

An Application on Various Variables for Production Line Quality Control

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Abstract

This study focuses on the analysis of various variables, an essential component of production line quality control. Businesses apply statistical quality control methods by examining different variables to monitor production processes, detect errors in advance, and enhance product quality. This research exemplifies the use of various variables for monitoring and improving production line processes. The data were examined on four different variables taken from a business and analyzed using statistical control charts. As a result of the analysis, there were no out-of-control values found in the measurement values of the product weight variable. No out-of-control condition has been detected in the product length variable. It has been identified that observation number 1 is out of control in the production speed variable. In the product quality variable, observations 19 and 31 have been identified as out of control. The results provide valuable insights for controlling and enhancing production processes. This study can assist businesses in improving their quality control practices and serving as an important tool for enhancing product quality.

Keywords: Business, Quality, Statistical Quality Control

JEL Code: L15, L11, C40, C46

1. Introduction

Production line quality control emerges as an indispensable element of modern industrial production processes. This critical process aims to ensure the quality, safety and suitability of products. Production line quality control includes a series of inspections and tests that are meticulously applied at every stage throughout the process, from raw material entry to the final product. This not only ensures that products comply with quality standards, but also increases

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customer satisfaction, reduces costs and increases production efficiency. This initiative aims to provide reliable and quality products to consumers while helping manufacturers survive in the competitive market.

In the realm of modern industrial production, the significance of production line quality control cannot be overstated. This vital process is dedicated to upholding the quality, safety, and suitability of the products that roll off the assembly lines. Production line quality control involves an intricate web of inspections and tests meticulously implemented at every juncture, spanning from the intake of raw materials to the delivery of the final product. Its primary objective is twofold: to ensure that products conform to stringent quality standards and to, in turn, elevate customer satisfaction, curtail operational costs, and enhance production efficiency. This concerted effort serves a dual purpose - it seeks to furnish consumers with dependable, top-notch products while concurrently fortifying the position of manufacturers within the fiercely competitive market landscape.

In the following pages, we will delve deeper into the multifaceted world of production line quality control. By exploring its underlying principles, methodologies, and the pivotal role it plays in the contemporary industrial panorama, we aim to shed light on its transformative influence on product quality, operational excellence, and market resilience. The journey begins by dissecting the fundamental concept of quality control and its evolution, followed by an examination of the integral components of a quality control system. We will then venture into the multifarious inspection and testing techniques that underpin this process, emphasizing their far-reaching implications.

Additionally, the paper will scrutinize the tangible benefits that accrue from the seamless execution of production line quality control, touching upon cost reduction strategies, heightened customer contentment, and elevated productivity. A significant part of our exploration will revolve around the contribution of quality control to the safety of products, emphasizing the paramount importance of safeguarding consumers against potential hazards. Furthermore, the research will spotlight the pivotal role of technological advancements in modernizing and streamlining the quality control process. We will delve into the impact of automation, data analytics, and artificial intelligence on quality control, demonstrating how these technologies have ushered in a new era of

precision and efficiency. As we journey through this in-depth analysis of production line quality control, it is our hope that readers will gain a comprehensive understanding of its pivotal role within the manufacturing sector and appreciate its far-reaching implications for both producers and consumers alike. This exploration aims to serve as a valuable resource for industry professionals, policymakers, and academics seeking to comprehend and harness the transformative power of quality control in the modern industrial landscape.

2. Literature

Statistical quality control is based on statistics and the application of statistical methods at every stage of design, production and service. Product quality issues tend to be more significant when the over-the-wall approach to design is employed. In this method, specifications are frequently established without taking into consideration the inherent variability present in materials, processes, and other system components, leading to the production of non-conforming components or products. Non-conforming products are those that do not meet one or more of their specified requirements (Montgomery, 2019). Quality control is a strategy that companies employ to remain competitive on a global scale among other companies and their products. Quality refers to a product or service's attributes that are sought after by users or customers, achieved through the measurement of processes and continuous improvements to maintain sustainability (Ishak et al., 2020; Anggraini et al., 2019). Statistical process control, defined as a methodology centered around control charts, is employed for the monitoring of multivariate processes. While the number of variables involved is a notable distinction between these methods, there are actually more crucial differences to consider. One of these distinctions lies in the frequent interrelated nature of the variables derived from multivariate processes (Eygü and Özçomak, 2017; Eygü, 2022). In this context, especially industrial companies frequently use statistical quality control methods (Andespa, 2020). Oberoi et al. (2016) conducted a process review using statistical quality control charts. They also stated that control charts are a process of eliminating technical problems and improving performance, which is widely accepted to analyze quality. In these control charts, histograms show the contribution of the normal distribution of frequency-monitored quality characteristics, while Shewhart control charts show that the examined processes are under statistical control (Gejdoš, 2015). Lim et al. (2014) conducted a research on the food industry using

statistical process control methods. They stated that the biggest benefit of applying the used methods in the food industry is improving food safety and reducing process variability. In this context, we are faced with the need to take into account the customer's perception of the quality of a product and the critical factors in the production process, distribution processes and product-market systems as general quality indicators (Orr, 1999; Peri, 2006 ; Trienekens ve Zuurbier, 2008). Moreover, food manufacturers often follow a variety of quality control and assurance methods that are destined for failure (Van Der Spiegel et al., 2003). The majority of research in statistical process control is of a generic and statistically theoretical nature. Consequently, there is a restricted amount of literature available on how to put SPC into practice to cater to the specific requirements of the food industry (Lim et al., 2014; Pable et al., 2010; Grigg, 1998, Grigg and Walls, 2007).

3. Method

This study focuses on the analysis of different variables that are an important component of production line quality control. In this regard, it exemplifies the use of different variables to monitor and improve production line processes. The data were examined on four different variables taken from a business and analyzed using statistical control charts.

3.1. Model and dataset

The data were examined on four different variables taken from a business and analyzed using statistical control charts. Variables used in analysis X1: product weight (g), X2: length (cm), X3: production speed (adet/saat), X4: it represents product quality (p). With these control charts, changes in the observation results of the products obtained from the processes are revealed. In addition, it is used to control processes, prevent possible defects in a timely manner and before they occur, and to improve and develop processes.

3.2. Findings

Out-of-control situations of the process related to the variables are examined with the help of control charts and given below.

Chart 1. Process product weight (g) variable control chart

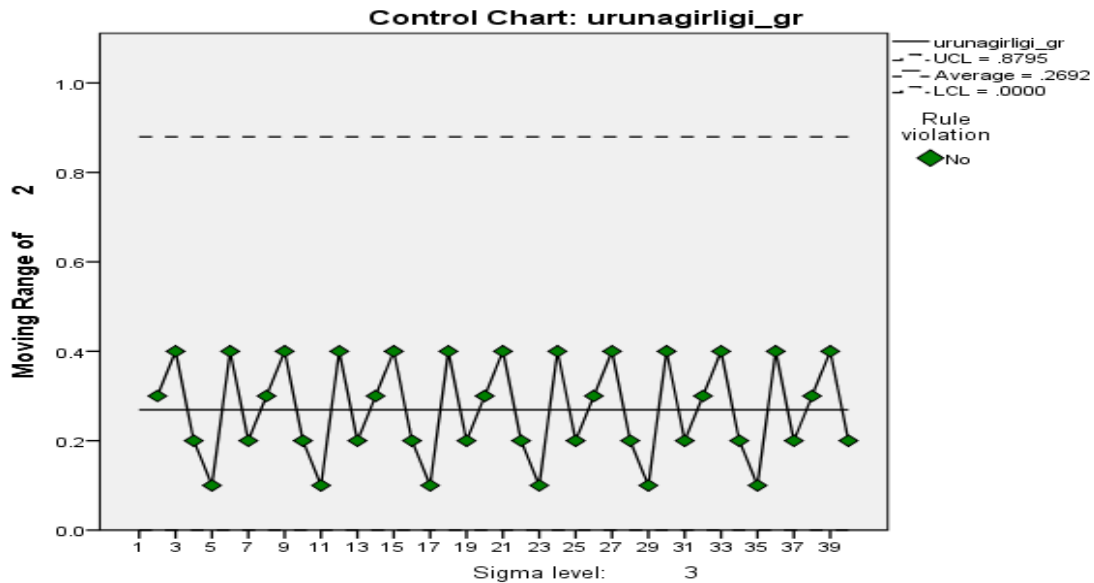
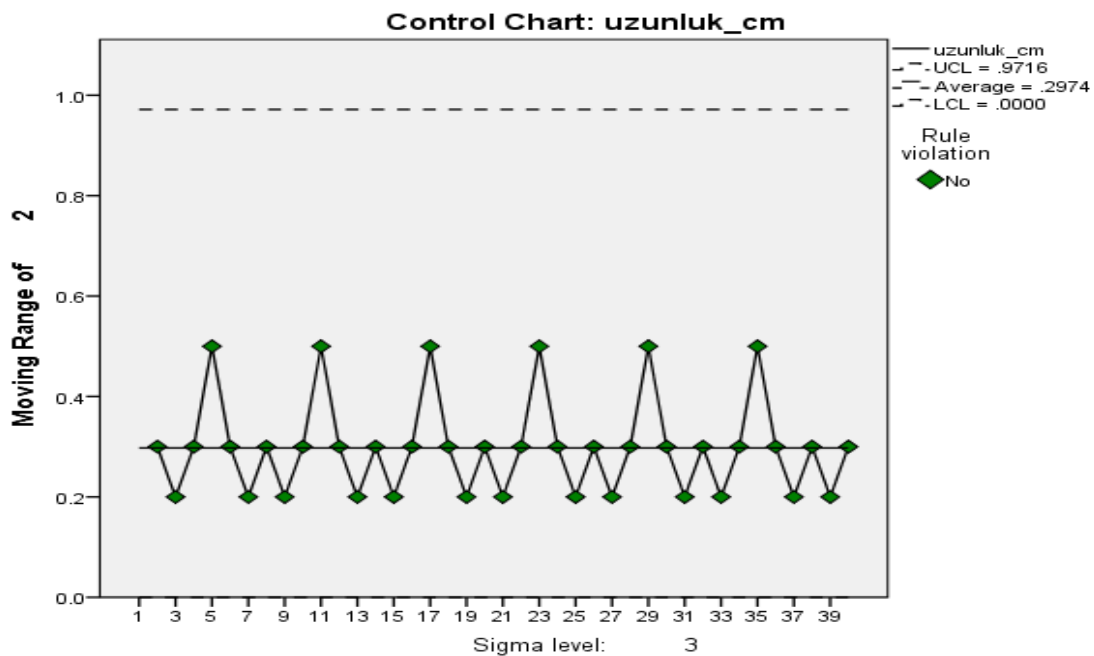


Chart 2. Process product length (cm) variable control chart



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Chart 3. Process production rate (pieces/hour) variable control chart

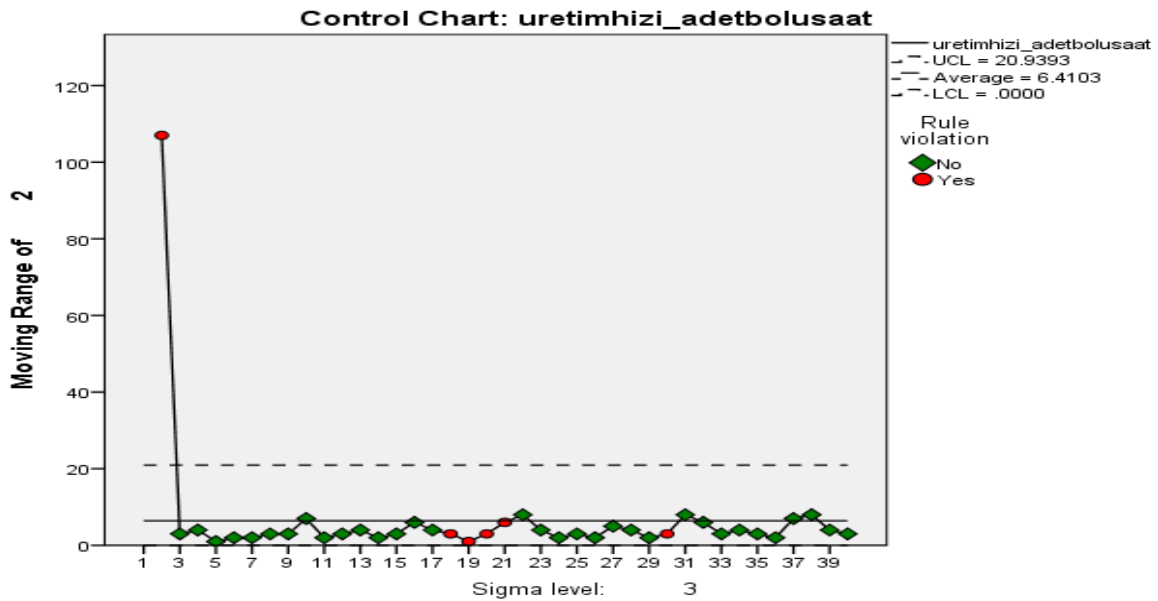
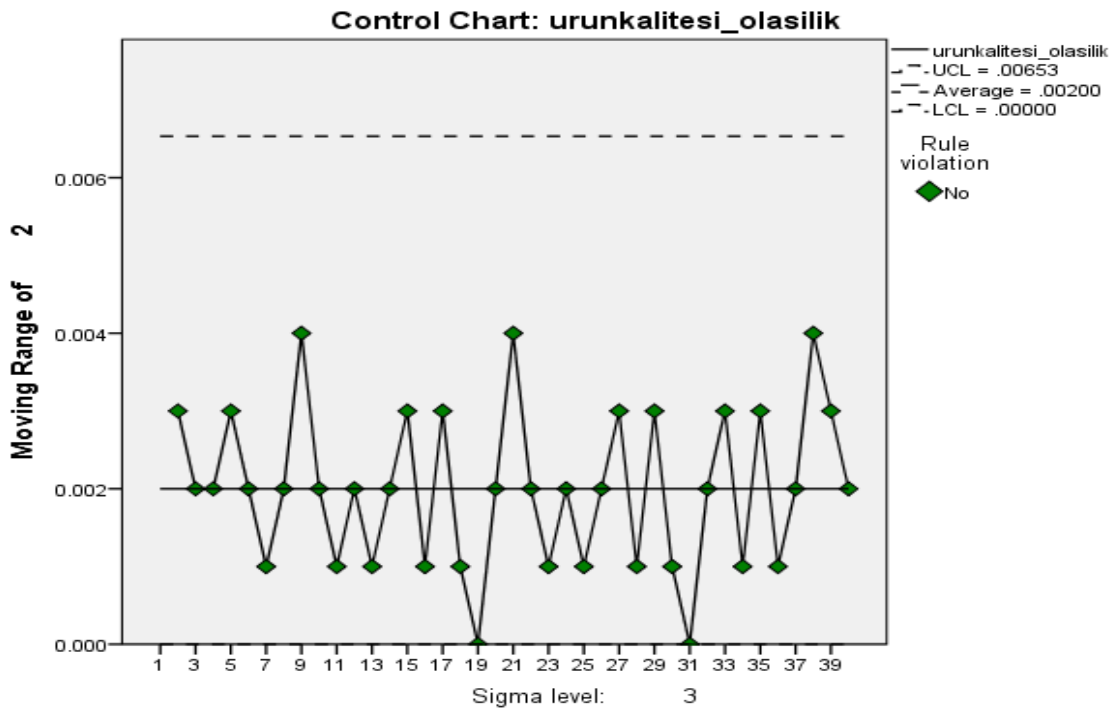


Chart 4. Process product quality (p) variable control chart



Conclusion

- This study focuses on the analysis of different variables that are an important component of production line quality control.
- The data obtained from a business was examined through four different variables and subjected to detailed analysis using statistical control charts. The variables examined are: product weight, product length, production speed and product quality.
- As a result of the analysis made for the product weight variable, no out-of-control values were detected in the measurement values, which shows that the product weight variable is under statistical control.
- No out-of-control could be detected for the product length variable. This shows that the product length in the enterprise is statistically stable.
- In the analysis made for the production rate variable, it was determined that there was an out of control situation in observation number 1. This shows that the production rate has changed unusually over a certain period of time. The business can review the relevant processes taking this situation into consideration.
- Finally, when the product quality variable was examined, it was determined that observations 19 and 31 were out of control. This situation shows that the company has problems with certain observations regarding product quality.
- In general, the results of this analysis show that the enterprise is under statistical control in the variables of product weight and length, while it reveals that there are certain problems in the variables of production speed and product quality. By evaluating these results, the business can take the necessary corrective measures in relevant areas and manage its processes more effectively.

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