plot of QC Pass for seve days

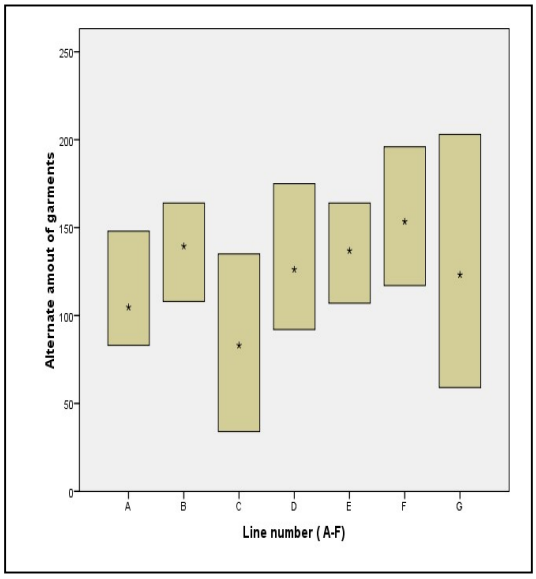

Figure 5: High-Low plot of Alter Garments for seven days

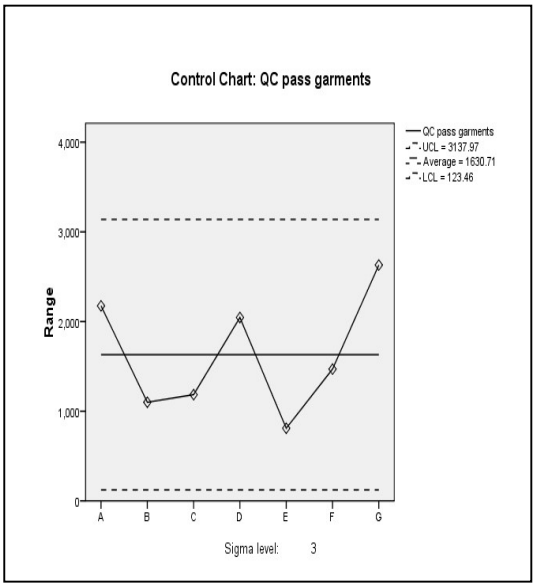

Figure 6 (a): Control Chart of QC Pass

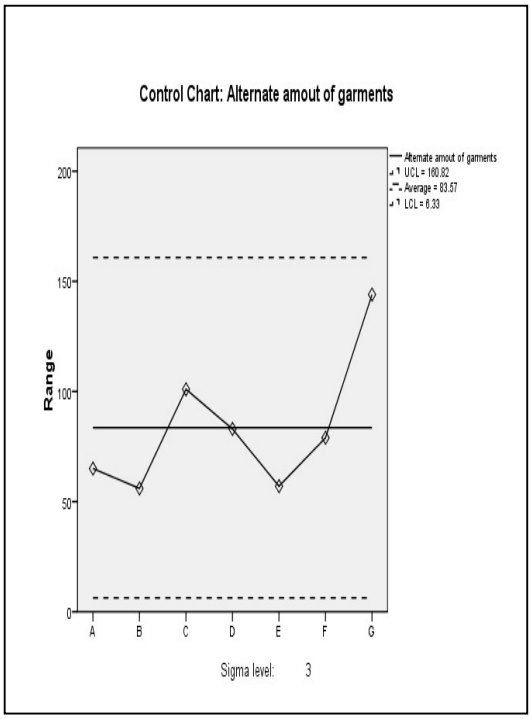

Figure 6 (b): Control Chart of Alter garments

5. CONCLUSION

The objective of this article was to analyze the Alter percentage of readymade garments. This SPSS analysis will give a clear concept to the manufacturer about their garment finishing process. The continuous SPSS analysis will help the

manufacturer to find out process gap and the area where improvement is needed. For this purpose, Knit T-Shirt was chosen as fashionable garments. In this research hourly quality check report was analyzed for 7 days by SPSS analysis to find out the alter percentage of total quality passes of 7 line knit composite. The alter percentage was shown by normal Q-Q plot, High low bar diagram and using Control chart. From the analysis it was observed that the alter percentage lied between 5.44 to 7.26. After analysis we can see that Q-Q plot is almost straight line which indicates that the data is approximately normal and from control chart it is observed that the almost all the point is within the control limit and they are randomly distributed. This article will help to do further research on minimizing the alter percentage of readymade garments as well as finding out the production gap in finishing section of apparel sector. This study also can be carried out for other fashionable garments. Further study will give help manufacturer to identify the performance rating of worker. So proper training can be arranged for the low performer to improve quality of garments.

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