Total Quality Control (TQC) Analysis of Paris Hijab Products at the Wholesale Center of Dodolan Hijab Surabaya Using Six Sigma, New Seven Tools and Kaizen Methods

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Abstract
Dodolan Hijab is a hijab shop located on Jl. Medayu Utara Gg. VIII A No.19, Medokan Ayu, Surabaya. This shop offers various types of hijab, with Hijab Paris being one of the most popular and in-demand products. However, for some time, there has been a significant problem related to the high level of damage to Hijab Paris products, which includes 33% torn hijabs, 35% slanted cuts, and 32% pulled threads. This study aims to identify the types of defects that cause the high defect rate in Hijab Paris products over 12 month, as well as to analyze the factors that affect their quality. For this reason, the Six Sigma, New Seven Tools, and Kaizen approaches were applied to analyze the root cause and provide improvement solutions. Of the 11,745 hijabs produced, 281 units were found to be damaged. The results of the study showed that torn hijab defects were a top priority to be repaired in order to improve overall product quality. The suggested improvements were expected to make the production process more efficient, enhance the quality of Paris hijab products, and ultimately increase customer satisfaction.

***Keywords*:** *Defect, Hijab, Kaizen, New Seven Tools, Six Sigma.*

Abstrak
Dodolan Hijab adalah usaha toko hijab yang terletak di Jl. Medayu Utara Gg. VIII A No.19, Medokan Ayu, Surabaya. Toko ini menawarkan berbagai jenis hijab, dengan Hijab Paris menjadi salah satu produk yang paling populer dan banyak diminati. Namun, selama beberapa waktu, terdapat masalah signifikan terkait tingginya tingkat kerusakan pada produk Hijab Paris, yang meliputi 33% hijab sobek, 35% potongan miring, dan 32% terdapat benang tertarik. Penelitian ini bertujuan untuk mengidentifikasi jenis cacat penyebab tingginya defect rate pada produk Hijab Paris selama periode 12 bulan, serta menganalisis faktor-faktor yang mempengaruhi kualitasnya. Untuk itu, pendekatan Six

Sigma, New Seven Tools, dan Kaizen diterapkan untuk menganalisis akar permasalahan dan memberikan solusi perbaikan. Sebanyak 11.745 hijab yang diproduksi, ditemukan 281 unit rusak. Hasil penelitian menunjukkan cacat hijab sobek menjadi prioritas utama untuk diperbaiki guna meningkatkan kualitas produk secara keseluruhan. Diharapkan, penerapan perbaikan yang disarankan mampu meningkatkan efisiensi proses produksi dan kualitas produk Hijab Paris, yang pada akhirnya berdampak positif terhadap kepuasan pelanggan.

***Keywords*: *Cacat, Hijab, Kaizen, New Seven Tools, Six Sigma*.**

1. Introduction

In the manufacturing industry, product quality is one of the main factors determaining a company's competitiveness (Chikán et al., 2022). Products that have high quality not only increase customer satisfaction but also help companies reduce production costs due to defects or products that do not meet standards. However, in the production process, deviations often occur which result in defective products, so effective quality control efforts are needed (Mitra, 2016). Quality control is a collaborative team activity rather than an individual effort (Nugraha, 2022). Its main objective is to ensure that the products produced meet established standards and align with customer expectations (Sader et al., 2022). Various approaches have been developed to improve product quality, including Total Quality Control (TQC), Six Sigma, and Kaizen (Nugraha et al., 2024). These methods focus on identifying the root causes of defects, reducing variability, and continuously improving processes to achieve better overall performance (Psarommatis, 2021).

Total Quality Control (TQC) is a management system that includes all elements of the organization in an effort to improve, maintain, and improve product quality (Kahar et al., 2022). This method focuses on continuous improvement by involving all parties in the company (Chuang, 2021). One of the analysis tools often used in TQC is Six Sigma, a methodology that aims to identify and reduce variation in the production process to eliminate product defects (Byrne et al., 2021). Six Sigma uses the DMAIC (Define, Measure, Analyze, Improve, Control) approach to analyze problems and implement continuous improvement (Pérez-Balboa et al., 2024). In addition, the New Seven Tools approach is also used as a tool to analyze and identify the root causes of problems in the production process (Tague, 2023). Meanwhile, Kaizen, which means "continuous improvement," emphasizes the involvement of all employees in small but consistent improvement efforts to improve production efficiency and quality (Berhe, 2024).

Pusat Grosir Dodolan Hijab is a company engaged in the wholesale sale of hijab in Indonesia. Despite its good product quality, the company faces issues with product defects, particularly in the Paris hijab, such as torn fabric, uneven cuts, and pulled threads. This affects customer satisfaction and the company's reputation. To address this, the Total Quality Control (TQC) method is applied using Six Sigma, New Seven Tools, and Kaizen approaches to identify and reduce product defects. This study focuses on quality control of Paris hijab products at Pusat Grosir Dodolan Hijab, aiming to improve production efficiency, enhance product quality, and boost competitiveness in the market. By implementing a systematic approach to quality control, the company can minimize defects and optimize processes, ultimately increasing customer satisfaction (Zadeh et al., 2024). These New Seven Tools are especially useful in identifying quality issues within a company's products or market, and play a key role in finding and resolving problems effectively (Rochmoeljati, 2022).

2. Method

This research was conducted at the Dodolan Hijab Wholesale Center in Surabaya, focusing on Paris hijabs. The data analyzed includes weekly recapitulations of arrivals over 50 weeks in 2024. The dependent variable is the number of defective hijabs, while independent variables include types of damage such as tears, uneven cuts, and pulled threads. Data was collected through interviews and weekly purchase reports. Analysis was performed using the Six Sigma and Kaizen approaches with Microsoft Excel, SPSS, and Minitab.

2.1 Data Analysis Method

This study applies the Six Sigma and Kaizen approaches. Data processing in Six Sigma utilizes quality control tools known as the New Seven Tools and follows five key stages:

1) **Define**
   This stage identifies and defines the product or process being analyzed, focusing on determining the main sources of defects that impact quality. Establishing a clear focus ensures a structured approach to improvement.
2) **Measure**
   This stage evaluates current process performance by identifying key metrics, collecting accurate data, and analyzing process capabilities. Control charts such as P and U charts are used to assess quality performance, while sigma level calculations provide a quantitative evaluation.
3) **Analyze**
   This stage investigates the root causes of defects using tools like fishbone diagrams and Pareto charts. Understanding the sources of issues is crucial for developing effective corrective actions.
4) **Improve**
   This stage formulates concrete solutions to enhance process performance and reduce defects. The 5W + 1H method is used to develop structured improvement proposals based on the identified root causes.
5) **Control**
   As the final stage, it ensures that improvements are maintained through proper documentation and supervision. However, in this study, the control phase is not fully implemented, as the Improve stage focuses on providing recommendations.

(Antony, 2021).

2.2 New Seven Tools

The latest quality control tools known as "New Seven Tools" are used in Total Quality Control (TQC) to analyze and improve the production process (Nugraha et al., 2024). The New

Seven Tools are quality control tools in Total Quality Control (TQC) used to analyze and improve production processes. These include (Mizuno, 2020):

1) Affinity Diagrams are used to group facts, opinions, and customer desires based on natural affinity.
2) Relationship Diagrams are useful for solving problems that have complex relationships.
3) Tree Diagrams are tools that help outline tasks needed to achieve main and sub-goals.
4) Matrix Diagrams are used to display relationships between multiple information groups.
5) Priority Matrices are helpful in organizing matrix data for clearer insights.
6) Arrow Diagrams are useful for project planning and scheduling.
7) Decision Process Diagrams are designed to identify potential issues and preventive actions.

2.3 Kaizen Method

The Kaizen concept is process-oriented, as opposed to the outcome-oriented thinking of Western countries. Continuous Improvement (Kaizen) means ongoing improvement, involving everyone. This includes top-level management, managers, and low-cost employees (Nugraha, 2022). In addition, the Kaizen approach is applied to encourage continuous improvement through the active participation of all employees in identifying and resolving quality problems (Franken et al., 2021).

1) Seiri is the arrangement of necessary and unnecessary items.
2) Seiton is the arrangement of items neatly arranged.
3) Seiso is the regular cleaning of the workplace.
4) Seiketsu is maintaining cleanliness and order.
5) Shitsuke is maintaining habits to maintain 5S practices.

3. Result and Discussion

3.1 Analysis with Six Sigma Method

Pusat Grosir Dodolan Hijab Surabaya is a Small and Medium Enterprise (SME) specializing in selling Paris hijabs to the local community. Despite its commitment to quality, the Paris hijab products often face issues with defects. To address this problem, the Six Sigma DMAIC (Define, Measure, Analyze, Improve, Control) method will be applied to enhance product quality and minimize defects effectively. At the Define stage, problems that occur in the company are identified to determine the products or processes that will be analyzed further. At this stage, the proportion of defects that are the main cause of product damage and failure is also defined. Paris hijab is a popular product made of lightweight materials such as voile, cotton, or other semi-transparent materials. Its rectangular design gives the wearer the flexibility to adjust the hijab according to their needs and fashion tastes. This hijab is available in various colors and motifs that provide many choices for its users. At this stage, three types of defects that are often found in Paris hijab are identified. First, torn hijab caused by rough handling during production or transportation, which reduces the aesthetic value and functionality of the product. Second, slanted cuts, which occur when the hijab is cut not according to the desired straight line, caused by measurement errors or the use of improper cutting tools. Third, the pulled thread section, which occurs due to poor material quality or rough handling, which can further damage the fabric fibers and reduce the visual appeal of the product.

Table 1. Product Defect Percentage

No	Defect Type	Number of Defects (Unit)	Percentage of Defects (%)
1	Ripped Hijab	93	33%
2	Slanted Hijab Cut	97	35%
3	There is a Part of the Thread That is Pulled	91	32%
Total		**281**	**100%**

Source: Personal Documentation, 2024.

At the Define stage, the number of defects in Paris hijab products was identified to provide an overview of the level of damage that occurred. Based on the table 1, there were three types of defects that were most often found in Paris hijab products at the Surabaya Dodolan Hijab Wholesale Center. First, torn hijab defects totaling 93 units, with a percentage of 33%. Second, slanted cuts on the hijab were found as many as 97 units or 35%. Third, there were parts of the thread that were pulled on 91 hijab units, representing 32% of the total defects. With a total of 281 defects, covering 100% of the damaged products, this data is an important reference in further analysis to determine repair priorities. Identification of the number of defects helps in planning more effective repair actions by focusing on the types of defects that occur most frequently.

Pusat Grosir Dodolan Hijab Surabaya, as a small and medium enterprise (SME), sells Paris hijabs with a target market around Surabaya and has regular customers from the local community. Although committed to providing quality products, there are product quality issues that need to be fixed. The three main problems that cause defects in Paris hijabs are torn hijabs due to careless handling, slanted cuts due to measurement errors or improper use of cutting tools, and pulled threads due to poor material quality or rough handling during production. The purpose of this study was to identify defects in Paris hijab products, make necessary improvements, and reduce production inspection costs. This study was conducted for 50 weeks, with a sample of 11,745 hijabs observed in three subgroups. The following is a SIPOC diagram for the Paris hijab production process in Table 2.

Table 2. SIPOC Diagram

Suppliers	Input	Process	Output	Customers
• PT Hijabku Cantik Indonesia • PT Surya Nusantara Abadi	• Hijab Products	• Sorting • Storage • Sales	• Hijab Products	• Residents around Surabaya

Source: Personal Documentation, 2024.

The Measure stage is the second step in Six Sigma quality improvement which aims to determine Critical to Quality (CTQ), calculate sigma values, and Defect Per Million of Opportunity (DPMO) based on conditions before implementation. At this stage, the research object and CTQ variables are identified. There are three defects that must be fixed in the Paris hijab product, each of which becomes a CTQ: CTQ-1 Torn Hijab, which reduces the aesthetic value and functionality due to tears in the hijab material, CTQ-2 Oblique Cut, which makes it difficult to form the hijab neatly due to asymmetrical cuts, and CTQ-3 There is a Pulled Thread Section, which creates an untidy appearance and has the potential to damage the fabric fibers. Furthermore, a normality test is carried out using Kolmogorov-Smirnov to ensure whether the residual values are normally distributed or not, which is important in a good regression model. Decisions are made based on the significance value: if it is greater than 0.05, the residual is normally distributed, and if it is less than 0.05, the residual is not normally distributed. The product normality test table is presented to support further analysis.

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		50
Normal Parameters[a,b]	Mean	0E-7
	Std. Deviation	1.20937680
Most Extreme Differences	Absolute	.154
	Positive	.154
	Negative	-.121
Kolmogorov-Smirnov Z		1.091
Asymp. Sig. (2-tailed)		.185

a. Test distribution is Normal.

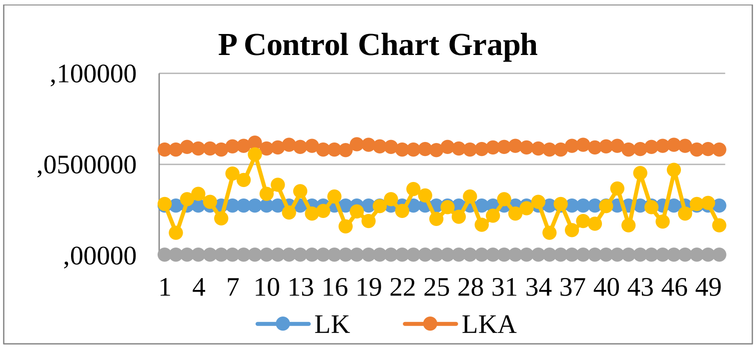
b. Calculated from data.

Source: Personal Documentation, 2025.

Picture 4. Kolmogorov Smirnov Normality Test

Based on the results of data processing using the Kolmogorov Smirnov normality test with SPSS software by entering data on the number of product defects (d), the number of torn hijab products, the number of slanted hijab cut products, and the number of products with pulled thread parts, a residual value was obtained which would later be tested using the Kolmogorov Smirnov normality test and a significance result of 0.185 was obtained where the result was greater than 0.05 which means the residual value is normally distributed. After conducting a normality test and ensuring that the residuals are normally distributed, the next step is to check the stability of the process using the P and U control charts.

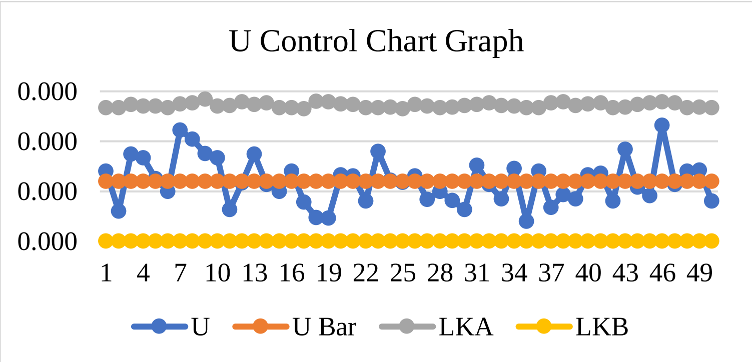
The P control chart used to measure the proportion of nonconformities in the hijab products being inspected is shown in Figure 5.



Source: Personal Documentation, 2025.

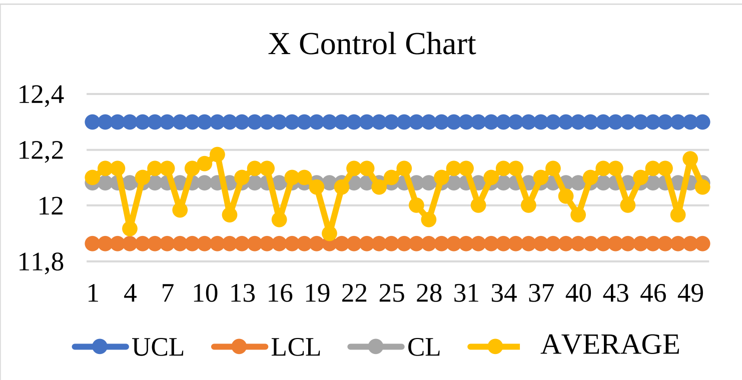
Figure 5. P Control Chart Graph

Based on the P control chart output, there is no data that exceeds the upper or lower control limits, indicating that the process is under control. The p¯value calculated from dividing the number of defects by the number of observations produces a value of 0.024, which also functions as the LK value. LKA and LKB for each observation are calculated by adding and subtracting 3σ to the p¯value, resulting in varying control limits for each observation. Since no data is out of control, the process can be considered under control, but improvements still need to be made to reduce the nonconformities that occur. Meanwhile, the U control chart used to measure the number of defects per unit in the hijab product subgroup being inspected can be seen in Figure 6.

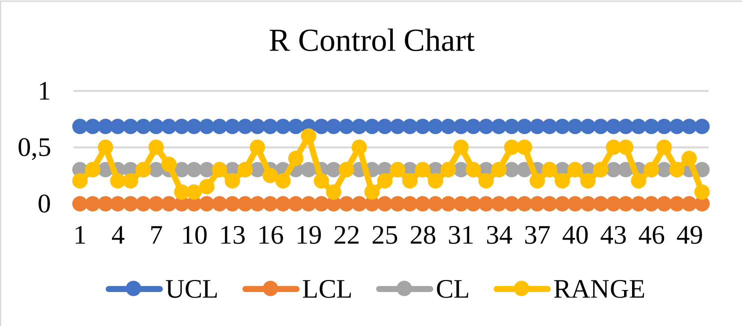


Source: Personal Documentation, 2025.
Figure 6. U Control Chart Graph

The U control chart graph output shows that there is no data that exceeds the upper or lower control limits, indicating that the process is also under control. The U value is calculated by dividing the number of defects by the sample size, resulting in a value of 0.024 which also functions as the LK. The LKA and LKB for each observation are calculated by adding and subtracting 3 U⁄n to the U value, resulting in different control limits for each observation. As with the P control chart, there is no out of control data on the U control chart, meaning that the production process is also under control. After ensuring that the data is in a controlled condition using the X control chart in Figure 7, the next step is to conduct a process capability analysis using the R control chart in Figure 8.

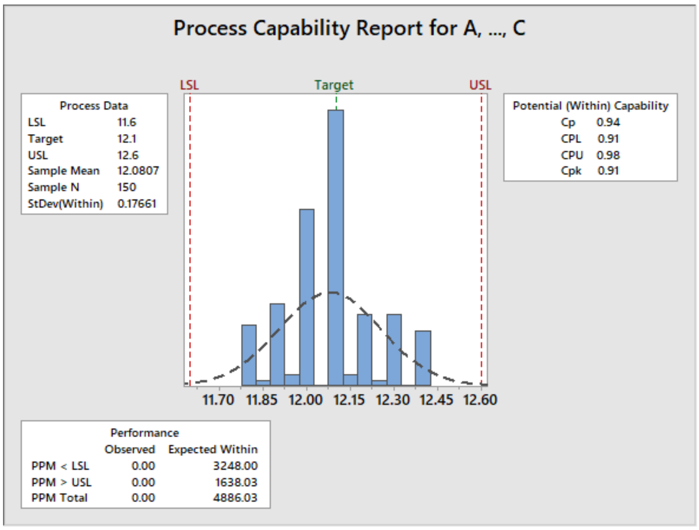


Source: Personal Documentation, 2025.
Figure 7. X Control Chart



Source: Personal Documentation, 2025.
Figure 8. R Control Chart

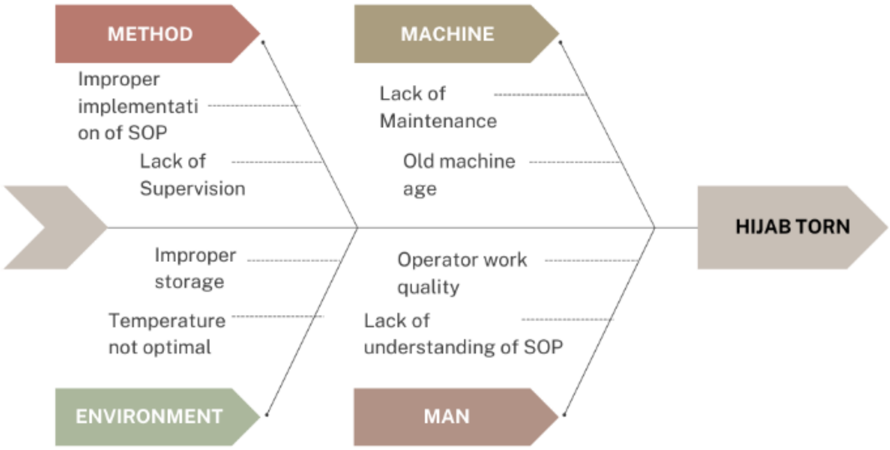
On the R control chart, it can be seen that there is no data that exceeds the upper control limit (UCL) or lower control limit (LCL), which indicates that the data is also in a uniform and controlled condition.



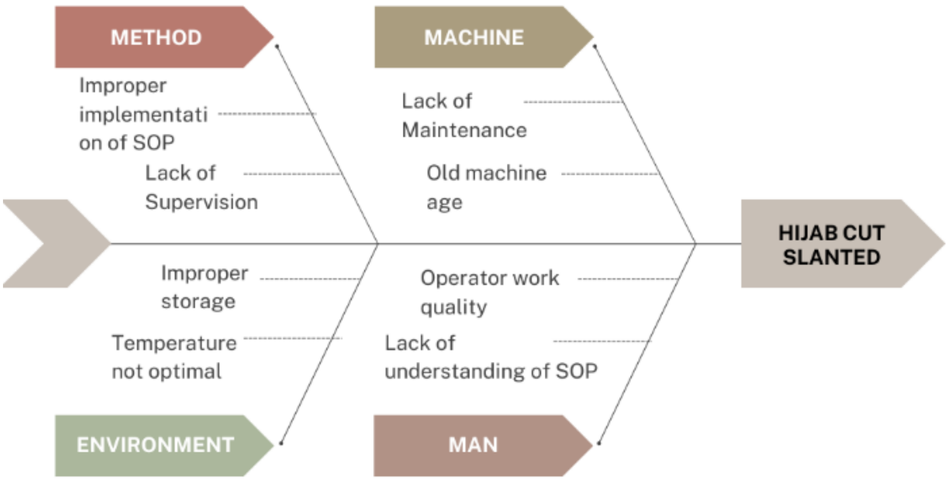
Source: Personal Documentation, 2025.
Figure 9. Process Capability Report

Based on the capability analysis in Figure 9, it is known that the Paris hijab product has a lower specification limit (LSL) of 11.6 m^2 and an upper specification limit (USL) of 12.6 m^2, with a target of 12.1 m^2. The calculation results show a Cp value of 0.94, which means that this process produces products that do not meet specifications and cannot be said to be capable, because the Cp value <1. In addition, the Cpk value of 0.91 indicates that this process is also not right in the middle of the specification limit, with a Cpk value <Cp. Finally, the 1/Cp value of 1.069 indicates that only 10.69% of the specifications were used in the process. Furthermore, to further measure the quality performance, the calculation of DPU, TOP, DPO, DPMO, and Six Sigma values was carried out. Based on the observation table that recorded 11,745 units of hijab products, with a total of 281 units of damage, the DPMO value was calculated and produced a figure of 8,003, while the sigma value obtained was 3.39328. These results indicate that quality control for Paris hijab products still requires improvement, because the high number of damages needs to be reduced to achieve better quality standards (Leksono et al., 2021).

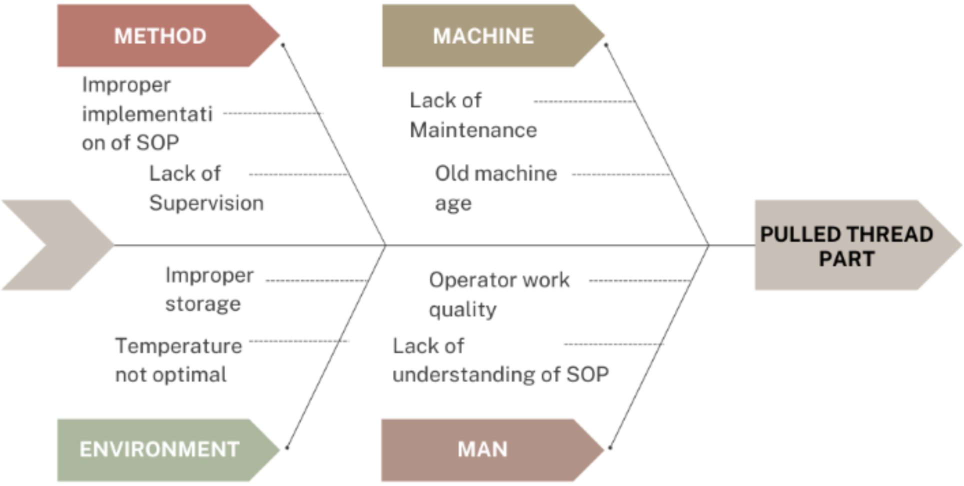
Then, in the Analyze stage in the Six Sigma method, it focuses on identifying factors causing product nonconformities using the Pareto diagram and fishbone diagram. The results of the analysis show that the largest nonconformity is the slanted hijab cut (35%), followed by torn hijab (33%) and pulled thread (32%). Therefore, improvements should be prioritized on the slanted hijab cut because reducing this problem can affect improvements in other nonconformities. In further analysis using the fishbone diagram, the causes of defects in the torn hijab were identified as lack of caution in working methods, poorly maintained machine conditions, low operator accuracy, and improper storage procedures Figure 10. The slanted hijab cut was caused by the implementation of methods that did not comply with SOP, old machines, and lack of operator training Figure 11. As for the pulled thread, the problem was also related to non-standard working methods, machine conditions, and human factors such as lack of operator accuracy and inadequate storage procedures Figure 12. These factors must be improved to reduce the level of defects in Paris hijab products.



Source: Personal Documentation, 2025.
Figure 10. Fishbone Hijab Torn



Source: Personal Documentation, 2025.
Figure 11. Fishbone Hijab Cut Slanted



Source: Personal Documentation, 2025.
Figure 12. Fishbone Has a Pulled Thread Part

In the Improve stage, improvements are made to reduce the potential for defects in Paris hijab products by seeking innovative solutions based on previous analysis. The approach used includes Table 4.11 5W + 1H Method of Paris Hijab Products to identify types of defects, sources of problems, root causes, and corrective steps that must be taken. In addition, the implementation of Kaizen through the Five-M Checklist and Kaizen Five-Step Plan is the main strategy in improving quality to achieve zero defects.

Table 3. 5W + 1H Method Hijab Paris Products

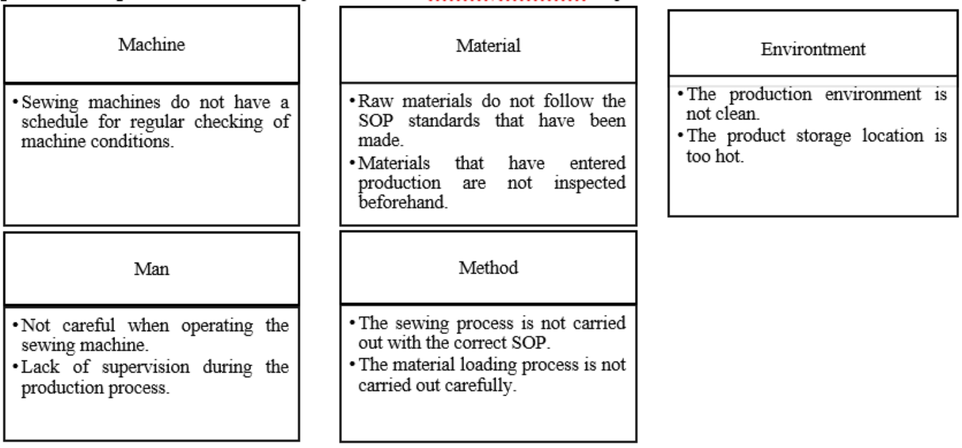
Type	**5W+1H**	**Description**
Main Purpose	What	What types of defects occur in Paris hijab products?
Location	Where	Where are the sources of defects in Paris hijab products?
Cause	Why	Why can defects in Paris hijab products occur from human, material, machine, method, and environmental factors?
People	Who	Who is responsible for corrective actions to monitor, regulate, and eliminate defects that occur?
Implementation	When	When are defects in Paris hijab products repaired?
Method	How	What corrective actions are taken to improve the quality of Paris hijab products so that the quality level approaches perfection (zero defect)?

Source: Personal Documentation, 2025.

The Control stage focuses on documenting the results of quality improvements and disseminating work standards so that improvements can be maintained. The steps required include employee training, preparing clearer SOPs, improving operator coordination, regular machine maintenance, and optimizing the work environment to be more comfortable and efficient

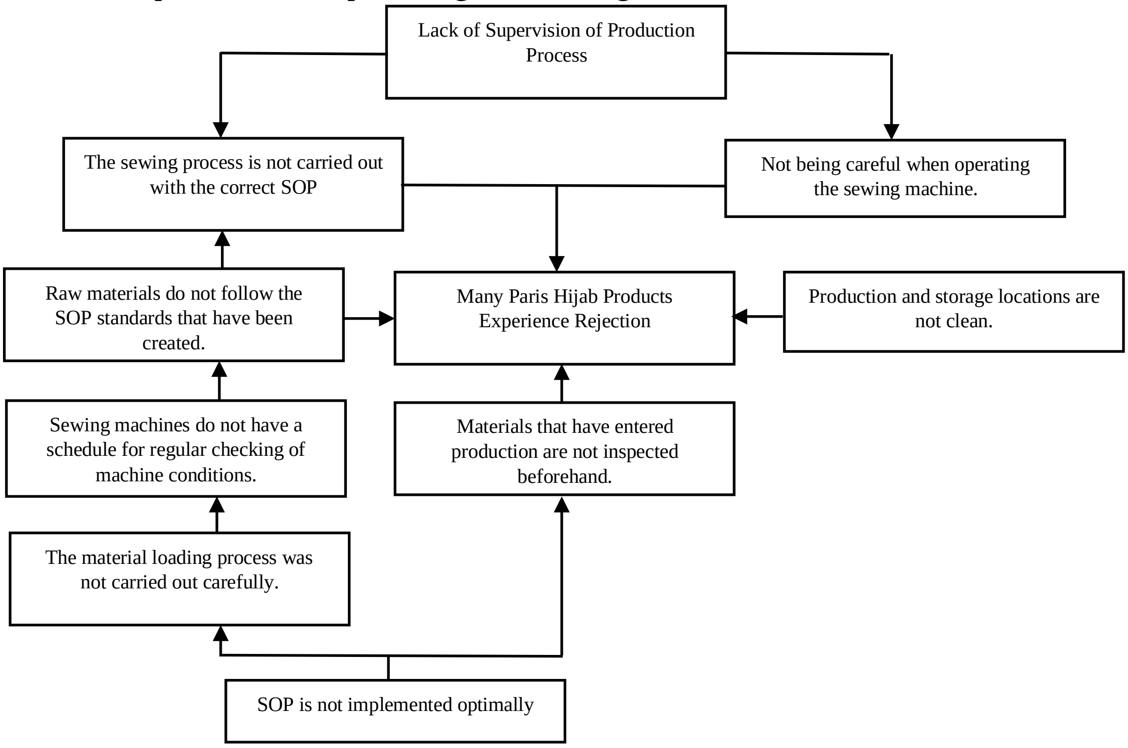
3.2 Analysis with New Seven Tools Method

New Seven Tools are used in Total Quality Control (TQC) to analyze and improve the production process of Paris hijab at Pusat Grosir Dodolan Hijab.

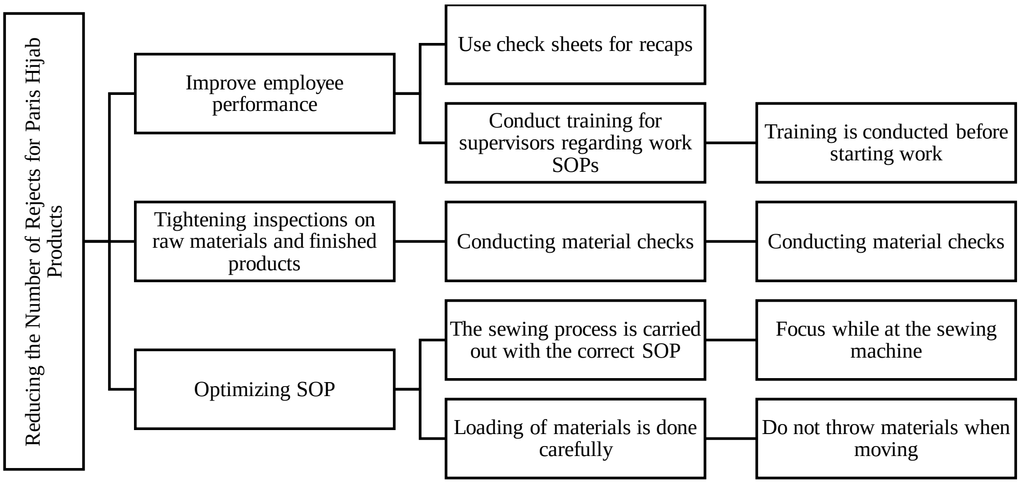


Source: Personal Documentation, 2025.
Figure 13. Affinity Diagram

One of the tools used is the Affinity Diagram at figure 13, which identifies the factors that cause defects, namely machines, materials, people, methods, and the environment. Furthermore, the Relationship Diagram (Figure 14) shows how these factors are interrelated, such as lack of supervision causing non-conformity of SOPs in production. The Tree Diagram outlines the main steps needed, such as improving supervisor performance, tightening raw material inspections, and optimizing SOPs at Figure 15.

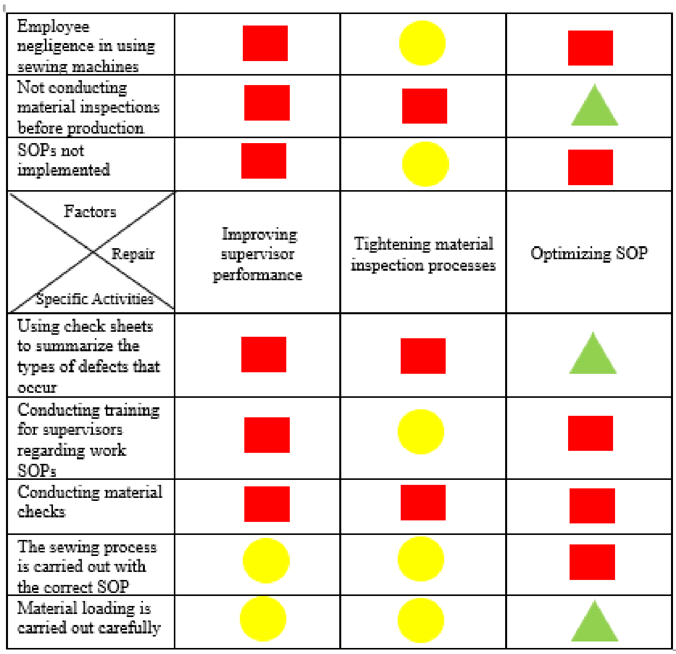


Source: Personal Documentation, 2025.
Figure 14. Relationship Diagram



Source: Personal Documentation, 2025.
Figure 15. Tree Diagram

To measure the relationship between factors, the Matrix Diagram (Figure 16) and Matrix Diagram Analysis (Table 4) help in determining the level of relationship between variables, such as the close relationship between employee negligence and improving supervisor performance.



Source: Personal Documentation, 2025.
Figure 16. Matrix Diagram

Table 4. Matrix Diagram Analysis

Primary	**Secondary**	**Importance**	**Wholesale Center for Hijab Dodolan**
Improve supervisor performance	Using check sheets to summarize	3	2
	Conducting training for supervisors regarding work SOPs	3	1

Primary	Secondary	Importance	Wholesale Center for Hijab Dodolan
Tighten material inspection process	Conducting material checks	3	1
Optimaze SOP	The sewing process is carried out with the correct SOP	2	2
	Material loading is carried out carefully	2	2

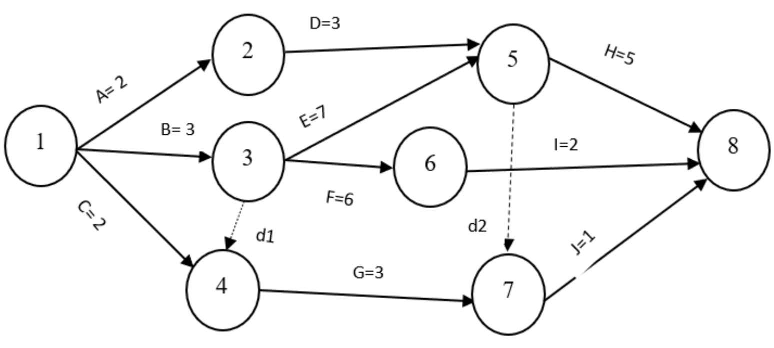
Source: Personal Documentation, 2025.

Next, Activity Network Diagram (Table 5 and Figure 17) shows the workflow and duration of the Paris hijab production process, which takes 11 days per production batch. If there is a delay in one of the processes, it will affect the next stage. Finally, PDPC (Process Decision Program Chart) (Figure 18) is used to identify potential problems and mitigation steps. Some of the main strategies implemented are improving supervisor performance through training and the use of check sheets, inspecting raw materials before production, and optimizing SOPs by ensuring that sewing and loading materials are carried out carefully. By implementing the New Seven Tools, the quality of Paris hijab production can be systematically improved.

Table 5. Details of Activities and Duration of Work Process

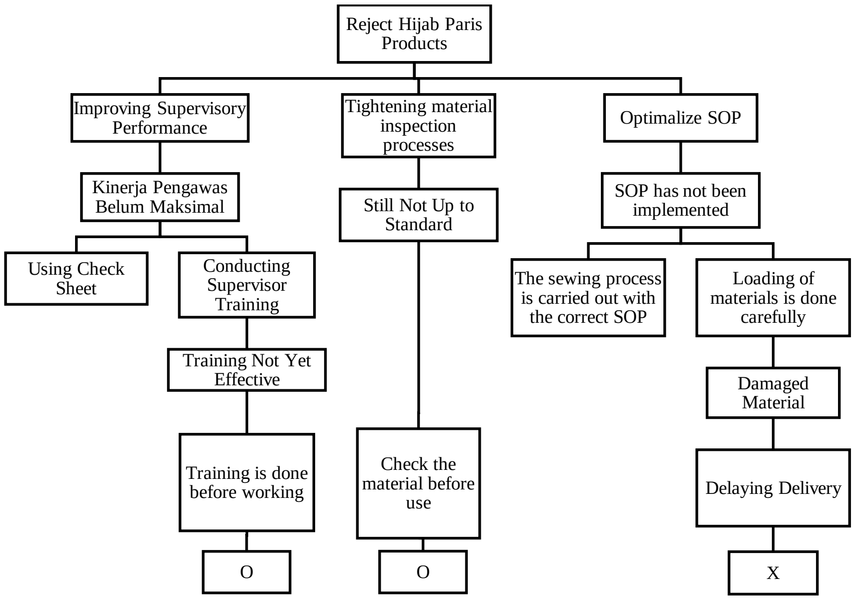
No	Work Process	Code	Start	Duration
1	Raw Material Loading	A	-	2
2	Raw Material Inspection	B	-	3
3	Fabric Preparation	C	-	2
4	Paris Hijab Fabric Cutting Process	D	A	3
5	Hijab Edge Sewing Process	E	B	7
6	Logo Installation Process	F	B	6
7	Finished Product Inspection	G	B,C	3
8	Packaging Process	H	D	5
9	Storage of Finished Products to the Warehouse	I	F	2
10	Moving Products for Distribution	J	D,G	1

Source: Personal Documentation, 2025.



Source: Personal Documentation, 2025.

Figure 17. Activity Network Diagram



Source: Personal Documentation, 2025.
Figure 18. PDPC Diagram

3.3 Analysis with Kaizen Method

Kaizen 5S at Dodolan Hijab is implemented to improve workplace efficiency and quality through five main steps. Seiri (Compact) ensures employees sort the necessary materials and tools, while Seiton (Neat) arranges hijabs by category for easy access and fast service. Seiso (Clean) emphasizes store cleanliness, including display and storage areas, to maintain product quality and customer comfort. Seiketsu (Care) ensures the previous 3S standards are maintained through standard work procedures, while Shitsuke (Diligent) fosters discipline and a sustainable work culture with regular training and evaluation. Through the implementation of Kaizen 5S, Dodolan Hijab can increase productivity, reduce waste, and create a better shopping experience (Rahman et al., 2023).

3.4 Improving the Quality of Paris Hijab Production

To maintain product quality and increase production efficiency, the Dodolan Hijab Wholesale Center needs to implement various improvement steps based on Six Sigma, New Seven Tools, and Kaizen analysis. Some steps that can be taken include regular training for employees to improve their skills in sewing and operating machines with the correct techniques according to SOP, as well as implementing strict inspection procedures for raw materials so that only quality materials are used in production. In addition, supervision and inspection at every stage of production must be tightened to ensure compliance with established quality standards. Maintaining cleanliness and the condition of the production environment is an important factor in reducing the risk of product damage. A final evaluation must be carried out before the product is distributed to ensure that only hijabs that meet the standards are sent to consumers, while products that do not pass the evaluation must be repaired or withdrawn before reaching the market.

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4. Conclusion

The implementation of Six Sigma through the DMAIC stages successfully identified and reduced product defects systematically, while the use of New Seven Tools helped in the analysis and improvement of the production process, increasing efficiency and standardization of work procedures. Kaizen has also proven effective in improving store operations, product quality, and customer satisfaction through continuous improvement. To minimize product defects, recommended improvement strategies include regular employee training, strict inspection of raw materials, supervision during production, maintaining a clean work environment, and final evaluation before distribution. With these steps, the Dodolan Hijab Wholesale Center is expected to improve the efficiency and quality of Paris hijab production.

Appreciation

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