IE 368 – Quality Planning and Control

Case Study 1

Due date: *April 10, 2023 (17:00)*

Cotton Ltd. is one of the biggest clothing companies in Turkey. They have more than 250 retail stores around the country in which they sell textile products for women, men and children. All the products for sale are produced in their 3 textile factories which are located in Çorlu, Gebze and Bursa.

The company has environmental concerns and liabilities as the textile industry is one of main sources of microplastics in streams and still waters. It is known that water and sediment samples collected from textile industrial areas contain abundant microplastics, predominantly polyester type of polymers. The company gives utmost importance to fulfill its liabilities and is open to collaborations with governmental and non-governmental organizations to provide information about their waste management policies.

Hence, they are investigated by GrayPiece, which is an environmental non-governmental organization, annually to verify that Cotton conforms to their waste management specifications. Thus, Cotton measures the amount of polyester in their wastewater on a daily basis. The specifications for polyester amounts regulated by the organization are LSL=0 piece/L and USL= 1600 pieces/L.

Table 1: Amount of plastic measured (in pieces/liters) in the wastewater of 3 facilities of Cotton

Day	Factory 1	Factory 2	Factory 3		Day	Factory 1	Factory 2	Factory 3
1	651	985	702		**16**	581	994	737
2	602	1054	719		**17**	573	1016	696
3	589	1035	704		**18**	577	1054	702
4	623	999	712		**19**	605	1110	686
5	662	966	681		**20**	603	1101	689
6	541	1012	676		**21**	638	947	702
7	617	1029	732		**22**	597	985	694
8	612	1030	722		**23**	599	983	711
9	612	1000	674		**24**	592	1019	701
10	569	1013	708		**25**	617	1034	719
11	610	968	726		**26**	605	1037	705
12	559	997	725		**27**	614	984	706
13	598	995	701		**28**	498	912	636
14	619	1001	710		**29**	620	996	675
15	634	1014	781		**30**	642	972	694

The data collected from the three factories of Cotton in the previous month is shown in Table 1. In the data collection processes of each factory, the following problems were detected by the quality engineers, and the necessary actions were taken by them.

On day 6: Factory 1 had an issue with a supplier which caused production to come to a halt early in the day. The problem was solved before the next days' production started.

On day 15: The plastic measuring device located in factory 3 was found to be improperly cleaned. It was detected on the same day and fixed.

On days 19 and 20: A newly hired worker in factory 2, while carrying out the maintenance work on the filtration system, could not properly seal the filters. It was detected on the evening of day 20 and fixed before day 21's production started.

On day 28: Due to a national holiday, in all factories, production was done only in 2 shifts, instead of the regular 3 shifts.

Cotton Ltd. wants to reduce the variability in the waste management processes by detecting and eliminating all assignable causes such as the ones listed above. The main difficulty in monitoring these processes is that the processes should be carried out in all three facilities, each has different workers, machines and working environments, as well as the production capacities. So, there could be variability from factory to factory, as well as for the same factory over time. Therefore, it's important to decrease both types of variability in the waste management system of Cotton Ltd. Another difficulty is associated with the measuring system, which consists of a particular device that should be checked manually for measures and thus takes time. If it is asked to measure several times in a day for quality control purposes, it may slow down the deliveries of factories to retail stores.

Suppose you were hired as an SPC consultant to Cotton Ltd. to help them with finding the most appropriate way to monitor their waste management processes.

What are all possible control chart options that Cotton Ltd. can use? Construct each of these charts and observe the data. Comment on the appropriateness of using those charts comparing their advantages/disadvantages.

Select the most appropriate chart(s) and estimate the mean and standard deviation for the measures of polyester amounts in wastewater samples.

Supposing that the mean and standard deviation estimates were reasonable, Cotton Ltd. was ready to monitor the polyester amounts in wastewaters. Thus, they collected new data shown in Table 2.

Table 2: Additional plastic measurement data

Day	Factory 1	Factory 2	Factory 3

31	624	988	742
32	602	967	731
33	603	1043	684
34	632	1032	664
35	603	958	713
36	640	995	713
37	581	1008	702
38	587	994	742
39	581	1011	722
40	612	998	716

Comment on what you observe on the chart(s) based on the newly collected data. As a consultant, comment also on how the Cotton Ltd. should continue monitoring and improving the process.

What can you tell about the capability of the waste management process to conform to the specifications? What can be done to improve the process quality?