SQC (Statistical Quality Control) Method Analysis of Quality Control in the Clothes Production Process
(Empirical Study of PT Busana Indah Global)

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Abstract. Rapid technological and scientific advances used in the manufacturing sector have the possibility of significantly altering the production process. One of the consequences of changes in the industrial world is how fiercely competitive businesses are. As a result, the business must make solid planning decisions in numerous areas, such as preparing for the development of a factory and other production facilities. To generate a result, whether it be a good or a service that benefits consumers, the manufacturing process is an action or activity that integrates several existing production components. The activity of processing raw materials and supporting materials with the use of equipment in order to create a product of value from the starting material is referred to as the production process. PT. Busana Indah Global is a manufacturer that creates garments for all age groups, from infants and toddlers to children, teenagers, and adults. The quality of a product competes with other brands the most in the market. Quality is frequently used to compare products from different manufacturers and set them apart from one another. Quality can be interpreted in a variety of ways, from conventional to strategic. Conventional definitions of quality typically focus on a product's immediate qualities, such as performance, dependability, usability, beauty, etc. While the strategic definition claims that quality is anything that can satisfy customers' wants or expectations SQC, or statistical quality control, is a tool for quality control that uses statistical techniques to address issues that occur inside the organization.

Keywords: Production · Quality Control · Defect · Statistical Quality Control

1 Introduction

Production activity is a crucial activity in businesses in the manufacturing sector. As a result, quality control needs to be taken into account at every step of the production process. A buyer's standard for making a significant choice, such as whether or not to purchase or promote a product, is quality control. Production is referred to as the company's kitchen in many discussions. If there are several types of barriers in the way of production, it will result in a variety of losses, both material and immaterial. In order to reduce product operations costs and ensure that quality requirements are met starting

at a specific moment, quality control is therefore necessary in a business. 2019 (Hidayah et al.)

Every business's principal objective is, in essence, to maximize profits through long-term growth. The ability of businesses to adapt to changing consumer demands, however, is directly correlated to how well the product quality is created and received by customers. (2019, Muhammad Naufal).

The pursuit of balancing client expectations through attempts to satisfy customer wants and wishes is at the heart of the notion of product quality. The ability of a product to carry out its functions, including overall durability, reliability, accuracy, ease of use, and product maintenance, among other product features, is referred to as product quality, according to Kotler and Armstrong (2014: 11).

The garment industry must pay attention to manufacturing quality products, and three factors— people, machines, and time—must be taken into account. Quality control must be implemented by the garment industry by monitoring every operation. To ensure the consistency of the quality of the production outcomes, this must be taken into account when making an item. 2019 (Hidayah et al.)

In order to generate a result, whether it be a good or a service that benefits consumers, the manufacturing process is an action or activity that integrates several existing production components. The action of processing raw materials and supportingmaterials while using equipment to create a valued product from the starting material is sometimes referred to as the production process.

Production planning and control are crucial in the modern industrial environment, particularly in the manufacturing sector. The business is aware of how crucial prompt completion is to keeping customers. 2018 (Rachman).

Based on the description above, the writer is interested in conducting research with the title *"The Influence of Digital Marketing and e-Commerce on Increasing Sales Volume"*

2   Literatur Review

Quality

The definitions of the word "quality" are numerous and varied, ranging from the conventional to the more strategic. Conventional definitions of quality typically focus on a product's immediate qualities, such as performance, dependability, usability, beauty, etc. However, according to the strategic definition, quality is anything that can satisfy the demands or expectations of clients (Gaspersz, 2002).

Along with focusing on the goods produced, the manufacturing sector must also pay attention to the quality of the production process. As a result, there are no faults in the finished product, which reduces the cost of both quality control and the production process. (Dhika, 2009).

According to the definition given above, quality is the capacity of a producer to provide a good or service that can satisfy or even exceed the needs and expectations of customers.

Quality Indicator

Kotler and Keller (2009, p. 8) list the following nine factors as the nine aspects of product quality:

a. Based on the product's size, form, or other physical characteristics, the Product Form can be easily differentiated from others.
b. Secondary characteristics or equipment that is useful for adding fundamental functions related to the options and development are called product features.
c. Performance is the primary factor that customers take into account when purchasing a product. Performance is related to the functional features of an item.
d. Accuracy/conformance (Conformance) refers to the degree of conformity with established requirements in light of client preferences.Digital marketing is promotional activities and market search through
e. Resilience pertaining to the duration of a product's use.
f. Reliability Relates to the possibility that a product will consistently perform its tasks within a given time frame and under a given set of circumstances.
g. Repairability, which has to do with how simple it will be to fix a damaged product. If the product is damaged, it should be simple for the user to fix it.
h. Style (Style) The way a product looks or how a buyer perceives it.
i. Design (Design) The general characteristics of a product that influence how it looks and works in relation to consumer preferences.Digital marketing is now extending to non-Internet channels that provide digital media, such as cell phones (SMS and MMS), callbacks and mobile ringtones on hold (Desai, 2019).

Factor Afecting Quality

According to (Hidayah et al., 2019), a company's product quality can fluctuate from time to time. This is due to the fact that a number of factors, some of which can determine whether a product can reach certain criteria or not, affect a product's quality. These factors are as follows:

Man

The importance of humans or employees in running a business will directly influence how well or poorly its products are made.

Management

Several organizations, which can be referred to as Function Groups, are given the duty of maintaining a certain degree of quality or production quality throughout the company. The leader in this scenario must provide effective coordination between the function group and the already-existing components of the business. As a result, this can promote harmony among coworkers and guard against product damage.

Money

The business must also contribute enough money to maintain or raise the caliber of its goods. For instance, for the upkeep and repair of machinery or equipment used in production, among other things.

Raw substance

One extremely significant component that has an impact on the quality of a company's product is the material or the raw material. As a result, quality control is crucial when it comes to raw materials. One must pay close attention to the following: the sourcing of raw materials, a review of the purchase documentation, the delivery of goods, and storage.

Equipment and machinery

The tools and machinery a company uses in its manufacturing process will have an impact on the quality of the goods it produces.

Quality Control

According to Vincent Gasperz (2005), quality control is a method and a deliberate activity used to achieve, maintain, and enhance the quality of a good or service so that it complies with predefined criteria and can satisfy customers.

The goal of quality control is to enhance product quality, maintain high quality, and decrease the quantity of defective materials. It establishes the size, method, and other functional needs of a product and its management. With quality control, businesses or manufacturers strive to maintain or even increase quality while keeping costs low or constant. Not only the final inspection is required, but also the items being handled in order to minimize losses brought on by inspection or inspection-related problems. (Nasti, undated).

In an effort to achieve quality standards, quality control procedures are carried out before a product or service mistake arises. Setting standards for products or processes by the manufacturer is just one aspect of quality control operations. The standards must also be in accordance with any requirements or tolerances established by the consumer.

Purpose Quality Control

Quality control is an integrated business activity that aims to maintain and raise the caliber of manufactured goods so that they function properly and the outcomes fulfill predetermined requirements. As stated by Ahyari (2002:230).

In order for the products to meet the product criteria that have been established based on the company leadership's policies, quality control is an attempt to maintain the quality of the goods produced (Assauri, 2008). to continuously monitor the production process and locate harm that takes place throughout the production process (Sultana, 2013).

The principles of quality control, according to the expert opinion, are efforts to achieve and improve processes that are carried out continuously to be analyzed to produce information that can be used to control and improve processes so that the process has the capability (capability) to meet the product specifications desired by the customer.

Production process

The manufacturing process, according to Agus Ahyari (2010), is a way of doing something, such as creating or adding new benefits. According to Sofjan Assauri (2016), producing useful goods is a process that involves labor, raw materials, and equipment.

According to the aforementioned definitions, the production process is an activity that entails creating or increasing the usage of a good or service by utilizing already-existing resources like labor, equipment, raw materials, and new funding to make it more beneficial for human needs. In order to generate a result, whether it be a good or a service that benefits consumers, the manufacturing process is an action or activity that integrates several existing production components.

3   Method

Types of research

A quantitative descriptive research method collects data, interprets the facts, and then describes the appearance and outcomes to produce an objective picture or description of a condition using numbers (Arikunto, 2006).

Location and Time of Research

The research will be conducted at PT Busana Indah Global, Jl Cirendeu rt 01/rw 01, Ciheulang tonggoh village, Cibadak, Sukabumi.

Population and Sample

The amount of faulty clothing goods at PT Busana Indah Global serves as the study's population. Using a sampling approach to return the sample in this investigation. In accordance with Jogiyanto (2014), the purposive sampling technique involves selecting samples from the population based on predetermined criteria. This method does not give everyone who can be chosen as samples of the population similar chances or opportunities.

In contrast to random, stratified, or geographical sampling, the purposive sampling technique involves taking samples for a particular reason. This technique is typically used due to a number of factors, such as sampling based on specific traits, criteria, or traits that are the primary traits of the population. These criteria are a sample of what the researcher is looking for based on the goals of the study. The products that were sampled between March and May 2022 were then found to be defective.

The four stages of this study were inspection utilizing a check sheet, analysis and calculation of the p control chart, analysis of cause and effect diagrams, and conclusion.

1. Use a check sheet to collect data.

    The data acquired from the company is then displayed in tabular form utilizing a check sheet in an organized and systematic manner, particularly when it comes to production data and defective product data. This is done to simplify the data's understanding so that more in- depth analysis can be performed on it.

2. Construct a P control chart.

    In this instance, statistical process control was performed on the data using the control chart p (damage proportion control chart). This p-control chart is utilized since the quality control process is attribute-based in nature, the data collected is used as a sample for observation, and the defective product is not permanent and cannot be mended any longer, thus it must be rejected by melting or recycling. Repeat. Making a control chart involves the processes listed below:

a. Calculates the percentage of damage.

$$CL = \frac{\Sigma np}{\Sigma n}$$

    Information:

- Np: Number of failures in a sub-group
- n: Number examined in sub-groups

b. Determining the maximum allowable control limit (UCL) Utilize the formula below to determine the upper control limit, or UCL:

$$\frac{p + 3\sqrt{p(1-}}{n}$$

    Information:

- P: Common product variance
- n: The quantity produced

c. Making an estimate of the lower control limit (LCL) Utilize the following formula to determine the lower control limit, or LCL:

$$P - 3\sqrt{\frac{p(1-p)}{n}}$$

Information:

- P: average product discrepancy
- n: Total production

Data source and data collection

With regard to quality control, which is defined as a quality requirement given to an item that determines whether the item/product is accepted or rejected, the quality measurement utilized in carrying out quality control on clothing or garments is carried out on an attribute basis. 2013 (Yuri and Nurcahyo). Therefore, it is impossible to measure can be difficult to measure the quality of a product's qualities. Open stitches, broken stitches, skip stitches, and poor form are some of the garment damage kinds that are frequently discovered.

Several steps are taken in order to address the issue of product quality control, as follows:

1. Check the data sheet.

The checksheet is helpful for speeding up the data collecting and analysis process. In addition, the checksheet is helpful for identifying issue areas based on frequency, kind, or the need for improvement.

Following are the results of data collection through a checksheet which can be seen in Table 1.

2. Using the Control Map Method for Analysis.

Making decisions using statistical approaches is the core of quality control. p is a statistical technique that can be applied for control. A p-control chart is a tool designed to track and assess whether a process or activity is subject to statistical quality control or not in order to address issues and enhance quality.

Table 1. March-May 2022 Production Report Defect Production

Bulan	Produksi	Cacat
Maret	613279	14377
April	424689	9723
Mei	66291	5958
Total	1104259	30058

Source: Daily Production Report & Daily Quality Control Report

An example of a quality feature that has been measured or calculated from a sample versus a time sample number is shown in the basic form of a control chart or graph. The median line, which represents the average value of quality parameters associated to controlled conditions, may be found on this graph (CL). The upper control line (UCL) and lower control limit are the two horizontal lines (LCL). Making the p-control chart involves the following steps:

a. Using the following formula to determine the proportion of damage:

$$\dot{p} = \frac{1.104.259}{30.058} = 0,272201$$

b. The formula, which is as follows, is used to determine the central line (CL), which is the average damage to product p:

$$CL = \frac{\Sigma 1.104.259}{\Sigma 30.058} = 0,272201$$

c. Using the following formula to determine the upper control limit (UCL):
d. Using the following formula to determine the lower control limit (LCL):

The complete Control Map calculation results for the time period of March to May 2022 can be made using the aforementioned calculation process (Figs 1 and 2).

A P-Chart graph can be created after computing the CL, UCL, and LCL in Table 2 **Calculation of control limits with the aid of Microsoft Excel.**

The aforementioned figure demonstrates that PT Busana Indah Global's quality standards are still up for debate, yet they are still crucial in order to reduce product flaws.

Table 2. P-Chart Control Limit Using Microsoft Excel.

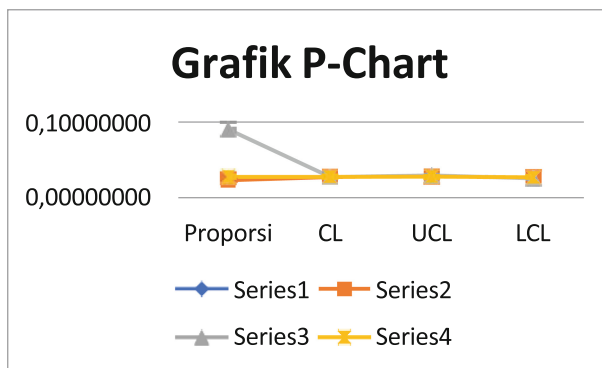| CL	UCL	LCL
0,027220063	0,0276846190	0,026755508

Fig. 1. P-Chart Graph Using Microsoft Excel

Then, using a central line-based P-Chart method, a central line was produced to validate the findings of the control chart analysis.

P-Chart method has a value of 0.217. The process is deemed to be in a state of control when the point is within the control limits (UCL and LCL), and no special action is required. However, a point that is outside the range of control is seen as evidence that the process is out of control and that action is needed to investigate and correct the course of events. Huge losses will result if this is neglected going forward.

The business needs to determine what causes it to happen.defective product control What's that is derived from resources and other elements, such as materials that aren't nice or good quality, etc. The company claims that although it appears that many faulty products are still being sold at an excessive rate, there is no issue with the business. Because they believe they can offer damaged items at a price that is drastically below what they actually charge. They sell outdated products since people like well-known brands even when they don't understand how durable they are.

Fishbone Diagram of Factors, Causes, and Effects

Regarding the use of causal diagrams to track the kinds of errors that happen, specifically people, raw materials, processes, and environment.

Based on the aforementioned four variables, it is possible to study the variables that have the most impact on the issue the organization is currently experiencing, namely the emergence of production flaws that cause the flow process to diverge from the original design. Condition Following is a description of this in terms of causation.

Examples of human category-based causes of defects are employees who are not conscientious and who are weary. The quality of the glue deteriorates depending on the type of raw components. A looser seal on the adhesive and hair loss might also contribute to this.

Fatigue caused by human labor inputs, working circumstances, and procedures can also be seen as a symptom of the emergence of defective products.

Fatigue brought on by human labor inputs, working conditions, and methods can also be considered as a sign of defective product occurrence.

Human-specific causes of impairment include improper sewing technique and a lack of neatness when sewing. Fabrics or labels that do not adhere to machine norms are examples of reasons for faults based on raw material categories. A sewing procedure that does not adhere to the regulations or quality requirements falls under the area of

Fig. 2. Fishbone diagram

work techniques as a cause of defects. Insufficient room ventilation is the category's basis for the disability cause.

References

Amdani, & Trisnawati, N. (2021). Analysis of Convection Product Quality Control Using Statistical Process Control Methods at Cv. Fitria. Journal of Ikra-ITH Economics, 4(1), 10–18.

Product quality control analysis based. (n.d.). 65–78.

Dhika, W. (2009). Analysis of the Quality Control of the Clothing Production Process in the Finishing Section at Pt. Jaya Asri Garmindo Karanganyar. Diploma Final Assignment: FACULTY OF ECONOMICS SEBELAS MARET UNIVERSITY, SURAKARTA.

Hidayah, N., Yusbardini, Y., & Awiyah, D. N. (2019). Application of Quality Management in Garment Businesses in Pademangan Timur District, North Jakarta. Indonesian Community Service Journal, 1(2), 176–183. https://doi.org/10.24912/jbmi.v1i2.2901

Kamaludin, & Sulistiono. (2013). Product Quality As An Important Factor in Export Marketing at PT. Eurogate Indonesia.June,1–45. https://doi.org/10.13140/RG.2.2.11109.91365

Quality, P., & Sigma, S. (2017). 1,2 1, 2. 514–521.

Kurniawan, A., Pere, E. S., & Faisal, M. (2022). Analysis of Skirt Product Quality Control Case Studies in the Sewing Department of PT. XXX. Proceedings of FRIMA (Management and Accounting Scientific Research Festival),6681(4),445–452.

https://doi.org/10.55916/frima.v0i4.413

Nastiti, H. (n.d.). PRODUCT QUALITY CONTROL ANALYSIS WITH STATISTICAL QUALITY

CONTROL METHOD (Case Study: at PT "X" Depok). 414–423.

Nurwathi, & Nur, D. A. (2019). Analysis of Quality Control Part A at PT. ZYX By Using Seven Tools Quality Control Tool As A Way Towards Zero Defect. RETIMS Journal, 1(1), 42–51.

Prihastono, E., & Amirudin, H. (2017). Sewing Quality Control at PT. Internusa Fashion Building III Semarang. Scientific Journal of Engineering Dynamics, Vol 10, 1–15.

Pt, P., & Jaya, D. (2019). ANALYSIS OF QUALITY CONTROL TO REDUCE THE NUMBER OF DAMAGED PRODUCTS. 1–13.

Puspitasari, D., Wahyudi, A., & Widajanti, E. (2018). Implementation of Effective Quality Control to Improve Product Quality at PT Sari Warna Asli Garment. Journal of Economics and Entrepreneurship, 18, 127–139.

Rachman, R. (2017). Product Quality Control in the Garment Industry Using Statistical Process Control (SPC). 4(2), 174–182.

Rachman, R. (2018). Garment Production Scheduling Using Heuristic Pour Algorithm. 5(1), 81–89.