MULTIFINANCE
Jurnal Ekonomi, Manajemen Dan Perbankan
Altin Riset Publishing
http://altinriset.com/journal/index.php/multifinance
E-ISSN: 3024-8175
Vol.3, No. 2, November 2025

ANALYSIS OF DOLL PRODUCT QUALITY CONTROL USING STATISTICAL QUALITY CONTROL (SQC) METHODS AT PT AURORA WORLD CIANJUR

[*1]Santo Dewatmoko, [2]Erika Nurmartiani, [3] Muhamad Arief Ramdhany
[*1]Universitas Taruna Bakti,[2]Universitas Sangga Buana YPKP Bandung,
[3]Universitas Pendidikan Indonesia
Email: [*1]santo.dewatmoko@gmail.com, [2]erika.nur@usbypkp.ac.id, [3]ramdhany@upi.edu

Abstract
This study analyzed the doll quality control system at PT Aurora World Cianjur, which uses the Statistical Quality Control (SQC) method. Results show that tears (37.34%) and basting stitching (35.47%) are the two most dominant production defects, collectively accounting for 72.82% of all defects. Data were collected with check-sheets, while Pareto diagrams identified defect priorities, p-charts evaluated process stability, and fishbone diagrams diagnosed root causes. The most significant finding was that the production process became unstable in May, with the defect rate reaching 0.1536—well above the control limit. Operator skills, material quality, work methods, and environmental conditions were identified as the main contributing factors. Focused improvements are recommended: operator training, material standardization, SOP implementation, and work environment optimization. Consistently addressing these human, method, environment, and material factors is expected to significantly reduce defect rates and enhance export competitiveness.
Keywords: dolls, product defects, quality control, statistical quality control (SQC)

Abstrak
Studi ini menganalisis sistem pengendalian mutu boneka di PT Aurora World Cianjur, yang menggunakan metode Pengendalian Mutu Statistik (SQC). Hasil penelitian menunjukkan bahwa sobekan (37,34%) dan jahitan jelujur (35,47%) merupakan dua cacat produksi yang paling dominan, secara kolektif mencakup 72,82% dari seluruh cacat. Data dikumpulkan dengan lembar periksa, sementara diagram Pareto mengidentifikasi prioritas cacat, diagram-p mengevaluasi stabilitas proses, dan diagram tulang ikan mendiagnosis akar permasalahan. Temuan paling signifikan adalah proses produksi menjadi tidak stabil pada bulan Mei, dengan tingkat cacat mencapai 0,1536—jauh di atas batas kendali. Keterampilan operator, kualitas material, metode kerja, dan kondisi lingkungan diidentifikasi sebagai faktor-faktor utama yang berkontribusi. Perbaikan yang terfokus direkomendasikan: pelatihan operator, standarisasi material, penerapan SOP, dan optimalisasi lingkungan kerja. Penanganan faktor-faktor manusia, metode, lingkungan, dan material ini secara konsisten diharapkan dapat mengurangi tingkat cacat secara signifikan dan meningkatkan daya saing ekspor.
***Kata Kunci**: boneka, cacat produk, pengendalian mutu, statistical quality control (SQC)*

Introduction

The production process in the manufacturing industry is a series of highly complex and interrelated activities, ranging from raw material procurement, processing, assembly, to producing final products that are ready for market. In the context of increasingly fierce global competition, quality is a key factor that determines the sustainability and competitiveness of a company. Quality products not only meet established technical standards, but also respond to consumer needs, desires, and expectations. Therefore, companies are required to consistently maintain and improve product quality in order to remain competitive in the market (Haryono, 2023). Product quality basically reflects the extent to which a product is able to meet customer specifications, standards, and expectations.

Rahman (2021) states that quality is the conformity between product characteristics and consumer expectations. In other words, quality is not only seen from physical or technical aspects, but also from customer perceptions of the product's value. If product quality does not meet expectations, customer satisfaction will decline, which in turn can have an impact on customer loyalty and company image. In the modern industrial world, customer satisfaction is a key indicator of a company's success. High-quality products provide a positive experience for consumers, increase trust, and strengthen the company's position in the market. Conversely, products with high defect rates have the potential to cause complaints, returns, and even a loss of customer trust. Therefore, quality control cannot be separated from a company's overall business strategy.

Quality control plays a very important role, especially for manufacturing companies that produce large quantities of products on a continuous basis. Juharni (2017) emphasizes that the main strategy in meeting customer needs and satisfaction is to prioritize quality in every stage of production. Quality is not only the responsibility of a particular department, but rather the responsibility of all elements of the organization, from top management to operators on the production line. Production and operational activities must be designed in such a way as to produce products of consistent quality. Zainnul (2019) states that quality is the result of a well-controlled production process. If the production process is not systematically controlled, variations and deviations will easily occur, leading to an increase in the number of defective products. This situation will certainly harm the company, both in terms of cost and time.

Unmaintained quality will have various negative consequences, such as increased production costs due to rework or repairs, waste of raw materials, and decreased operational efficiency. Noegraha (2023) emphasizes that failure to monitor and control quality can lead to additional costs and time for product repairs. In addition, defective products that make it to the market also have the potential to damage the company's reputation and reduce customer satisfaction. In dealing with quality issues, companies need a systematic and data-driven approach. One approach that is widely used in quality control is Statistical Quality Control (SQC). SQC is a quality control technique that uses statistical methods to monitor, analyze, and control variations in the production process. Ramlawati (2020) explains that SQC is a statistical technique that applies probability theory in sample inspection activities to monitor product quality.

The use of statistical methods in quality control is very important because it provides an objective picture of the production process. Lawi et al. (2024) state that statistical methods are a crucial phase in quality control because they enable companies to identify process deviations early on. Thus, corrective actions can be taken before these deviations develop into bigger problems. The main objective of implementing Statistical Quality Control is to ensure product quality at an optimal cost. Oktavia et al. (2021) argue that SQC helps companies maintain a balance between quality and cost efficiency through a statistical approach. By using SQC tools such as check sheets, histograms, Pareto diagrams, control charts, and fishbone diagrams, companies can identify the main sources of defects, process variation patterns, and factors that affect product quality. The implementation of SQC enables companies to monitor the production process continuously and systematically.

Through control charts, companies can determine whether the production process is statistically controlled or not. If points outside the control limits are found, this indicates the presence of an assignable cause that must be immediately investigated and corrected. Thus, SQC not only functions as a problem detection tool, but also as a means of prevention so that defects do not recur. PT Aurora World Cianjur is a manufacturing company engaged in the production of dolls for export. As a company oriented towards the international market, PT Aurora World Cianjur is required to meet high and consistent quality standards. Exported doll products must meet certain specifications in terms of design, neatness of stitching, material safety, and product durability. Failure to meet these quality standards can have serious consequences, ranging from product rejection by buyers to termination of business cooperation.

However, PT Aurora World Cianjur faces problems in maintaining the consistency of its product quality. Based on internal company data, the defect rate for doll products from January to June 2024 reached around 10%. This figure shows that of the total production, there is a relatively high proportion of defective products. These defective products include various types of damage, such as untidy stitching, asymmetrical doll shapes, defects in accessories, and color mismatches. The high defect rate has a direct impact on the company's operational effectiveness. Defective products must be repaired or even discarded, which means a waste of raw materials, labor, and production time. In addition, the rework process can also disrupt the production flow and reduce overall productivity. This condition ultimately leads to an increase in production costs that must be borne by the company.

From the customer's perspective, defective products that make it to the market can reduce customer satisfaction and trust. In the context of the export market, customer dissatisfaction not only affects a single transaction but can also affect the sustainability of long-term business relationships. Therefore, the quality issues faced by PT Aurora World Cianjur need serious attention and appropriate handling. Based on these conditions, the company needs to evaluate and improve the quality control system that is being implemented. One of the efforts that can be made is to apply the Statistical Quality Control method in a more systematic and structured manner. Through SQC, the company can identify the most dominant types of defects, analyze the main causes of defects, and determine effective and sustainable improvement measures.

Research on quality control using the SQC method at PT Aurora World Cianjur is important and relevant. This research is expected to provide a comprehensive overview of the quality of doll products, as well as a basis for the company in making strategic decisions related to quality improvement. In addition, the results of this study are also expected to contribute academically to the development of quality management studies, particularly in the export-based manufacturing industry. Based on the background description above, the research questions in this study can be formulated as follows: (1) How is the quality control analysis of doll products at PT Aurora World Cianjur conducted? and (2) How is the quality control of doll products using the Statistical Quality Control (SQC) method applied at PT Aurora World Cianjur?

Research Method

This research was conducted using the SQC method, which includes check-sheet inspections, Pareto chart analysis, control chart analysis, and fishbone diagram analysis. To plan the repairs, a table was compiled based on the most common types of damage.

1. Check-Sheet

Check-sheets are used to collect data during production activities. This data collection is then processed into information to support decision-making (Bakhtiar et al., 2013, cited in Rahman et al., 2023). This inspection has three objectives: optimizing the systematic data collection and processing process, identifying quality issues through defect frequency calculations, and providing a control basis for improving product quality.

2. Pareto Diagram

According to Wardah et al. (2022), a Pareto diagram is a percentage bar chart that ranks major problems according to their level of occurrence. This analytical tool applies the Pareto principle, which states that most effects (approximately 80%) generally originate from a small number of causes (approximately 20%).

3. p-Control Chart

A p-control chart is a statistical tool used to support data-driven decision-making processes. According to Aini et al. (2024), a control chart serves to inform production stages whether they deviate from control standards. Control charts focus on data variation (Yannimar, 2023). Furthermore, control charts are also used to determine whether a process's capability meets predetermined standards.

The steps involved in preparing a control chart can be explained as follows:

a) Calculating defects

The first step is to calculate the proportion of defects in a sample, as follows:

$$p = \frac{np}{n}$$

Where:

np: number of defective units in a subgroup

n: number of units inspected in the subgroup

b) Calculating the Center Line (CL)

Calculate the average value used as the center line on the control chart:

$$CL = \bar{p} = \frac{\sum np}{\sum n}$$

Where:

$\sum np$: accumulated product defects

$\sum n$: total production quantity

c) Calculating the Upper Control Limit (UCL)

The UCL is the maximum limit line on the control chart, above which deviations indicate process abnormalities:

$$UCL = \underline{p} + 3\sqrt{\frac{\underline{p}(1 - \underline{p})}{n}}$$

Where:

$\bar{p}$: Average proportion of defects

n: Total units produced

d) **Determining the Lower Control Limit (LCL**)

This indicates the lowest deviation value that remains within the control limits. If the calculated LCL produces a negative value, then the LCL is considered to have a value of zero:

$$UCL = \underline{p} - 3\sqrt{\frac{\underline{p}(1 - \underline{p})}{n}}$$

Where:

$\bar{p}$: Average proportion of defects

n: Total units produced

4. Fishbone Diagram

A fishbone diagram (or cause-and-effect diagram) is a tool for describing factors that influence product quality and the causes of defects. According to Astuti et al. (2025), this diagram can trace the root of quality problems down to the smallest factor. It identifies five main factors causing defects: people, methods, machines, raw materials, and the work environment

Results and Discussion

This analysis employed data collection techniques, including interviews and direct observation, at the company. Furthermore, this study utilized supporting data from the Quality Control (QC) Finishing division of PT Aurora World Cianjur, providing general information related to the company's operational activities.

1. Check-Sheet

The check sheet is one of the quality control tools used to record and collect data, which are then analyzed as a basis for decision-making within the company. Table 1 presents the inspection sheet for product defects found in dolls at the Quality Control (QC) Finishing section of PT Aurora World Cianjur for the period January to June 2024.

Table 1. Check Sheet of Doll Defects at PT Aurora World Cianjur (January–June 2024)

Month (2024)	**Product Defects (pcs)**				**Total Defects (pcs)**	**Total Production (pcs)**
	Tearing	*Loose Stitch*	*Thread Defect*	*Accessory Defect*		
January	52,384	51,972	29,418	4,532	138,306	1,622,016
February	40,772	39,554	22,524	2,254	105,104	1,253,376
March	55,292	49,641	36,896	3,244	145,073	1,474,560
April	37,781	34,470	28,709	2,338	103,298	958,464
May	64,431	62,818	50,051	3,022	180,322	1,174,236
June	56,528	53,339	38,030	2,596	150,493	1,315,584
Total					**822,596**	**7,798,236**

Based on the data presented in the check sheet, it can be observed that the total production output of PT Aurora World Cianjur from January to June 2024 amounted to 7,798,236 units. Among these, 822,596 dolls were identified as defective during the QC Finishing inspection process.

2. Pareto Diagram

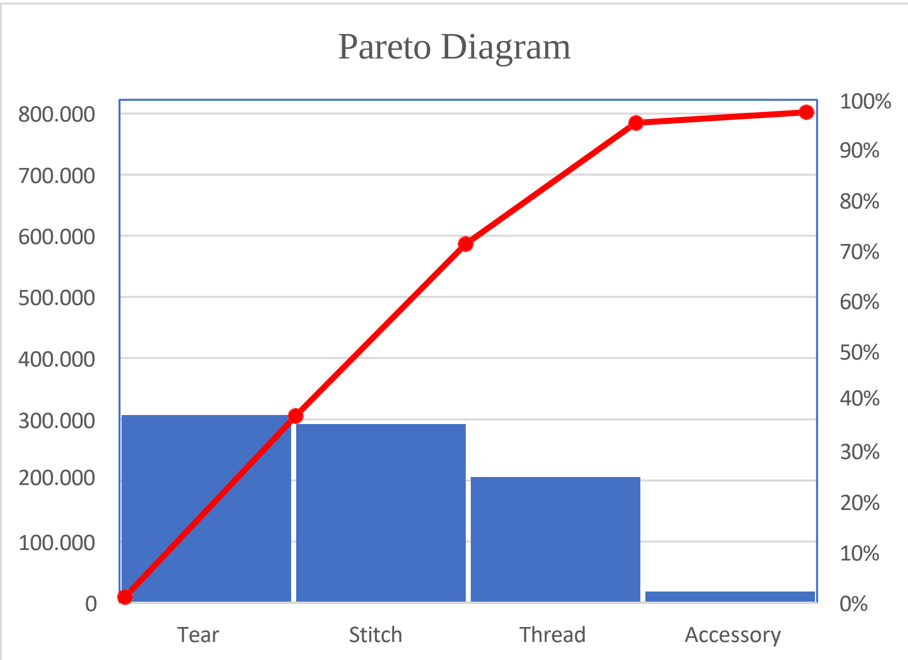
The Pareto diagram is used to identify the most dominant types of problems so that appropriate corrective actions can be taken through cause analysis and solution determination. The initial step involves categorizing defects based on their frequency, from the highest to the lowest. Table 2 presents the order of defect frequencies found in dolls at the QC Finishing section during the period of January to June 2024. Based on the data in Table 2, a Pareto Diagram can be constructed as shown in Figure 1, illustrating the ranking of quality issues according to the number of occurrences from the highest to the lowest, along with their cumulative percentages.

Table 2. Percentage of Doll Defects at PT Aurora World Cianjur (January–June 2024)

No.	Type of Defect	Total (pcs)	Defect Percentage (%)	Cumulative Percentage (%)
1	*Tearing*	307,188	37.34	37.34
2	*Loose Stitch*	291,794	35.47	72.82
3	*Thread Defect*	205,628	25.00	97.81
4	*Accessory Defect*	17,986	2.19	100.00
Total		**822,596**	**100.00**	—

Based on Table 2, it can be observed that tearing represents the most frequent defect type, contributing 37.34% of the total defects, followed by loose stitch (35.47%) and thread defect (25.00%). Meanwhile, accessory defect accounts for only 2.19%, indicating it as the least dominant issue. The cumulative percentage curve demonstrates that the first three defect types constitute nearly the entire defect population, which highlights the Pareto principle (80/20 rule) in identifying critical areas for quality improvement.

Figure 1. Pareto diagram of defective products



Based on the analysis results, the defect data of doll production at PT Aurora World Cianjur during the period of January to June 2024 revealed two dominant types of defects that caused product damage. The most frequently found defect types were: (1) tearing defects, accounting for 37.34% of the total defects, and (2) loose stitch defects, accounting for 35.47%. The analysis indicates that tearing defects had the highest frequency among all types of product defects.

3. Control p-chart

Technical decision-making can be objectively supported by statistical calculations. They are used to monitor processes and ensure that activities remain within permitted limits. The procedure for implementing this measurement technique includes several important steps, as follows:

a) Calculate the Center Line (CL) value

$$CL = \underline{p} = \frac{822{,}596}{7{,}798{,}236} = 0.1055$$

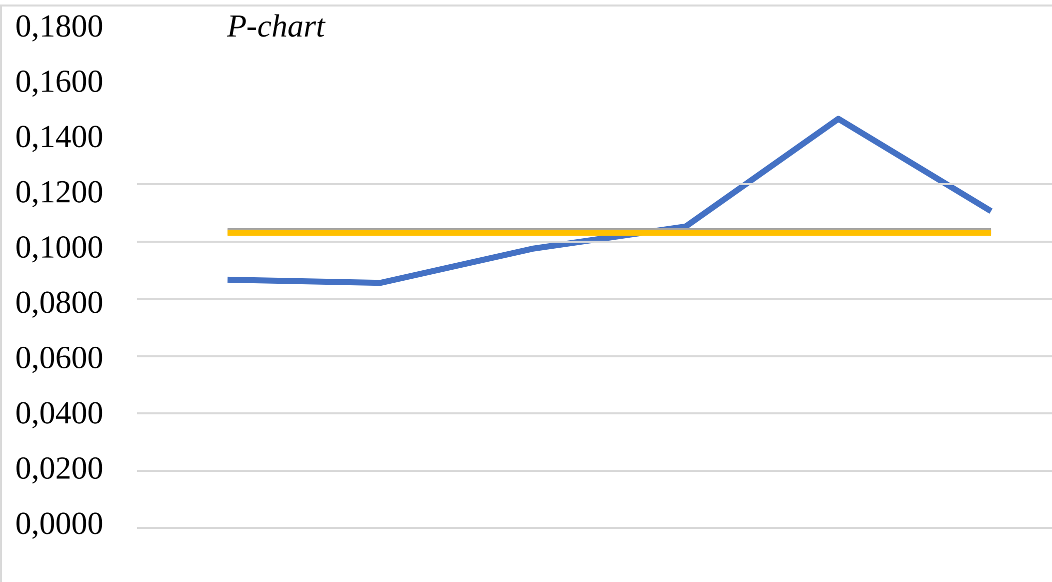
b) Calculate Upper Control Limit (UCL), referring to the formula = 0.1058

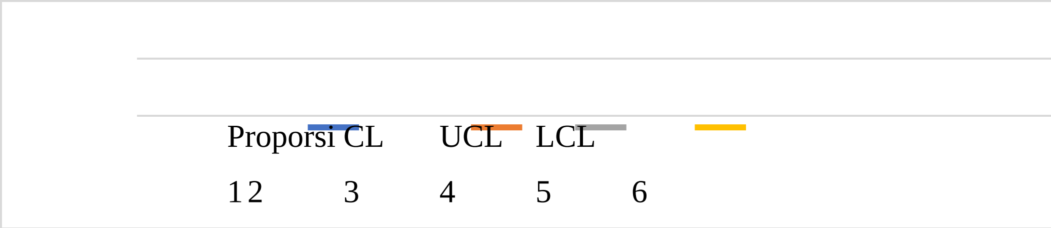
c) Calculate Lower Control Limit (LCL), referring to the formula = 0.1052

Table 3. Control Limits of p-Chart for Doll Products at PT Aurora World Cianjur (January–June 2024)

Month (2024)	**Total Production (pcs)**	**Total Defects (pcs)**	**Proportion (p)**	**CL (Center Line)**	**UCL (Upper Control Limit)**	**LCL (Lower Control Limit)**
January	1,622,016	138,306	0.0853	0.1055	0.1058	0.1052
February	1,253,376	105,104	0.0839	0.1055	0.1058	0.1052
March	1,474,560	145,073	0.0984	0.1055	0.1058	0.1052
April	958,464	103,298	0.1078	0.1055	0.1058	0.1052
May	1,174,236	180,322	0.1536	0.1055	0.1058	0.1052
June	1,315,584	150,493	0.1144	0.1055	0.1058	0.1052
Total	**7,798,236**	**822,596**	—	—	—	—

Figure 2. p-Chart for Doll Product (January–June 2024)





Based on the p-chart control limits presented in Table 3, the proportion of defects in doll production at PT Aurora World Cianjur generally remained close to the center line (CL = 0.1055). However, variations occurred in several months. In particular, the defect proportion in May (0.1536) exceeded the Upper Control Limit (UCL = 0.1058), indicating that the production process during this month was out of control and influenced by assignable or special causes. In contrast, the proportions in January (0.0853), February (0.0839), and March (0.0984) were below the center line but still within the control limits, suggesting normal process variability.

After examining the results, the May had the highest defect rate, exceeding the UCL by 0.1536, indicating an out-of-control deviation that needed to be addressed. Conversely, January and February performed better, with defect rates below the UCL, but April and June remained above the control limit. Overall, the production process is not completely stable, requiring immediate improvements.

4. Fishbone Diagram

As a follow-up to the findings of dominant defects (tears and basting) in production, a root cause analysis was conducted using a Fishbone Diagram (cause-and-effect diagram). This analysis aims to identify factors that influence product quality. The root causes are visualized in Figure 3 (for tear defects) and Figure 4 (for basting defects) as follows:

Figure 3. Tearing Fishbone Diagram

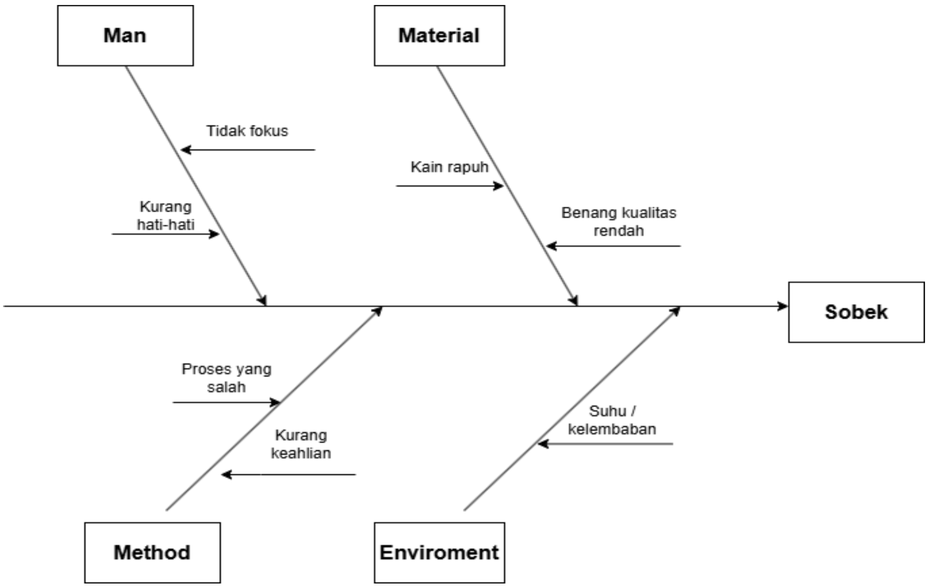
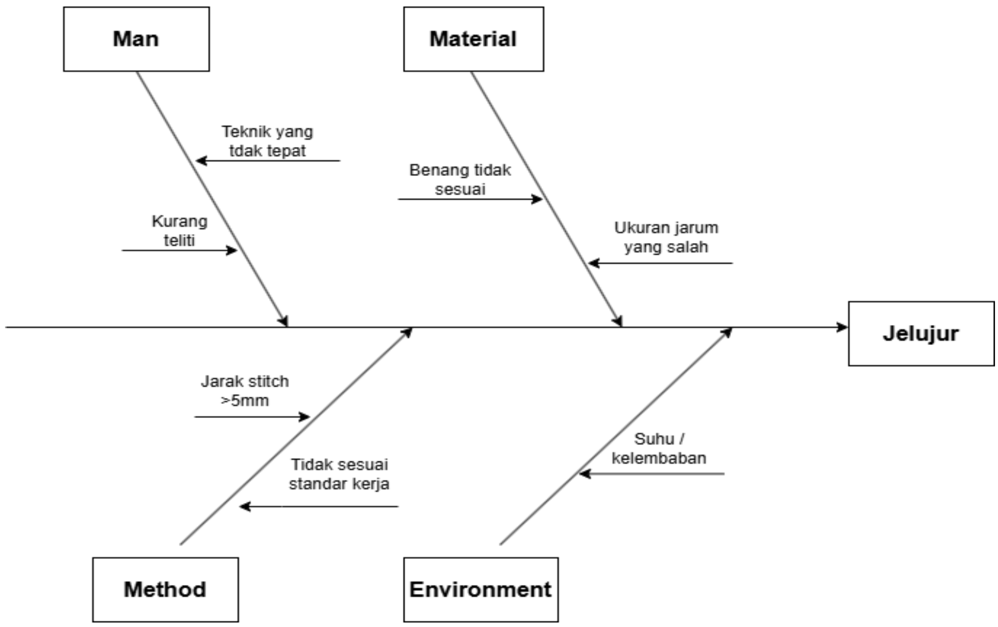


Figure 4. Stitched Fishbone Diagram



Based on the Fishbone Diagram analysis, it can be concluded that the causes of production defects, such as tears and basting, are human, material, method, and environmental factors. Human factors are a significant aspect, including suboptimal operator skills in sewing techniques (such as basting stitches) and a lack of quality control during the production process. Furthermore, material factors also play a significant role, ranging from low-quality fabric (which is easily unraveled) to inadequate thickness, making the fabric brittle.

5. Improvement Plan

In an effort to improve production quality and reduce dominant defects (tears and basting), improvements are focused on:

1) Human factors (man), namely, retraining production operators on proper standard work procedures and the importance of consistency throughout the production process.
2) Method factors (method), namely, evaluating work techniques and tightening the implementation of Standard Operating Procedures (SOPs) to prevent errors in the production process.
3) Environmental factors (environment), namely, maintaining cleanliness to ensure a stable environment and not affecting the quality of raw materials or the production process.
4) Material factors (materials), namely increasing raw material supervision through stricter work procedures and collaborating with suppliers to ensure the raw materials used are of consistent quality.

By improving these four factors, it is hoped that the number of tears and basting defects will decrease and product quality will be more assured.

Conclusion

This study aimed to evaluate the effectiveness of quality control in the doll production process at PT Aurora World Cianjur using the *Statistical Quality Control (SQC)* approach. The findings confirmed that the company's production quality is primarily influenced by two dominant defect types—*tearing* and *loose stitch defects* which together account for over seventy percent of total defects. These findings validate the hypothesis that specific, recurring defect types significantly affect the stability of the production process and overall product quality. Moreover, the *p*-chart analysis demonstrated that the process was not statistically stable throughout the observed period, particularly in May, indicating that special causes of variation were present and required managerial attention.

From a scientific standpoint, this study reinforces the practical value of SQC tools such as check sheets, Pareto diagrams, control charts, and Fishbone Diagrams in diagnosing production inefficiencies and tracing root causes of quality deviations. The results suggest that quality control effectiveness can be enhanced through systematic data-based decision-making and continuous process evaluation. Future research may expand the analytical framework by integrating real-time data monitoring, advanced control charts, or machine-learning–based quality prediction models to improve accuracy and responsiveness in industrial quality management.

References

Aini, L. Q. & Sukanta (2024). Analisis Pengendalian Kualitas Produk Menggunakan Metode Statistical Quality Control (SQC) di PT. Bumimulia Indah Lestari. *UNISTEK*, *11*(1), 25-39.

Astuti, W., Maksum, A. H., & Herwanto, D. (2025). Penerapan Metode Statistical Quality Control (Sqc) Dan Analisis Fmea Untuk Menurunkan Tingkat Reject Holes Cigarette Paper Grade Coresta 60 Di Pt Bukit Muria Jaya (BMJ). *Industri Inovatif: Jurnal Teknik Industri*, *15*(1), 14-25.

Haryono, M. F. Y., & Sumiati, S. (2023). Analisis Pengendalian Kualitas Produk Paving Block Menggunakan Metode Statistical Quality Control (SQC) Dan Failure Mode Effect Analysis (FMEA) Di PT. Duta Beton Mandiri, Pasuruan. *Jurnal Penelitian Rumpun Ilmu Teknik*, *2*(3), 45-65.

Juharni (2017). *Manajemen Mutu Terpadu : Total Quality Management*. Sah Media.

Lawi, A., Afma, V. M., Laila, W., Nasirly, R., Budiarto, D., Alfian, A., Hastarina, M., Fajrah, N., Pasmawati, Y., Melliana, Mesra, T., Kusmindari, C. D., Sunarni, T., Arsi, F., Wahyudi, B., & Harits, D. (2024). *Pengendalian kualitas*. Widina Media Utama.

Noegraha, I. S. (2023). Pengendalian Kualitas Produk Tekstil Di Pt Nagasakti Kurnia Textile Mills Menggunakan Metode Sqc Dan Fmea. *Sistemik: Jurnal Ilmiah Nasional Bidang Ilmu Teknik*, *11*(2), 72-81.

Oktavia, A. & Herwanto, D. (2021). Analisis Pengendalian Kualitas Produk Menggunakan Pendekatan Statistical Quality Control (SQC) di PT. Samcon. *Industri Inovatif: Jurnal Teknik Industri*, *11*(2), 106-113.

Rahman, F. S., & Nasrudin, I. (2023, December). Penerapan SQC Dan Fmea Dalam Analisis Produk Cacat Di Cv. Konveksi 3 Dara Bandung. In *Prosiding Seminar Sosial Politik, Bisnis, Akuntansi dan Teknik* (Vol. 5, pp. 261-272).

Rahman, M . A. (2021). *Manajemen Kualitas: Suatu Pengantar*. Pusaka Almaida. Ramlawati (2020). *Total Quality Management*. Nas Media Pustaka.

Syarifuddin, S., Aulia, F. N., & Erliana, C. I. (2021). Analisis Kualitas Olein Dengan Menggunakan Metode Sqc Di Pt. Industri Nabati Lestari. *Industrial Engineering Journal*, *10*(2).

Wardah, S., Suharto, S., & Lestari, R. (2022). Analisis Pengendalian Kualitas Proses Produksi Produk Nata De Coco Dengan Metode Statistic Quality Control (Sqc). JISI: Jurnal Integrasi Sistem Industri, 9(2), 165-175.

Yannimar, A. S., Budiarti, N., & Priyasmanu, T. (2023). Analisis Pengendalian Kualitas Produksi Susu UHT Menggunakan Metode Statistical Quality Control (SQC) Di PT. Greenfields Indonesia. *Jurnal Valtech*, *6*(2), 302-310.

Zainnul, M. (2019). *Manajemen Operasional*. Deepublish Publisher.