(REFEREED RESEARCH)

A STATISTICAL PROCESS CONTROL APPLICATION FOR SEWING FAULTS IN MEN'S SUIT PRODUCTION

ERKEK TAKIM ELBİSESİ ÜRETİMİNDE DİKİŞ HATALARI İÇİN BİR İSTATİSTİKSEL PROSES KONTROL UYGULAMASI

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ABSTRACT

Sewing process is one of the most important stages in labour intensive ready-made clothing enterprises. Quality faults occurring during this process adversely affect the product quality and product efficiency, and also increase the production cost. The aim of this study is to investigate whether the jacket production process is under control in a men's suit production enterprise and to detect the processes with highest rates of sewing faults in sewing department and finally to make suggestions for improving the quality control. Among the Statistical Process Control methods; control list, p control chart and Pareto analysis were used in the study. "p control chart" was used to test whether the production process is controlled in the enterprise. Furthermore, the statistical methods were employed to determine the issues that need to be done in the improvement efforts and to detect the relations between the process groups supposedly effective on faults occurring in men's jacket production and the amount of faults. One Way Anova, Duncan test and Qui-Square analysis were used for the statistical analysis. Also, the processes with highest amounts of sewing faults and the effects of these processes on fault rates were investigated with Pareto analysis. As a result, it was concluded that the production process was statistically not under control in the ready-made clothing enterprise chosen for this study, the fault rates of process groups differed between the weeks and there was a statistically significant relation between the quality faults and the weeks. In addition, this study demonstrated that the investigation of each process group by drawing their p control charts would make significant contributions to foresee the results and prepare more effective the improvement plans.

Key Words: Ready-made clothing, Men's suit, Sewing fault, Quality and control, Statistical process control.

ÖZET

Emek yoğun bir sektör olan hazır giyim işletmelerinde dikim işlemi, üretim sürecinin en önemli aşamalarından birini oluşturmaktadır. Bu süreçte oluşan kalite hataları ürün kalitesini ve üretim verimliliğini olumsuz yönde etkilemekte, bunun yanında üretim maliyetlerinin de artmasına neden olmaktadır. Bu araştırmanın amacı; erkek takım elbisesi üreten bir işletmede ceket üretim sürecinin kalite açısından kontrol altında olup olmadığını belirlemek ve dikim bölümünde en yüksek dikiş hatası oranına sahip işlemleri saptayarak kalite kontrol iyileştirme süreci için öneriler geliştirmektir. Çalışmada İstatistiksel Proses Kontrol (İPK) yöntemlerinden; kontrol listesi, p kontrol grafiği ve pareto analizi kullanılmıştır. İşletmede üretimin kontrol altında olup olmadığı "p kontrol grafiği" ile tespit edilmiştir. Ayrıca iyileştirme sürecinde yapılması gerekenleri saptamak amacı ile erkek ceketi üretiminde meydana gelen hatalar üzerinde etkili olduğu düşünülen işlem grupları ile hata miktarları arasındaki ilişkiler istatistiksel yöntemlerle araştırılmıştır. İstatistiksel analiz için, tek yönlü varyans analizi (Oneway Anova), Duncan testi ve Ki-kare analizi kullanılmıştır. Ayrıca, dikiş hatası miktarı en yüksek olan işlemler ve bu işlemlerin hatalı oranına etkileri pareto analizi ile araştırılmıştır. Sonuç olarak, çalışmanın yapıldığı hazır giyim işletmesinde, üretim sürecinin istatistiksel olarak kontrol altında olmadığı, işlem gruplarına ait hata miktarlarının haftalara göre farklılık gösterdiği ve kalite hataları ile haftalar arasında istatistiksel olarak anlamlı bir ilişkinin bulunduğu belirlenmiştir. Bununla birlikte bu çalışma, kalite iyileştirme sürecinde her işlem grubunun kendi içinde p kontrol grafiklerinin çizilerek incelenmesinin, sonucun önceden görülüp daha etkili iyileştirme planlarının yapılmasına, önemli katkılar sağlayacağını göstermiştir.

Anahtar Kelimeler: Hazır giyim, Erkek takım elbisesi, Dikiş hataları, Kalite ve kontrol, İstatistiksel proses kontrol.

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1. INTRODUCTION

High production quality is an important factor for enterprises to gain competitive advantage in the global market. Improvement of quality level is depended on the correct identification of problems occurring in production. Therefore, enterprises must develop a system to correctly identify the problems at their source during production. At the same time, this would also enable the efficient use of all the production factors (1).

Many new methods have been developed to improve the quality in enterprises. The first step of all improvement methods is the exact introduction and excellent definition of problems. Determination of factors effective on fault rates is the second important step of fault prevention studies (2). For a production of high quality standards, all parameters effective on production should be optimized and the sustainability of this optimization should be provided by process control and constant improvement activities. Statistical Process Control phase consists of a series of procedures including data collection, organization, analysis and interpretation as well as protection of the current quality level and providing even a higher quality level (3). There are many studies in literature regarding the use of Statistical Process Methods in process control and improvement studies. Some of these studies are mentioned below.

Yücel explained the Fault Type and Effect Analysis (FTEA), a method for determining fault and rating according to precedence, and carried out an applied analysis on jean pant and shirt production faults in a confection store. As a result, sewing faults were determined as the most effective factor for fault production and sewing faults could be reduced by 4.1% in the production line of jean pant and 5.2% in jean shirt production line. In addition, 966.3 min was gained in fault recovery time (4). Bircan and Gedik investigated the reasons for production faults in Sivas Sewing Workshop by using Statistical Process Control techniques. Within the scope of their study, they used pareto analysis, cause-effect diagram, control table, fault intensity diagram and control charts. As a result, it was determined from the p and np control charts that the short term target (5%) in production process was obtained and production was controlled in the Sewing Workshop (5). Ertuğrul and Karakaşoğlu studied three approaches that can be used to form p control chart with changeable sample size and carried out an exemplary application in a textile enterprise (6). Kaya and Erdoğan applied One Way Anova, Duncan Test and correlation analysis to data they collected in a confection enterprise producing clothes from knit fabrics, and thus, they investigated the effects of processes, workers, machine types and repetition number on quality faults in the sewing department. As a result, they determined the processes, workers and repetition number among the factors affecting quality faults in sewing department; however, machine type was not effective on quality faults (2). Kayaalp and Erdoğan examined the number of sewing faults during processes in a sewing workshop by using SPC methods in a mid-sized confection enterprise, and determined the processes with highest fault numbers and their effects on fault rate. They investigated whether the daily fault rates were statistically controlled in the sewing workshop by using p control chart, and reported that sewing fault could be reduced with SPC methods in confection enterprises, which could be easily used in mid-sized enterprises, as well (7).

The present study initially investigates whether the quality is under control in production process in a men's suit production enterprise, and then the fault factors in the enterprise are studied with statistical methods. Priorities of the enterprise are determined to improve the quality and certain suggestions are made.

2. MATERIAL AND METHOD

In the present study, the production process in a mid-sized ready-made clothing enterprise producing men's suit was analyzed by using data of sewing fault numbers between October 2009 and May 2010, and thus, it was determined whether the production was controlled in terms of quality. Subsequently, the effects of sewing faults on production quality were investigated by statistical methods, and the relations between the faults in men's suit production and the related processes were studied, and finally certain suggestions were made to take the quality under control in the enterprise.

In the study, Statistical Process Control (SPC) methods were used and all the statistical analyses were made by SPSS 10.0 packet software. The SPC methods consisted of control list, p control chart and Pareto analysis, which are shortly described below.

- Control List: It includes different tables to facilitate the statistical analysis demonstrating the collected data regarding the production process, tendencies and distributions of data. These tables should be arranged before starting the statistical analysis (7, 10).
- Pareto Analysis: This method is based on the assumption that the majority of results are caused by several important reasons and the remaining reasons have a relatively small effect. The purpose of this analysis is to use the limited resources by distinguishing the important reasons constituting the majority of the results. Pareto diagram demonstrates the reasons listed according to their precedence levels, which are generally determined by frequency (8, 11).
- P Control Chart: The aim of quality control charts is to keep the variables inevitably occurring during production within the acceptable limits in terms of quality and to determine whether the process is controlled. "Fault rate" of product is used as variable in p control chart. In the chart, the fault rates of samples are demonstrated based on the number of samples and time. The centre line (CL) in control chart represents the mean value of fault rates, while the upper line represents the upper control boundary, and the lower line indicates the lower control boundary. For a controlled process, the fault rates of all samples must be between the upper and lower control boundaries (3, 12).

In the present study, the staff controlling the product quality at the end of sewing process during 35 weeks of production registered daily number of sewing faults during production in sewing control form. At weekends, "weekly fault follow-up reports" were prepared using these data. The control list used in the statistical analyses was arranged in accordance with the data in fault follow-up reports. For this purpose, the processes in men's jacket production were investigated under four groups, which are;

- Sleeve (faulty/flawed/stained and bursted)
- Body (pocket gap/bursted/faulty/fillet line fault/collar, fusing brim and diverse faults)
- Lining (inner pinpoint fault /bursted/ flawed/accessories fault and diverse faults)
- Montage (sleeve seam gap/sleeve setting fault/lining size fault/bursted/ faulty slit and diverse faults).

Subsequently, the weekly faulty rates were calculated by using control list, and p control chart was prepared for the fault rates in sewing department. With the chart given in Figure 1, it was investigated whether the quality was statistically controlled in the sewing department.

100% examination was applied in the enterprise. For this reason, the following equations explained below were used to prepare p control charts.

In case of changeable sample size and indefinite standards, middle (MCL), upper (UCL) and lower control lines were calculated by Equations 1, 2 and 3 (9).

$$MCL = \overline{p}\,(The\ mean\ fault\ rate) = \tag{1}$$

$$= \frac{Total\ number\ of\ faulty\ products}{Total\ number\ of\ controlled\ products}$$

$$UCL = \overline{p} + 3.\sqrt{\frac{\overline{p}.(1-\overline{p})}{n_i}} \tag{2}$$

$$LCL = \overline{p} - 3.\sqrt{\frac{\overline{p}.(1-\overline{p})}{n_i}} \tag{3}$$

After determining whether the production was controlled in the enterprise, the relations between the process groups expected to be effective on faults and the fault rates were statistically investigated. Qui-square test was used to investigate the relation between the fault rates in enterprise and the weeks, and the line chart method was used to examine the changes in this relation according to the weeks, while the relations between the process groups and the weeks were investigated by One Way Anova test, and Duncan test was used to classify the process groups according the efficiency levels. Significance level was set to α = 0.05.

Within the scope of improvement studies, each process group was separately investigated by drawing p control charts to determine to what extent the elimination of faults in process groups is effective on controlling the product quality. Subsequently, the fault rates in p control charts were hypothetically reduced below the upper limits and their contributions in controlling the production process were investigated. Finally, Pareto analysis was made by using data in control list to reduce the sewing faults in the enterprise and to determine the initial process to be improved. The purpose of Pareto analysis is to determine the process group with the highest fault rate, the faulty applications in this process group and the effects of these applications on faulty rates.

3. RESULTS AND DISCUSSION

In the study, it was initially determined whether the quality was statistically under control in the enterprise. Afterwards, the process group and process to be primarily handled in improvement studies to control the quality were determined. Lastly, the positive effects of improvements for uncontrolled faults on the enterprise quality were hypothetically examined in order to the guide quality improvement studies.

3.1. Current State of Quality in the Enterprise

Data of total sewing faults in the jacket production process of this men's suit production enterprise between October 2009 and May 2010 are presented with MCL, UCL and LCL values in Table 1.

Table 1. Control list prepared with 35-week fault data

Weeks	Sample (n)	Number of Faults	Faulty Rate (p)	UCL	MCL	LCL
1	2932	231	0.08	0.091	0.076	0.061
2	3120	270	0.09	0.090	0.076	0.062
3	3590	532	0.15	0.089	0.076	0.063
4	2326	349	0.15	0.092	0.076	0.060
5	3064	427	0.14	0.090	0.076	0.062
6	2900	328	0.11	0.091	0.076	0.061
7	3390	353	0.10	0.090	0.076	0.062
8	2331	134	0.06	0.092	0.076	0.060
9	2566	148	0.06	0.092	0.076	0.060
10	3841	178	0.05	0.089	0.076	0.063
11	3065	191	0.06	0.090	0.076	0.062
12	3607	327	0.09	0.089	0.076	0.063
13	2508	232	0.09	0.092	0.076	0.060
14	3216	409	0.13	0.090	0.076	0.062
15	3191	238	0.07	0.090	0.076	0.062
16	3663	146	0.04	0.089	0.076	0.063
17	3659	268	0.07	0.089	0.076	0.063
18	3195	181	0.06	0.090	0.076	0.062
19	3828	242	0.06	0.089	0.076	0.063
20	3155	199	0.06	0.090	0.076	0.062
21	3166	249	0.08	0.090	0.076	0.062
22	3660	279	0.08	0.089	0.076	0.063
23	2428	49	0.02	0.092	0.076	0.060
24	3118	174	0.06	0.090	0.076	0.062
25	3724	233	0.06	0.089	0.076	0.063
26	1772	148	0.08	0.095	0.076	0.057
27	1897	165	0.09	0.094	0.076	0.058
28	3242	174	0.05	0.090	0.076	0.062
29	3608	196	0.05	0.089	0.076	0.063
30	2591	206	0.08	0.092	0.076	0.060
31	3771	219	0.06	0.089	0.076	0.063
32	3845	211	0.05	0.089	0.076	0.063
33	3637	254	0.07	0.089	0.076	0.063
34	3094	195	0.06	0.090	0.076	0.062
35	3878	259	0.07	0.089	0.076	0.063
Total	**110578**	**8394**				

During this 35-week period, a total of 110.578 products were controlled and 8.394 of them were reprocessed on account of sewing fault. Faulty rate was determined as 7.6% in this period. The MCL value used for drawing p control chart was calculated by using Equation 1 as below.

$$MCL = \overline{p} = \frac{8394}{110578} = 0.076$$

Upper and lower control limits must be separately calculated for each sample group (n_i); for this reason, UCL and LCL were separately calculated for each week by Equations 2 and 3. For a clear understanding, calculation for sample group in the 1st week (n_1) is given below as an example.

$MCL = \overline{p} = 0.076$, $n_1 = 2932$

$$UCL = 0.076 + 3.\sqrt{\frac{0.076.(1-0.076)}{2932}} = 0.091$$

$$LCL = 0.076 - 3.\sqrt{\frac{0.076.(1-0.076)}{2932}} = 0.061$$

The p control chart used to investigate whether the production process was controlled in the enterprise was drawn based on data in Table 1 and presented in Figure 1.

Faulty rates of 35 weeks, MCL, UCL and LCL separately calculated for each week are given in the chart given in Figure 1. The chart demonstrates that faulty rates were higher than the UCL values in 3rd, 4th, 5th, 6th, 7th and 14th weeks, while the fault rates of 12th and 13th weeks coincided with the limit values. On the other hand, fault rates were higher than LCL in 10th, 16th, 18th, 23th, 24th, 28th, 29th, 31th, and 32th weeks, while the fault rates of 8th and 9th weeks coincided with LCL. When the fault rates are within the control limits in p control charts, product quality is accepted statistically under control (9). The p control chart of ready-made clothing enterprise investigated in the study (Figure1) demonstrates the presence of fault rates outside the UCL and LCL, which indicates that product quality is statistically not controlled in the enterprise. For this reason, certain improvements should be made in the production process of this enterprise. The studies performed to determine fault rates during production process as well as the process groups and the processes that need to be improved are explained below. In this stage, qui-square test was used to investigate the relation between the quality fault rates in the enterprise and the weeks. Test results are given in Table 2.

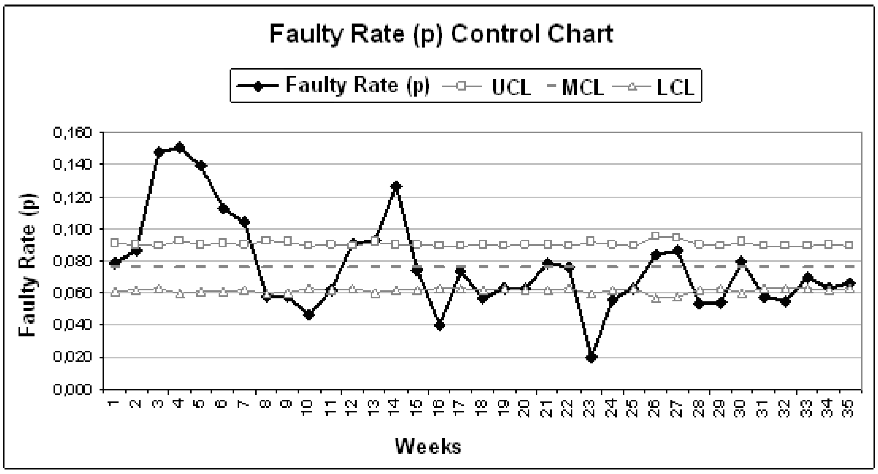

Figure 1. Faulty rate (p) control chart prepared for sewing faults

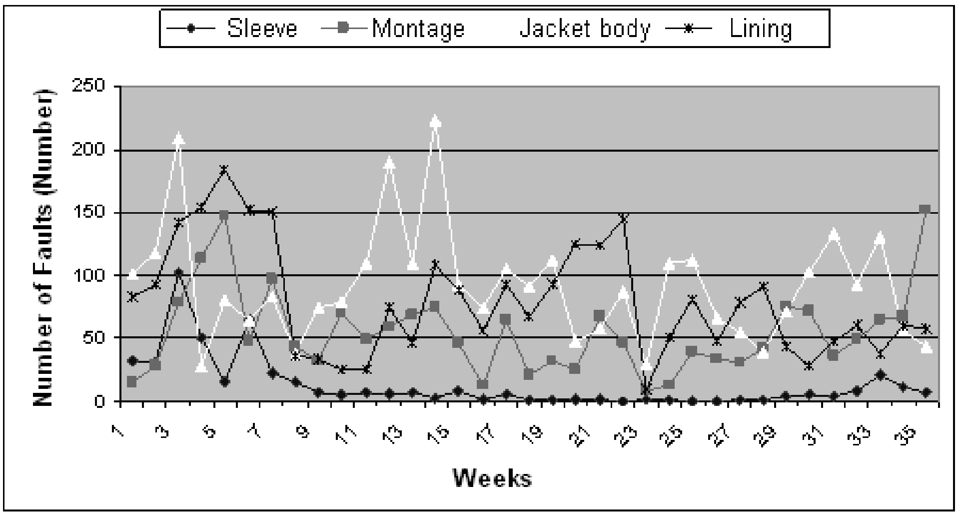

Figure 2. Relation between the quality fault amounts and weeks

Table 2. Results of the qui-square test investigating the relation between quality faults and weeks

	Value	Indepen-dence Level	Significance	
Pearson qui-square	1792.102	102	.000<p=0.05	significant
Total fault	8394			

Table 2 demonstrates a statistically significant relation between the quality fault amounts and the weeks at 0.05 significance level. In order to investigate the characteristics of the significant relation, a chart demonstrating the fault amounts of process groups based on weeks was drawn and presented in Figure 2.

In the chart given in Figure 2, a conspicuous redundancy is seen in fault amounts of all process groups for the first seven weeks. The fault amount of sleeve process group visibly decreased as of seventh week, and continued in a low course afterwards. Fault amount of montage process group also decreased starting from the seventh week and continued in a certain low level, but it significantly increased in the last week. The fault amounts of the jacket body and lining process groups increased to some extent in the initial phases, but it followed an irregular course during 35 weeks. This situation indicated that the real reasons effective on fault amounts of process groups, especially of the jacket body and lining process groups, were not determined and thus the necessary precautions were not taken, either. The high fault amounts in all process groups seen in the control chart during the initial weeks could be attributed to the adaptation problems to work after turning from Ramadan holiday and the intensive work load before the Sacrifice holiday corresponding to the eight week. Because ready-made clothing production requires attention and working close to material in all phases of production. However, decreases in hand-eye coordination, interest and attention as well as fatigue could be observed in workers due to intensive work load. Furthermore, it was proved in certain studies that forgetfulness and retardation in mental functions of individuals could also be present, which might increase the possibility of fault (13).

One Way Anova analysis was applied to investigate the effects of process groups on faults in the sewing department and the obtained results are given in Table 3.

As can be seen in Table 3, the difference between the process groups and the quality faults was found significant in the One Way Anova Analysis. Therefore, it was concluded that the process groups differed in the quality faults and the process groups were classified with Duncan test in terms of their difference levels. Test results are given in Table 4.

According to the results of Duncan Test given in Table 4, the process groups were classified into three groups. The mean fault amount was determined as 13.00 in the sleeve process group, 55.06 in the montage process group, 79.83 in the lining process group, and 91.94 in the jacket body process group. Considering the mean fault amounts of process groups, the jacket body and lining process groups were found different from other groups.

In order to investigate the quality faults in more detail, amounts and percentages of quality faults in the process groups are given in Table 5.

Table 5 demonstrates that the rate of faults in the lining and jacket body process groups which are assumed to have priority accounts for 71.62% in total, and the process group with the highest mean fault amount (38.34%) was found as jacket body process group. Therefore, it is suggested to start improvement studies with the jacket body process group and continue with other studies one by one. The faults in jacket body process group are composed of bursted, faulty, fillet line fault, diverse faults, felt brim in sleeve, fusing brim and pocket gap faults. The Pareto analysis was performed to determine which faults to be dealt with first. The data used in Pareto analysis are given in Table 6 and the obtained results are given in Figure 3.

Table 3. Oneway Anova analysis results

	Sum of Squares	Degree of Freedom	Mean of Squares	F Value	Significance	Comment
Intra-groups	127643.000	3	42547.667	30.120	.000<p=0.05	Significant
Inter-groups	192112.743	136	1412.594			
Total	319755.743	139				

Table 4. Results of Duncan test

Processes	Number of Observations observations(hafta)	1st group	2nd group	3rd group
Sleeve	35	13.00		
Montage	35		55.06	
Lining	35			79.83
Jacket body	35			91.94

Table 5. Quality fault rates of process groups

Processes	Number of Observations (weeks)	Total Number of Faults (n)	Fault Rate (%)
Sleeve	35	455	5.42
Montage	35	1927	22.96
Lining	35	2794	33.28
Jacket body	35	3218	38.34
Total		8394	100.00

Table 6. Data of fault amounts in jacket body process group

Processes	Fault Amount (n)	Fault Rate (%)	Cumulative Fault Rate (%)
Pocket gap	1168	36.40	36.40
Punctured	589	18.35	54.75
Felt brim in collar	457	14.24	68.99
Fusing brim	331	10.31	79.31
Diverse	272	8.48	87.79
Defective faulty	246	7.67	95.46
Fillet line fault	146	4.55	100.00
Total	**3209**	**100.00**	

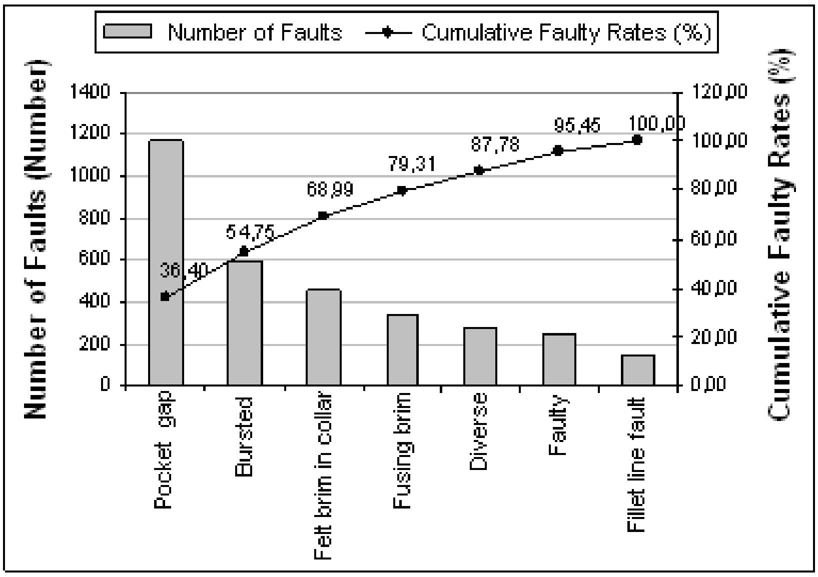

Figure 3. Pareto analysis for sewing faults in the jacket body process group

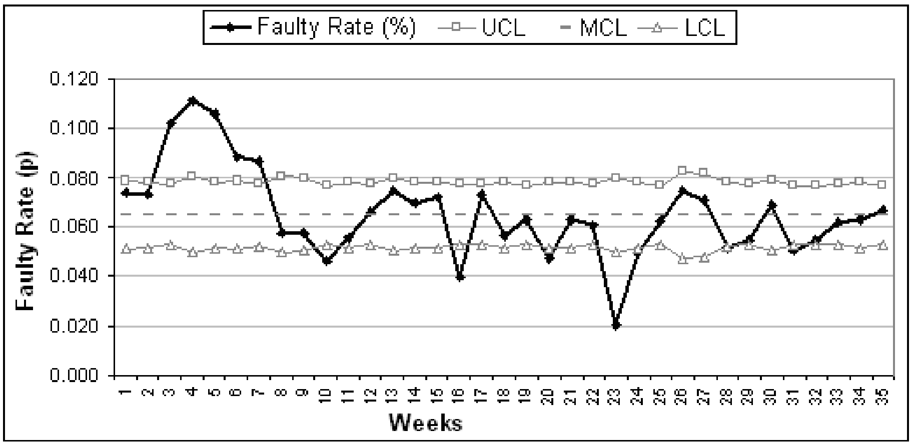

Figure 4. The p control diagram drawn with the corrected data of jacket body and lining process groups

The chart in Figure 3 demonstrates that the "pocket gap fault" was the process with the highest amount of fault (36.4%) in the jacket body process group within the study period, and this fault accounted for nearly 2/5 of total sewing faults. For this reason, elimination of this fault is considered to significantly improve the production quality of enterprise. For this purpose, real reasons behind "pocket gap' fault should be defined and whether it is caused by machinery or workers should be determined, and consequently, suitable solutions should be investigated.

3.2. Hypothetical Analysis of The Effect of Improvement Studies on The Quality of Enterprise

In the Duncan Test, the jacket body and lining process groups were determined as the groups that should be primarily dealt with. From this regard, control charts were separately formed for the data of jacket body and lining process groups in order to observe the effects of the elimination of the reasons for the faults in jacket body and lining process groups on production. In these charts, all the uncontrolled fault amounts were reorganized to stay below the upper limits. The data that were reorganized based on the assumption that the reasons behind the faults in jacket body and lining process groups were eliminated were reflected in control list and then p control diagram given in Figure 4 was created. In the comparison of the diagrams given in Figure 4 and Figure 1, the fault rates of only three (12th, 13th, and 14th weeks) out of eight weeks could be taken under control, though the reasons behind the faults in the significant process groups were eliminated.

For this reason, p control diagram was separately drawn for the other less significant process groups (sleeve and montage). In the p control diagrams of sleeve and montage process groups, all the fault rates were kept within the control limits for all weeks, and they were reflected on control list, and consequently, the p control diagram was redrawn. The p control diagram redrawn based on the assumption that all the reasons of faults were eliminated is given in Figure 5. In this diagram, the production process could be taken under control in general, and the sewing rate (7.6%) could be reduced to 6% if the total amount of fault is hypothetically reduced by 21.23%.

The hypothetical arrangements demonstrated that the elimination of the reasons behind the faults in the jacket body and lining process groups, which accounted for 71.62% of all faults, would not provide the expected contribution to take all the production process under control in the enterprise. Therefore, it was concluded that the reasons of the faults in all process groups, which result in uncontrolled production, should be separately handled. It is considered that the high averages of fault amounts (Figure 2) in the sleeve and montage process groups in the 1st and 2nd groups during the initial weeks were effective in this result. Consequently, it should be more useful to prepare separate control charts for each process group during improvement studies. Furthermore, the same consideration should be employed during the studies for all process groups and fault reasons in order to take the production process under control in the enterprise.

4. CONCLUSION

This study investigated whether the 35 weeks of jacket sewing process is controlled in a ready-made clothing enterprise manufacturing men’s suit in terms of quality; in addition, the reasons increasing quality faults and the priorities were determined for the improvement studies. During data collection, the sewing faults were determined in 8.394 out of 110.578 jackets. The rate of sewing faults (MCL) was determined as 7.6%.

As a result, the jacket production process was concluded statistically not under control in the enterprise. In addition, there was a statistically significant relation between the quality fault amounts and the weeks at 0.05 significance level. This finding supports the result that the quality is not controlled in the enterprise due to the significant changes in fault amounts between weeks and the presence of a general irregularity.

The difference between the process groups and the quality faults was found statistically significant at 0.05 significance level. Therefore, it was concluded that the process groups differed in the quality faults and they were classified by Duncan test with regard to their difference levels. Consequently, the jacket body and lining process groups were determined to differ from other process groups. The quality faults determined in Duncan test were investigated in more detail, and as a result, the fault amounts of jacket body and lining process groups accounted for 71.62% of total. This implied that it would be more appropriate to start the improvement studies initially with the jacket body process group as it had the highest fault amounts, and it should be followed by the lining process group. With the aid of Duncan test, Pareto analysis was applied for the primary reasons behind the faults in the jacket body process group and “pocket gap” was determined to constitute 2/5 of total sewing faults. This indicated that Pareto analysis is required to determine the priorities for a rapid improvement, and the improvement studies was first started with “pocket gap” in this enterprise.

In order to provide insight for improvement studies, the uncontrolled fault rates of the jacket body and lining process groups were hypothetically drawn within the control limit, but this did not provide the expected improvement for taking the production quality under control. It became possible to take the production quality under control when the uncontrolled fault rates of other process groups were drawn within the control limits. This indicated that focusing on the process groups making highest contributions to fault creation would not provide the expected improvement for taking all the production process under control in some enterprises. Therefore, it is concluded more appropriate to prepare separate control charts for each process group and fault reasons in the improvement studies, and to follow the changes in fault rates.

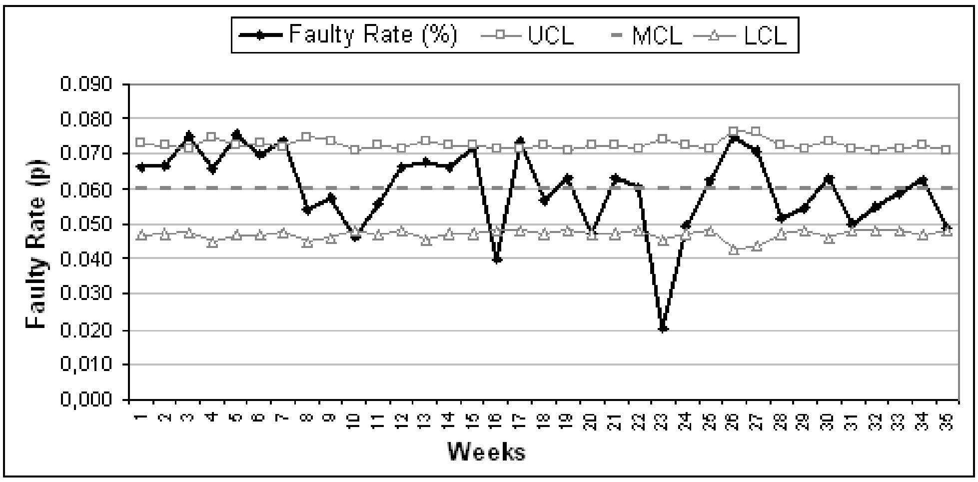

Figure 5. The p control diagram drawn with the corrected data of all process groups

In the present study, when the total amount of faults was hypothetically reduced by 21.23%, the production process could be taken under control in the enterprise and the rate of sewing fault could be improved by 1.6%.

In the present study, it is established that Statistical Process Control Methods could be suggested for planning improvement studies and analyzing whether the quality is under control in a ready-made clothing enterprise. In addition, it can be suggested to prepare separate (p) control charts for all process groups contributing to fault reasons and to investigate hypothetically the effects of improvement studies on quality level. Within the scope of quality improvement studies, it could be recommended to make regular quality control education, to investigate permanent solutions instead of daily solutions, to keep the workers' motivation high, and to make regular maintenance of machines. To enable a good quality system in enterprises, there should be adequate number of quality staff and the quality consciousness of workers should be increased. Quality system includes all the phases of production from the input of materials to product output, and quality standards should be created. Material quality should be controlled by performing input controls, while production quality should be provided by intermediary controls during production, and product quality should be provided by making output controls in the enterprise. Quality level should be constantly improved by using SPC methods, and for this purpose, regular trainings should be prepared in the enterprise.

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