Quality Control Using the SPC Method to Reduce Defective Products in Finished Garments At VYO Factory Convection

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ABSTRACT

CV.Vyo Factory, which is located at Kebakkramat, Karanganyar, Solo, is a manufacturing industry that operates in the convection industry. The problem raised in this research is the increase in defects in the production produced. As a result, companies continue to produce products that are defective in production. The results of initial observations in the field showed that there were many defective products from production at CV. Vyo Factory. It can be seen that the number of damaged products from February 2023-February 2024 continues to increase. The method used in this research is the Statistical Process Control method, attribute data and variable data collection is carried out at CV. Vyo Factory was obtained by observing the population of t-shirt products that experienced defects at the time of the research from 01 May 2024 to 30 June 2024. This is based on a control chart calculation graph (c-chart) which shows that defective t-shirt products exceed control limits, so improvements or evaluation of quality control need to be carried out. Based on the results of the analysis, it is known that using a Check Sheet, it can be seen that there are 3 categories of product damage, namely material defects, stitching defects and finishing defects, with the number of each material defect being 48 pcs, stitching defects being 275 pcs and finishing defects being 7 pcs. fruit. fruit. With a total of 330 damaged products produced, the monthly average is 1.68%.

1. INTRODUCTION

Manufacturing companies process raw materials or raw materials into finished goods or semi-finished goods and then sell them to consumers. In manufacturing companies, there are many industries operating in their respective fields. One of them is the clothing industry which is known as the convection industry which produces a lot of ready-made clothes. The convection industry is currently developing increasingly rapidly so that companies are required to always produce products of good quality and in accordance with their function. Community needs drive the production index for the Indonesian garment or convection industry. The apparel industry sector (convection) reached a trend in 2018 of 117.73 and rose 9.80% in 2019 to 183.71 (Central Statistics Agency, 2018). Quality control is one of the main functions and has an important role in the convection industry. Implementing quality control will ensure that the product meets the

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quality standards set by the company and consumers (Oakland, 2019). Kumar et al., (2019) explained that a company's inability to control quality will lead to an increase in defective products and returns. As a result, the company will experience losses both material and non-material. These losses include decreased sales, increased operational costs due to rework and repairs, loss of consumer trust, and a decline in the company's reputation (Montgomery, 2020).

Quality control in the convection industry can be carried out by setting quality standards, checking raw materials, monitoring the production process, and carrying out inspections or inspections (Purnomo et al., 2023). Apart from that, according to Ibrahim & Rusdiana (2021) quality control can also be carried out by seeking, controlling and ensuring the production process runs smoothly in accordance with the standards set by the company. CV. Vyo Factory is located at Jl. Solo- Sragen, Kebakkramat, Kemiri, Kebakkramat, Karanganyar, Solo is a manufacturing industry which operates in the field of clothing production or what is commonly known as the garment or convection industry. Products produced by CV. Vyo Factory is a variety of clothing ranging from children's clothing to adult clothing such as t-shirts, shirts and polo shirts, blouses, robes, and many more. CV. Vyo Factory is an industry that produces based on Purchase Orders or orders.

The problem raised in this research is the increase in defects in the production produced. Quality inspection at CV. Vyo Factory still emphasizes final products that have not yet carried out quality management both in terms of process control and improving product quality using significant quality control methods. As a result, companies continue to produce products that are defective in production. The results of initial observations in the field showed that there were many defective products from production at CV. Vyo Factory. It can be seen that the number of damaged products from February 2023-February 2024 continues to increase. Starting from a percentage in February 2023 of 4%, it continues to increase to a reject percentage of 13%. The large number of defects in production results in a decrease in product quality. This is detrimental to the company because it increases production time and incurs additional operational costs. Efforts made to reduce defective products at CV. Vyo Factory is quality controlled.

Quality control is closely related to company quality standards. In controlling product quality, the company will consistently carry out quality control to improve the company's reputation and reduce production costs. The method that can be used for quality control is the SPC (Statistical Process Control) method. According to Hidayat (2019) Statistical Process Control (SPC) is a quality measuring tool that can help managers from various industrial fields to take appropriate actions to achieve business success. The use of the Statistical Process Control (SPC) method uses graphic tools in the form of control charts which can be used to monitor functional relationship data from time to time (Elyas & Handayani, 2020). Therefore, in this research the author will carry out an analysis of product quality control using the SPC (Statistical Process Control) method at CV. Vyo Factory to determine the characteristics of defective products in producing products that comply with established standards. So the author can provide suggestions for company improvements in CV. Vyo Factory. The hope is that companies can improve the factors that cause defective products in an effort to minimize defects and continuously improve product quality.

2. RESEARCH METHODS

The method used in this research is the Statistical Process Control method which is a collection of problem solving tools in quality control which aims to achieve process stability

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and increase capability by reducing variability (Montgomery, 2019). The stages in this method are: checksheet, control chart, Pareto diagram, and fishbone diagram. Retrieval of attribute data and variable data is carried out at CV. Vyo Factory was obtained by observing the population of shirt products that experienced defects at the time of the research from 01 May 2024 to 30 June 2024.

The sampling technique used in this research was Proportionate Stratified Random Sampling, which was carried out by dividing the population into sub-populations. / strata proportionally and randomly (Sekaran, 2006: 87). Based on this technique with proportional strata with a confidence level of 95%, with an error rate of 5%, a sample of 380 samples was obtained.

3. RESULTS AND DISCUSSION

Production Cost

Based on the results of interviews with the CV finance department. Vyo Factory, you can find out the production costs incurred to produce shirts, blouses and robes. Production cost data can be seen in the following table.

Table 1. Production Cost CV. Vyo Factory

Information	Costs
Production	1600
Material Costs	Rp55.000.000
Overhead Costs	Rp1.500.000
The amount of	**Rp56.500.000**

Damage to clothing is the cause of the quality of the clothing produced not being in accordance with established quality standards. Based on the results of interviews with the business owner, there were three variables that caused damage in this study, namely material defects, stitching defects, and finishing defects.

This material defect has the same meaning as a fabric defect, where fabric is an important component in producing clothing. Before the production process is carried out, it is very necessary to check the materials to avoid defects. However, on CV. Vyo Factory currently does not apply printing to fabric so damage often occurs to the fabric being produced. Secondly, stitching defects in the sewing process are carried out using a sewing machine operated by human power (workers). Mistakes in stitching are usually caused directly by production workers. Lastly, Finishing Defects: This defect involves the occurrence of damage at the final stage of production, such as a lack of accessories or decoration.

Quality Control using the SPC Method

1. Check sheet

The first stage carried out for data processing in quality control analysis is by creating a check sheet using Ms. Excel containing production data and types of errors in production at CV Vyo Factory. Making this check sheet aims to simplify the process of data collection and analysis and see the type of product damage and the frequency of damage that occurs. The results of data processing using check sheets that have been carried out can be seen in the table.

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Tabel 2. Check Sheet

Periode	Jumlah Produksi	Jenis Kerusakan			Jumlah Produk Rusak	Persentase (%)
		Cacat Bahan	Cacat Jahitan	Cacat Finishing		
Mei	1600	19	98	1	118	7,4
Juni	2980	12	88	4	104	3,5
Juli	1986	17	89	2	108	5,4
Total	**6566**	**48**	**275**	**7**	**330**	**5,0**
Rata-rata	**2188,7**	**16,00**	**91,67**	**2,33**	**110,00**	**1,68**

Based on the table above, it is known that there are 3 categories of product damage, namely material defects, stitching defects and finishing defects, with the respective number of material defects being 48 pcs, stitching defects being 275 pcs and finishing defects being 7 pcs. With a total of 330 damaged products produced, the monthly average is 1.68%.

2. C-Chart/ Control Chart

The next stage is to carry out control chart analysis to determine and explain the quality control conditions at CV. Vyo Factory. This control chart will explain how to calculate the average defective product and statistical control limits through a control chart. After carrying out the calculations, the next step is to create a C control chart using the MS program. Excel is presented in figure 1. below.

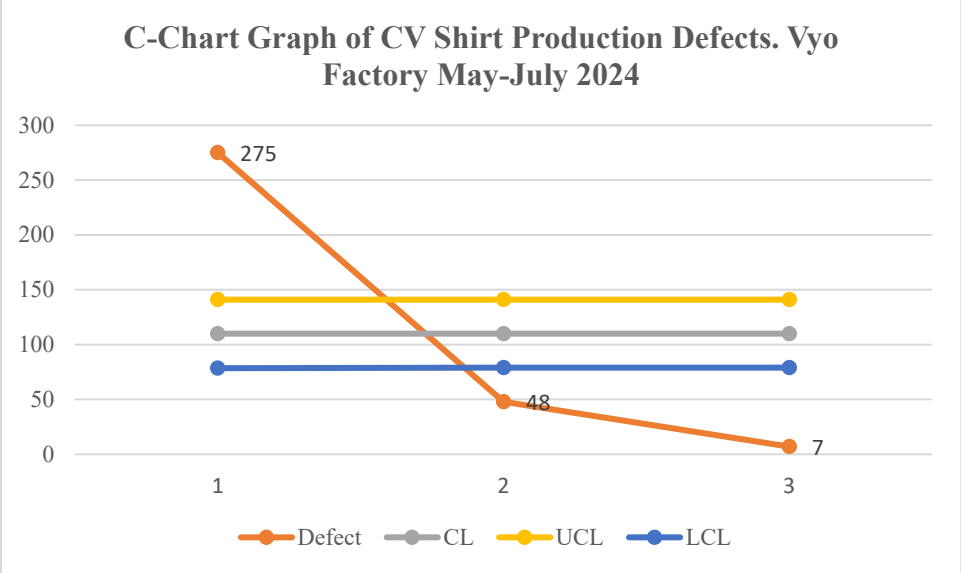

Figure 1. C-Chart Graph of Shirt Defects

Based on the picture above, can see the C-Chart control graph which shows that the defective product exceeds the control limits. Because there is a point that exceeds the control limit, it can be said that the shirt products in CV. Vyo Factory is out of control so it needs improvement or evaluation of quality control.

3. Pareto Diagram

The next stage is to create a Pareto diagram which is useful for identifying, sorting and selecting defective product problems from largest to smallest. With this diagram, CV Vyo Factory can find out the biggest/dominant types of damage to shirt products so that the company can focus on resolving them.

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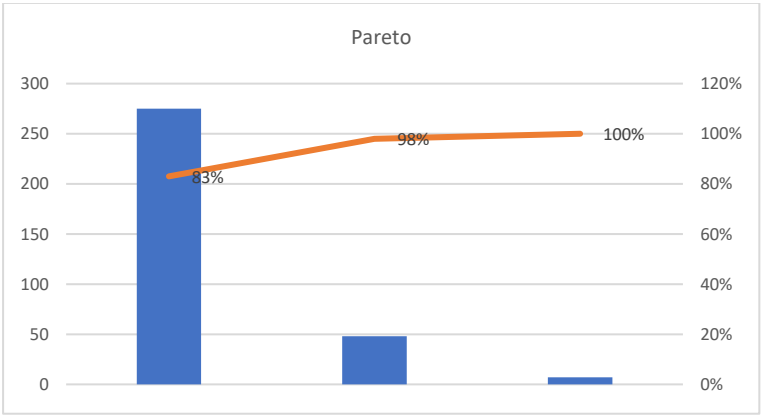

Figure 2. Pareto Diagram

Based on Figure 2, it can be seen that the dominant defect problem in shirts is stitching defects with a defect percentage of 83%.

4. Fishbone Diagram

Fishbone diagrams are used to analyze and identify factors that cause product damage. The following is an application of the fishbone diagram for types of shirt product defects.

1) Material Defects

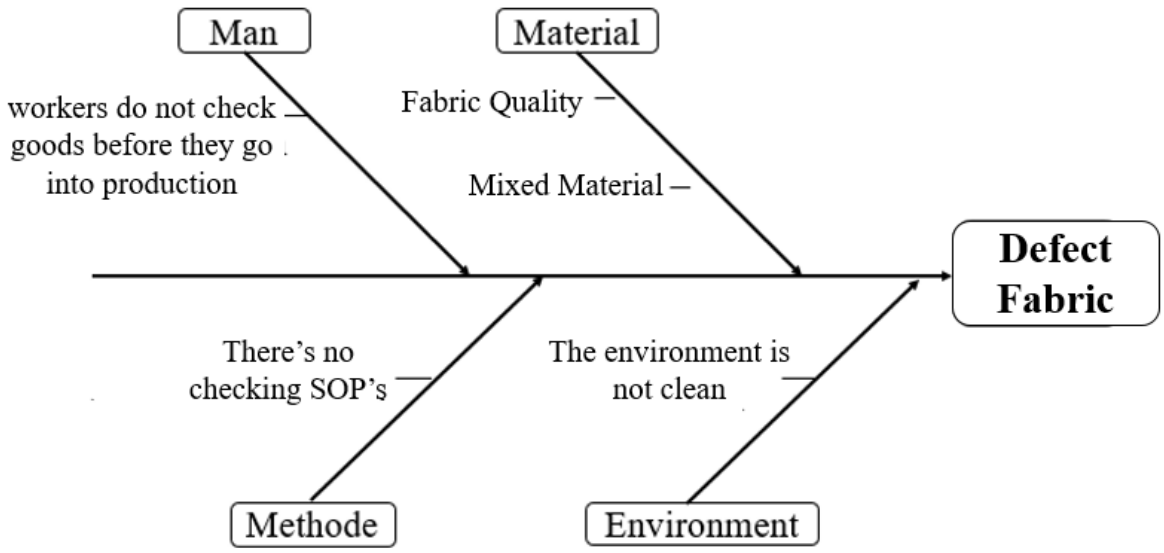

Figure 3. Fishbone Diagram Material Defects

Based on the fishbone diagram image of material defects above, the factors causing defects can be explained as follows:

a. Man

The human factor that causes defects in materials is that workers do not check the materials before they enter production. This results in a lack of adequate supervision of raw material inspection.

b. Materials

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The quality of the material is the main factor that can cause defects in the material. This material quality factor is divided into two categories, namely raw materials that are defective before being received by the factory and raw materials that do not comply with specifications. Mixed raw materials also cause material quality due to damage during storage.

c. Method
The method factor that causes defects in materials is the absence of company operational standards for checking (inspection) on raw materials. Without clear standards, there is no reference that can be used to judge whether the material is of good quality or not.

d. Environment
An unclean environment causes material defects because it is contaminated with dust and dirt, a damp and dirty environment also causes the emergence of microorganisms which can contaminate materials and cause damage.

2) Sewing Defects

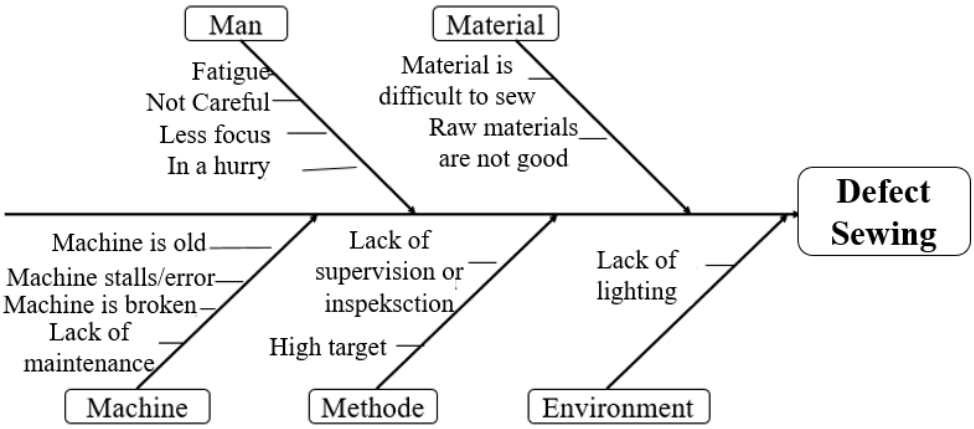

Figure 4. Fishbone Diagram Sewing Defects

Based on the fishbone diagram image of material defects above, the factors causing defects can be explained as follows:

a. Man
The factor that workers are not careful when producing causes errors when sewing. The lack of focus level of workers is due to several things such as poor physical condition, fatigue, lack of environmental comfort level and time constraints, which makes the workforce rush to work.

b. Material
Raw materials are difficult to sew due to inappropriate selection of raw materials and errors in sending raw materials from the supplier which makes the material difficult for the needle to penetrate and results in problematic stitching on the product.

c. Machine
Lack of machine maintenance causes machine operations to be disrupted and creates production delays. Machines that are poorly maintained will experience interference and damage because the machine has no working capacity. Machines that are old and frequently used certainly hamper production due to frequent breakdowns or machine failures caused by the age of the machine and it is no longer suitable for use. Each machine has a maximum age limit for use, therefore machines that are old must be replaced immediately so that production continues to run smoothly.

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d. Method
Achieving high targets causes workers to be too hasty and prioritize quantity, thereby forgetting about product quality. Lack of supervision in the sewing process causes workers who make mistakes to be less supervised and produce products that do not comply with SOPs, especially for workers who still need advice and guidance.
e. Environment
Inadequate lighting can cause workers to make mistakes in the production process, such as cutting inappropriate materials or sewing sloppyly.

3) Finishing Defect

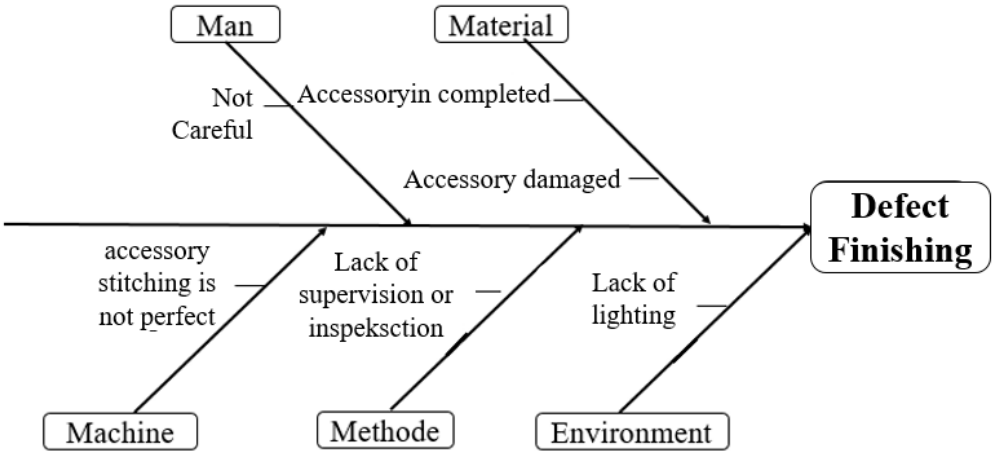

Figure 5. Fishbone Diagram Finishing Defect

Based on the fishbone diagram image of material defects above, the factors causing defects can be explained as follows:
a. Man
Workers who are less careful and less focused can cause errors in the finishing stage.
b. Material
Accessories are an important part of the finishing stage. Lack of accessories can be identified such as lack of buttons, lack of zippers and lack of straps.

Analysis Costs Production

After carrying out analysis using the SPC method, the percentage of defects in shirt products at CV can be determined. Vyo Factory. From this percentage, it can be seen the difference in costs incurred between production costs and the costs of repairing defective products. The following cost calculation can be seen in the table below.

Table 3. Analysis Cost Production

Information	
The amount of Production	1600
The amount of defects	118
Percentage defects	7%

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Information	Cost	
	Production	Repair
Material Cost	Rp55.000.000	Rp4.056.250
Overhead Cost	Rp3.500.000	Rp258.125
The amount of costs	Rp58.500.000	Rp4.314.375

Based on the analysis of production cost calculations, it can be seen that with a reject percentage of 7%, the repair costs incurred by the company are Rp. 4,314,375. Therefore, if CV. Vyo Factory continues to produce rejected products, so it will experience material losses.

4. CONCLUSION

Based on the results of the analysis and discussion that has been carried out using the Statistical Process Control (SPC) method, it can be seen that quality control of shirt products at CV. Vyo Factory needs to be repaired. This is based on a control chart calculation graph (c-chart) showing that defective shirt products exceed control limits, so improvements or evaluation of quality control need to be carried out. Therefore, further analysis was carried out regarding the factors that cause defects in shirt products.

Based on the results of the analysis using a Check Sheet, it can be seen that there are 3 categories of product damage, namely material defects, stitching defects and finishing defects, with the respective number of material defects being 48 pcs, stitching defects being 275 pcs and finishing defects being 7 pcs. pcs. With a total of 330 damaged products produced, the monthly average is 1.68%. Based on the results of the analysis using the Pareto diagram, the dominant type of defect is stitching defects. It can be seen that the dominant defect problem in shirts is stitching defects with a defect percentage of 83%. Based on the results of the fishbone diagram analysis, the dominant factors causing defects in shirt production are human, machine, method, material and environmental factors.

5. DECLARATION OF COMPETING INTEREST

We declare that we have no conflict of interest.

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