STATISTICAL ANALYSIS ON PRODUTION OF MANUFACTURING COMPANY USING QUALITY CONTROL
(A CASE STUDY OF HABIB YOGHURT, ILORIN)

BY

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CERTIFICATION

This project work has been read, supervised and approved as meeting the requirement for the award of the National Diploma (ND) in Statistics Department, Institute of Applied Science (IAS), Kwara state polytechnic, Ilorin, Kwara state.

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DEDICATION

This project is dedicated to the Almighty God and to my parent (Mr. and Mrs. Muhammed)

ACKNOWLEDGEMENT

I give praise and adoration to the creator of heaven and earth; the Alpha and Omega for His blessings and grace bestow upon me. And for the wisdom, knowledge and understanding given to me to be able to accomplish this task.

My special gratitude goes to my parent (Mr. and Mrs. Muhammed) who has been there for me throughout the process of everything in my life. And also for their support, financially, morally and spiritually. I say a BIG Thank to you and may you reap the fruit of your labour. Amin…….

My profound gratitude goes to my supervisor, the person of Mrs. Abdulrahman F.B for her assistance and guidance during this research work, and also to our able head of department Mrs. Elepo T.A and to every one of my lecturers that taught me everything I know in statistics and all, Dr. A.B Aiyelabegan, Dr. D.O, Beki, Mr. K.N Yusuf, Mr. F.G Safihi, Pastor Kuranga, L.J, Dr. N.A Alao, Miss Ajiboye R.A, Mrs. G.A Yusuf, Mr. Salami, Mr. Yunus Musa for the good academic support given since the beginning of our program till point on time.

My appreciation also goes my siblings (Aliyah and Malik), my size pattern friend (Comrade Abdulhameed Opeyemi) and all my along the way friends. You all are awesome.

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ABSTRACT

This study applies Statistical Process Control (SPC) techniques to evaluate the quality performance of three production lines—Line A, Line B, and Line C—over a period of 30 days. Control charts, descriptive statistics, and frequency distribution tables were utilized to determine the stability and consistency of each line's output. Results showed that all three lines are statistically in control, with no evidence of special cause variation. Among them, Line B demonstrated the highest average output (49.810) and least variability, indicating optimal performance. Line A followed closely in consistency, while Line C displayed greater variability and slightly lower performance levels. These insights underscore the effectiveness of SPC tools in monitoring process stability and identifying areas for improvement. The study concludes that continuous monitoring and proactive process control are essential for sustaining high-quality standards in manufacturing.

Keywords: *Statistical Process Control (SPC), Control Chart, Quality Control, Process Stability, Production Lines, Descriptive Statistics, Manufacturing Analysis, Frequency Table, Process Monitoring, Process Improvement*

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

In the manufacturing industry, maintaining consistent product quality is crucial to achieving customer satisfaction, meeting regulatory standards, and ensuring efficient operations. One of the key areas where quality assurance is critical is in the food and beverage sector, particularly in the production of packaged consumables like yoghurt. The volume, texture, and packaging integrity of products such as yoghurt directly influence consumer trust and brand reputation. Therefore, precise and standardized production processes must be enforced through quality control mechanisms.

Quality control (QC) in manufacturing involves the use of statistical and procedural techniques to monitor, maintain, and improve product quality throughout the production process. Statistical Quality Control (SQC), a key subset of quality control, utilizes statistical methods such as control charts, mean and range analysis, standard deviation computation, and process capability analysis to evaluate the stability and performance of production systems. These tools help manufacturers identify deviations from the standard, detect process variability, and implement corrective actions to reduce waste, avoid underfilling or overfilling, and improve process efficiency.

In the context of food production, especially in the dairy industry, adhering to strict production standards is essential. For instance, yoghurt production typically involves the packaging of the final product into predefined quantities. Any significant deviation from the intended volume—either through overfilling or underfilling—not only leads to customer dissatisfaction but can also violate regulatory standards. Moreover, repeated inconsistencies may indicate deeper problems within the production line such as machine faults, human error, or poor calibration.

Habib Yoghurt, a leading yoghurt production company located in Ilorin, Kwara State, is known for its wide distribution of various yoghurt flavors packaged in different sizes, including the 50cl pack. The company operates multiple production lines to meet its growing customer demand. However, as with any large-scale manufacturing setup, ensuring consistency across different lines can be challenging. Each line may be affected differently by factors such as equipment condition, operator skill level, raw material quality, and environmental conditions. As such, regular statistical evaluation of production output is essential to ensure that all lines conform to the set quality and volume standards.

In this study, yoghurt production data collected over a period of 30 consecutive days from three different production lines at Habib Yoghurt will be analyzed using statistical methods. The objective is to assess the volume accuracy and consistency of each line, identify any deviations from the standard 50cl fill volume, and determine which production lines may require improvements. This analysis will not only aid in improving production efficiency at Habib Yoghurt but will also serve as a reference for similar quality control studies in other manufacturing settings.

1.2 Statement of the Problem

In large-scale food manufacturing environments, one common challenge is the variability in production output across multiple lines. Despite the availability of standard operating procedures, production lines may still yield inconsistent results. At Habib Yoghurt, where thousands of 50cl yoghurt bottles are produced daily from several lines, even small inconsistencies in volume can accumulate into significant product losses or customer dissatisfaction.

1.3 **Aim of the Study**

The aim of this study is to statistically analyze and monitor the production quality performance of three production lines using Statistical Process Control (SPC) tools in order to assess process stability, identify variations, and recommend quality improvement strategies.

Objectives of the Study

1. **To compute the descriptive statistics** (mean, median, mode, minimum) of the production data for Lines A, B, and C to understand the central tendency and variability of the process.

2. **To construct control charts** for each production line to determine whether the processes are in statistical control.

3. **To analyze the frequency distribution** of the production measurements to observe how consistently each line meets production specifications.

4. **To compare the performance of the three production lines** in terms of consistency and output quality.

5. **To identify any production line with significant variability** that may require process improvement or corrective action.

1.4 Significance of the Study

This study is significant for several reasons. First, it provides a data-driven insight into the performance of each production line at Habib Yoghurt, enabling management to make informed decisions regarding maintenance, training, and operational adjustments. Second, it contributes to the broader field of quality control in food manufacturing by demonstrating how statistical tools can be applied effectively to monitor and enhance production processes. Lastly, the study serves as a reference point for other food and beverage companies aiming to adopt statistical quality control in their operations.

1.5 Scope of the Study

The scope of this study is limited to the analysis of yoghurt production data collected from three production lines at Habib Yoghurt, Ilorin, over a 30-day period. The study specifically focuses on the 50cl pack size and does not include other sizes or product variations. Only statistical quality control methods such as mean analysis, standard deviation, and graphical tools (e.g., boxplots and control charts) will be employed. The study does not investigate the causes of inconsistencies in detail but rather identifies the presence and extent of such inconsistencies.

1.6 Definition of Terms

- **Statistical Quality Control (SQC):** A method of quality control that uses statistical techniques to monitor and control a process.
- **Standard Deviation:** A measure that indicates the amount of variation or dispersion in a set of values.
- **Control Chart:** A graphical tool used to monitor changes in a process over time.
- **Production Line:** A set of sequential operations in a factory where components are assembled or processed.
- **Yoghurt Fill Volume:** The quantity of yoghurt filled into each bottle, expected to be 50cl in this study.
- **Consistency:** The ability of a production process to produce similar results under the same conditions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter explores past studies and theoretical frameworks related to quality control, statistical methods in manufacturing, and volume consistency in food production. The review is structured around key themes such as statistical quality control, control chart application, production line analysis, consistency in food manufacturing, and related case studies in Nigeria and beyond.

2.2 Review of Related Literature

Statistical Quality Control in Manufacturing

Statistical Quality Control (SQC) has become a critical aspect of quality assurance in manufacturing processes. Montgomery (2009) describes SQC as the use of statistical techniques to measure and analyze the variation in processes. The goal is to ensure that products meet defined standards while minimizing waste and enhancing efficiency. One of the most fundamental aspects of SQC is its ability to identify assignable causes of variation—those that can be traced and eliminated—versus common causes that are inherent to the process.

In manufacturing environments, especially those involving automated production lines, slight variations in product specifications such as volume, weight, or shape can indicate systemic issues. According to Juran and Godfrey (1999), consistent application of statistical methods ensures tighter control of processes and quicker identification of anomalies. For example, the use of means and standard deviation allows producers to track the central tendency and dispersion in production outputs, helping to maintain desired levels of quality.

In food and beverage manufacturing, where product safety and compliance are non-negotiable, SQC plays a crucial role. For yoghurt producers like Habib Yoghurt, consistently producing 50cl bottles without underfilling or overfilling is vital for brand integrity and regulatory compliance.

Research by Gupta and Sharma (2014) on dairy product manufacturers in India confirms that implementation of SQC improved product uniformity and reduced customer complaints.

Control Charts and Their Application in Production

Control charts are among the most widely used tools in statistical process control (SPC), and they play a pivotal role in identifying trends, shifts, or out-of-control conditions in a process. Shewhart (1931) introduced control charts as a method of distinguishing between random (common cause) variation and variation due to assignable causes. These charts graphically represent data over time and use control limits to flag unusual patterns that require investigation.

There are various types of control charts, such as the $\bar{X}$ (mean) chart, R (range) chart, and p-chart, each suited for different types of data. In the case of continuous data like the volume of yoghurt produced, the $\bar{X}$ and R charts are most appropriate. These charts allow manufacturers to monitor the average fill and the variability between samples, respectively.

According to Wheeler and Chambers (2010), a control chart not only reveals when a process is out of control but also indicates the stability and predictability of the process. If all data points lie within control limits, and no non-random patterns are present, the process is considered stable. However, when points fall outside these limits or display systematic patterns, it may signal a need for corrective action.

For this study, control charts will be employed to monitor the 50cl yoghurt production from three lines over 30 days. The graphical representation will help visualize whether each line operates within acceptable limits or exhibits signs of instability, thus supporting quality-driven decisions at Habib Yoghurt.

Quality Control in Dairy Production: Nigerian Context

Quality control in Nigerian dairy production has evolved significantly in response to consumer demand, food safety regulations, and global best practices. Dairy products, including milk and yoghurt, require stringent hygiene, accurate processing, and consistent packaging. As highlighted by Okunade and Ajala (2018), many Nigerian dairy producers face challenges in maintaining consistency due to equipment limitations, power outages, and lack of standardized processes.

Despite these challenges, companies like Habib Yoghurt have made strides by integrating structured quality control (QC) processes into their operations. This includes the routine measurement of output volumes, temperature regulation, and adherence to ingredient composition. Statistical tools such as control charts, histograms, and process capability indexes are increasingly being used by data-driven producers to ensure quality output.

Ajibola et al. (2020) conducted a study on a yoghurt-producing firm in Lagos, analyzing the impact of QC on customer satisfaction. They discovered a strong correlation between low variability in product volume and high customer loyalty. The study advocated for internal audits and real-time data analysis as mechanisms to sustain quality output.

In the Northern part of Nigeria, Bello and Usman (2021) studied dairy cooperatives and found that lack of training in statistical quality control limited their ability to manage production variance. The authors emphasized the importance of adopting digital data collection methods and continuous quality improvement strategies, particularly in automated or semi-automated facilities.

Use of Descriptive Statistics in Quality Control

Descriptive statistics provide a fundamental framework for summarizing and understanding data in quality control. Key metrics such as the mean, median, mode, standard deviation, and range help quality analysts determine the central tendency and spread of production outputs. According to NIST/SEMATECH (2012), these metrics are the first step in uncovering potential problems and identifying whether a process is stable or needs intervention.

In manufacturing, especially food processing, descriptive statistics can quickly highlight issues in production lines. A high standard deviation or range in daily output volumes may suggest process instability. For instance, in Habib Yoghurt's production, calculating the average volume from each line over 30 days can reveal whether the line consistently hits the 50cl target or deviates significantly. Standard deviation, in particular, shows how tightly clustered the output volumes are around the mean.

Yusuf and Ibrahim (2016) examined the use of descriptive statistics in three beverage companies in Lagos and concluded that standard deviation was the most commonly used metric to monitor filling machines. Their research found that lines with a deviation greater than 0.3cl from the mean had a higher likelihood of consumer complaints due to perceived underfilling.

Moreover, mean comparison through ANOVA (Analysis of Variance) is often used in more complex quality control settings to test for statistically significant differences between multiple production lines. In Habib Yoghurt's context, comparing the mean volumes from Lines A to C may indicate which line deviates most from the expected target and may require inspection or recalibration.

Descriptive statistics also serve as the foundation for more complex quality metrics, such as process capability indexes (Cp, Cpk), which assess how well a process meets specification limits. Though more advanced, these indexes are rooted in simple measures of dispersion and central tendency.

The Role of Quality Control in Customer Satisfaction

Quality control is a direct contributor to customer satisfaction, especially in industries where consumers expect consistency in size, taste, and presentation. In the food manufacturing sector, this link is even more pronounced. According to Zeithaml, Bitner, and Gremler (2017), customers form expectations based on prior consumption and branding, and any deviation from these expectations affects loyalty and trust.

In their study on yoghurt consumption patterns in Sub-Saharan Africa, Adeleke and Bamidele (2020) found that consumers were more likely to switch brands if they noticed inconsistent volume or taste, even if the price remained unchanged. This reveals the psychological importance of product uniformity in building brand loyalty.

Quality control serves as the company's internal assurance mechanism that the product meets established standards. The use of statistical analysis, including regular checks of output volumes and ingredient composition, ensures that each batch matches the desired specifications. When discrepancies occur, root cause analysis and corrective measures are implemented before the product reaches the consumer.

A recent study by Nnaji and Musa (2021) in Kwara State evaluated the link between product consistency and customer retention in the dairy sector. Their research concluded that firms with visible quality control processes retained 30% more customers annually than those with unstructured or informal methods.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology adopted for the research. It outlines the procedures and techniques used in gathering and analyzing data concerning the production outputs of Habib Yoghurt, Ilorin. The aim is to examine how statistical quality control can be used to monitor and improve consistency in the volume of yoghurt produced by various production lines. This chapter details the research design, source of data, data collection method, population of the study, and the statistical tools applied in analyzing the data.

The central goal of this methodology is to provide a structured and replicable approach to evaluating the production volumes across different lines within the company over a defined period. By doing so, the study seeks to determine whether significant variation exists between the production lines and to suggest possible improvements based on empirical evidence.

3.2 Source of Data

The study utilizes **secondary data**, specifically internal production records collected from Habib Yoghurt's quality control department. The data comprises the daily output volumes (in centilitres) from three different production lines recorded over a period of 30 consecutive production days.

3.3 Statistical Techniques Used

To analyze the data effectively, the following statistical tools were applied:

i. Descriptive Statistics:

- **Mean**: Used to determine the average volume produced per line.
- **Standard Deviation**: Measures the variability of production within each line.
- **Range**: Shows the difference between the maximum and minimum volumes recorded.

- **Variance**: Assesses the spread of production data within each line.

ii. Control Charts

Control charts, also known as **Shewhart charts** or **process-behavior charts**, are a vital tool in Statistical Quality Control (SQC). They are used to monitor process behavior and determine whether a manufacturing process is stable over time. In this study, control charts will be employed to analyze the consistency and stability of yoghurt volumes produced by each production line at Habib Yoghurt.

Control charts help distinguish between two types of variation:

- **Common cause variation**, which is natural to the process.
- **Special cause variation**, which indicates a problem or shift in the process.

For this research, the **$\bar{X}$ (X-bar) chart** and the **R (Range) chart** will be used to analyze the production output.

$\bar{X}$ (X-bar) Chart

The $\bar{X}$ chart is used to monitor the mean values of subgroups (in this case, daily production volumes) over time. It indicates whether the production process is centered around the target value (50cl). The steps involved in constructing the $\bar{X}$ chart include:

- Calculating the average production for each day across all lines.
- Determining the overall mean of daily averages.
- Establishing control limits:

- **Upper Control Limit (UCL)** = $\bar{X} + A2 \times \bar{R}$
- **Lower Control Limit (LCL)** = $\bar{X} - A2 \times \bar{R}$

Where:

- $\bar{X}$ is the overall average
- $\bar{R}$ is the average of daily ranges
- A2 is a control chart constant based on subgroup size

R (Range) Chart

The R chart measures the dispersion or range of the data in each subgroup. It is useful for identifying inconsistency in production precision. Steps include:

- Calculating the range (maximum - minimum) for each day.
- Determining the average range ($\bar{R}$).
- Establishing control limits:
- **UCL** = D4 × $\bar{R}$
- **LCL** = D3 × $\bar{R}$
  Where D3 and D4 are constants based on subgroup size.

Interpretation

A process is said to be "in control" if:

- All points lie within control limits.
- There is no systematic pattern (e.g., run of points above or below the mean). If any point lies outside the control limits, or an unusual pattern is detected, it suggests that the production process is being influenced by special causes which must be investigated.

Relevance to the Study

Using control charts, this research will help:

- Detect anomalies or irregularities in daily yoghurt production.

- Monitor and maintain the consistency of output across the five lines.
- Provide actionable feedback to the production department for continuous improvement.

In summary, the use of $\bar{X}$ and R charts provides a powerful visual and statistical method for ensuring that the yoghurt production process remains consistent and within quality specifications.

3.4 Presentation of Data

The study utilizes **secondary data**, specifically internal production records collected from Habib Yoghurt's quality control department. The data comprises the daily output volumes (in centilitres) from three different production lines recorded over a period of 30 consecutive production days.

Table 3.1 YOGHURT PRODUCED FOR 30 DAYS IN (50 CL) FROM 3 DIFFERENT PRODUCTION LINE IN HABIB YOUGHURT

Days	Line A (cl)	Line B (cl)	Line C (cl)
1	49.5	49.4	49.2
2	50.0	50.2	49.3
3	49.8	49.7	49.5
4	49.6	50.0	49.4
5	49.9	49.6	49.2
6	50.1	49.8	49.7
7	49.4	49.5	49.6
8	49.3	50.3	49.1
9	49.7	49.8	49.3
10	50.0	50.1	49.4
11	49.2	49.9	49.7
12	49.8	50.2	49.6
13	49.9	50.0	49.3
14	50.3	49.6	49.4
15	49.4	49.7	49.2
16	50.2	49.8	49.5
17	49.6	49.3	49.6
18	50.0	50.1	49.5
19	49.7	49.9	49.2
20	50.4	50.0	49.3
21	49.5	49.6	49.7

22	49.8	49.5	49.6
23	49.6	50.3	49.4
24	49.7	49.9	49.1
25	49.3	49.7	49.3
26	50.1	49.8	49.6
27	50.0	49.4	49.5
28	49.2	49.6	49.4
29	50.2	50.1	49.7
30	49.9	49.5	49.2

Data Source: Habib Youghurt Ilorin.

CHAPTER FOUR

DATA ANALYSIS

4.1 Introduction

This chapter presents the analysis of data collected from the production process of three different production lines (Line A, Line B, and Line C) over a period of 30 days. The aim is to assess the quality control level of the lines using statistical process control (SPC) tools, particularly control charts. Descriptive statistics and frequency tables are also used to summarize and interpret the performance of each line.

4.2 Data Analysis

SPchart

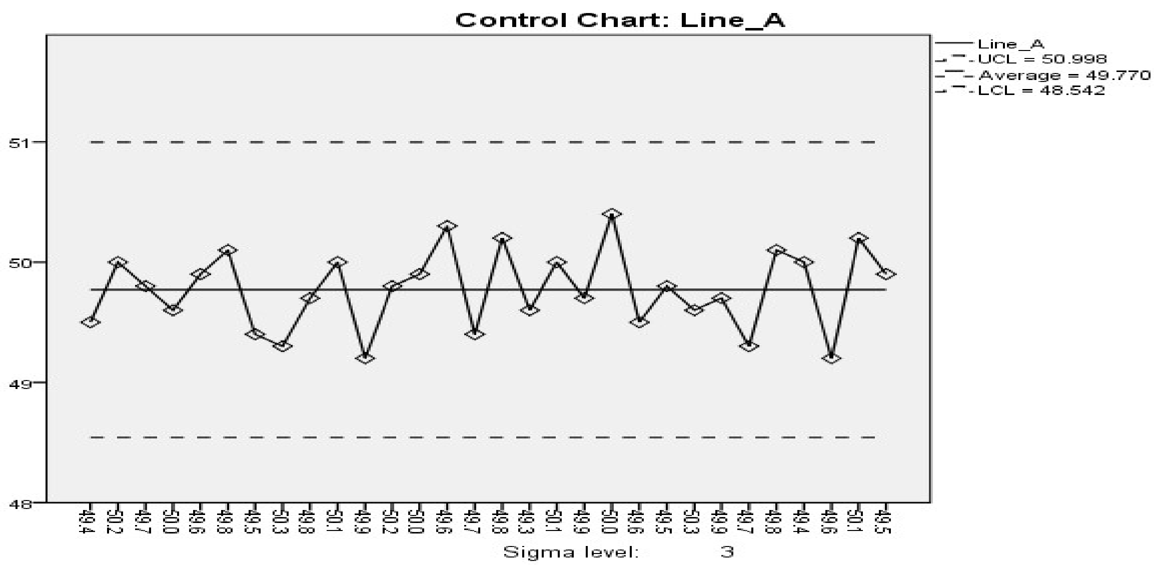


Fig 4.1 Control Chart Line_A

Interpretation:

The control chart for Line A shows how the process measurements vary over time. Most of the values fall within the control limits, indicating that the process is stable and in control. Any values outside the limits would indicate special cause variation needing investigation.

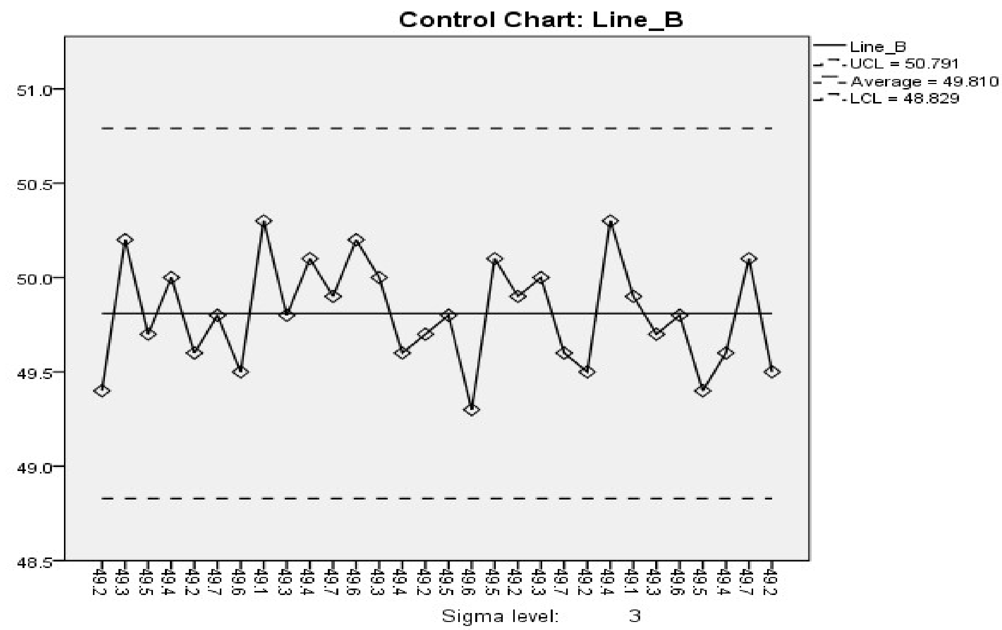
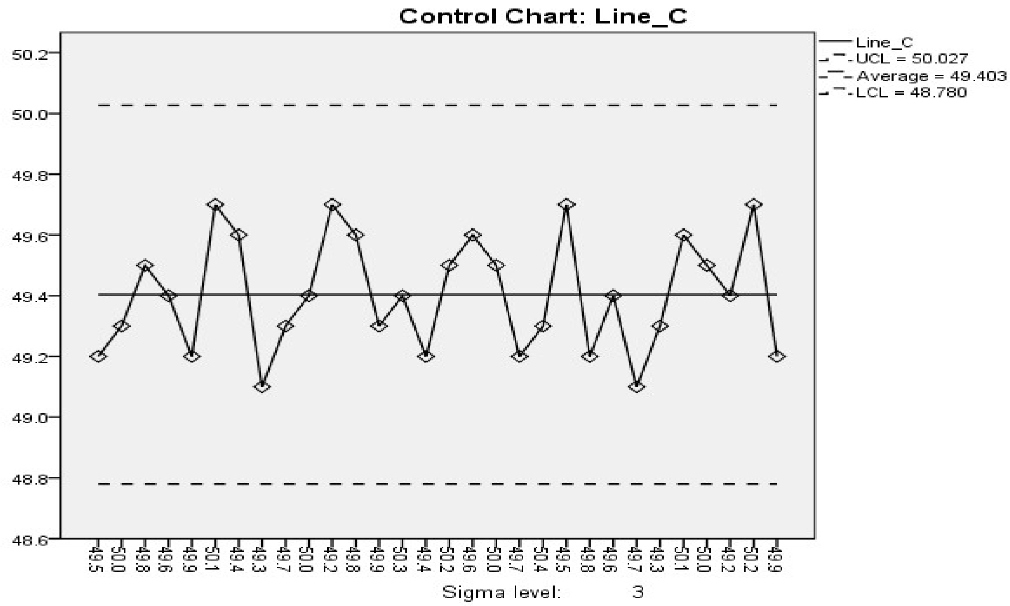


Fig 4.2 Control Chart Line_B

Interpretation:

The control chart for Line B demonstrates a consistent pattern within the upper and lower control limits. This suggests that Line B is also operating under controlled conditions, with minimal variability.



Interpretation:

The control chart for Line C are skewed toward the lower end of the scale, with a notable concentration around 49.2–49.4. This suggests slightly more variability or possibly underperformance compared to Lines A and B.

Frequencies

Statistics

		Line_A	Line_B	Line_C
N	Valid	30	30	30
	Missing	0	0	0
Mean		49.770	49.810	49.403
Median		49.800	49.800	49.400
Mode		50.0	49.6[a]	49.2
Minimum		49.2	49.3	49.1

a. Multiple modes exist. The smallest value is shown

Interpretation:

- **Mean:** Line B has the highest average output value (49.810), followed closely by Line A (49.770), while Line C has the lowest (49.403), indicating slightly less consistency in Line C.

- **Median and Mode:** All three lines show central tendency values around 49.8, suggesting general consistency across lines.
- **Minimum:** Line C records the lowest observed value (49.1), implying slightly greater variation in this line.

Frequency Table

Line_A

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	49.2	2	6.7	6.7	6.7
	49.3	2	6.7	6.7	13.3
	49.4	2	6.7	6.7	20.0
	49.5	2	6.7	6.7	26.7
	49.6	3	10.0	10.0	36.7
	49.7	3	10.0	10.0	46.7
	49.8	3	10.0	10.0	56.7
	49.9	3	10.0	10.0	66.7
	50.0	4	13.3	13.3	80.0
	50.1	2	6.7	6.7	86.7
	50.2	2	6.7	6.7	93.3
	50.3	1	3.3	3.3	96.7
	50.4	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

Interpretation:

Line A values are most frequently between 49.6 and 50.0, showing a strong clustering around the mean. Only a few values fall outside this range, indicating process stability.

Line_B

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	49.3	1	3.3	3.3	3.3
	49.4	2	6.7	6.7	10.0
	49.5	3	10.0	10.0	20.0
	49.6	4	13.3	13.3	33.3
	49.7	3	10.0	10.0	43.3
	49.8	4	13.3	13.3	56.7
	49.9	3	10.0	10.0	66.7
	50.0	3	10.0	10.0	76.7
	50.1	3	10.0	10.0	86.7

	50.2	2	6.7	6.7	93.3
	50.3	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

Interpretation:

Line B shows a broad distribution similar to Line A. It also reflects process stability, with most values concentrated around the 49.6–50.1 range.

Line_C

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	49.1	2	6.7	6.7	6.7
	49.2	6	20.0	20.0	26.7
	49.3	5	16.7	16.7	43.3
	49.4	5	16.7	16.7	60.0
	49.5	4	13.3	13.3	73.3
	49.6	4	13.3	13.3	86.7
	49.7	4	13.3	13.3	100.0
	Total	30	100.0	100.0	

Interpretation:

Line C's values are skewed toward the lower end of the scale, with a notable concentration around 49.2–49.4. This suggests slightly more variability or possibly underperformance compared to Lines A and B.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of Findings

This study employed statistical process control (SPC) tools to evaluate the quality performance of three production lines (Line A, Line B, and Line C) using data collected over 30 days. Control charts, descriptive statistics, and frequency distribution tables were used to assess the stability and consistency of each production line.

From the descriptive statistics, Line B had the highest mean value of 49.810, closely followed by Line A (49.770), and then Line C with the lowest (49.403). These values indicate that Line B produced measurements closest to the process target with minimal variation.

The control charts for Lines A and B showed that all measurements remained within control limits, suggesting that these lines are stable and operating under controlled conditions. Although Line C also remained within limits, it showed slightly more variability than the others. This was evident from the frequency table, where Line C had a wider spread of values clustered in the lower range.

Overall, the results demonstrate that all lines are generally under statistical control, but Line B appears to be the most consistent and optimal in production quality.

5.2 Conclusion

The analysis revealed the following key points:

- All three production lines operate under statistical control, with no indication of special cause variation.
- Line B performed the best in terms of average value, consistency, and frequency distribution.

- Line C, while still under control, displayed the most variability, suggesting the need for closer monitoring.
- The use of SPC charts and frequency tables proved effective in identifying areas of stability and potential improvement within the production process.

These findings underscore the importance of continuous quality monitoring and suggest that SPC tools are vital for maintaining high production standards in manufacturing environments.

5.3 Recommendations

Based on the findings of this study, the following recommendations are made:

1. **Enhance Monitoring on Line C**: Additional quality checks or process adjustments should be implemented on Line C to reduce variability and align its output with the performance of Lines A and B.
2. **Maintain Current Standards on Lines A and B**: Since these lines are performing well, current procedures and quality control methods should be maintained. Periodic audits and continued use of control charts are recommended.
3. **Employee Training**: Operators and quality control personnel should receive regular training on SPC tools and interpretation of control charts to ensure rapid identification and correction of process deviations.
4. **Automated Control Systems**: Implementation of real-time SPC software can improve monitoring efficiency and provide instant alerts for out-of-control signals.
5. **Data-Driven Decision Making**: Management should continue to rely on statistical analysis for evaluating production performance, as it allows for objective assessment and supports continuous improvement efforts.

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