Quality Control Analysis Using Statistical Procces Control (Spc) To Reduce Product Defects In Roastery X

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Abstract: Quality is the overall pattern and the characteristics of the goods and services that are capable of meeting the needs of customers today and in the future. Quality control is the engineering and operations to meet the requirements for quality. This research aims to know the description of the production process, examines the factors that lead to the failure of the product, knowing the implementation of quality control, knowing the actions that should be done by the company in preventing the occurrence of the failure of the product in Roastery X. Roastery X is a brand developed an agrocultural company in Garut, West Java. Roastery X producing coffee, spices and produce. This study specifically researching coffee products. the method used is descriptive and analysis methods used to use Statistical Process Control in the form of pareto diagrams, fishbone, and P Chart. from the results of the research the main factors cause disability product coffee is the human factor, factor machine, and method.

Keyword: Quality Control, Statistical Process Control, Pareto Diagram, P-chart

1. Research Background

Roastery X is one of the places in management good coffee it was Robusta and Arabica coffee. This company contributes to the development of the original West Java coffee industry by processing upstream and downstream coffee, with upstream processing carried out from post-harvest coffee activities which include harvesting, sorting coffee cherries, stripping the skin, fermentation, washing, drying, stripping. horn skin and epidermis, coffee bean sorting, packaging and storage. Meanwhile, the downstream processing of coffee beans done by Roastery X includes roasting process *(roasting)*,milling *(grinding)*, packaging *(packaging)* and distribution markets.

The Robusta Wani produced by Roastery X is one of the superior products from Kadatuan that is most liked and favored by the public. Roastery X itself has 3 superior product classes, including regular (House Blend Pure Arabica Jawara, Pure Robusta and House Blend Robusta Wani), premium (Bukit Tunggul Arabica, Manglayang Arabica and Arabica Natural Honey) and platinum (Luwak Liar and Pea Berry) . Robusta Wani coffee is one of the differentiations of Roastery X coffee products that are most liked and favored by the community compared to Jawara Arabica coffee. Robusta Wani Coffee is a House Blend consisting of 80% Huni Robusta coffee and 20% Arabica. Therefore, by examining the processing of Robusta Wani ground coffee at Roastery X, it is hoped that it can add experience, insight and practical knowledge that can be implemented and developed in the future.

Of the many products produced by Roastery X, the author conducted research on Wani Robusta coffee. The company produces an average of 40 tons of products for one year. Roastery X still has a problem, namely the large number of defective products that are produced exceeds the set product defect standard, which is 3%. This is not a cause of loss in quality which results in losses for the Company. Data on the number of production along with defective products in 2016-2018 for each production.

Tabel 1
Coffee Ground and the Defect at Roastery X

Period	Production (kg)	Product Defect (kg)	% of Product Defect	Loss (Rp)
08/03/2016	13	1	7,70%	180.000
8/13/2016	12	1	8,30%	180.000
8/26/2016	65	2	3,10%	360.000
9/15/2016	60	2	3,30%	360.000
9/16/2016	60	2	3,30%	360.000

11/11/2016	15	1	6,70%	180.000
05/12/2017	20	1	5%	180.000
8/15/2017	350	16	4,60%	2.880.000
10/04/2017	100	9	9%	1.620.000
9/15/2017	50	4	8%	720.000
11/03/2017	50	9	18%	1.620.000
12/23/2017	50	10	20%	1.800.000
03/12/2018	100	13	13%	2.340.000
Rata- Rata	**72,69**	**11.04**	**8,46%**	
Total Loss				**12.780.000**

Referring to table 1, it can be seen the amount of Robusta production women and how many defective products are there. The number of defects tends to fluctuate from each production carried out. Roastery X has set its maximum product defect standard. Judging from table 1.1 the number of defects in Robusta Wani products exceeds the maximum standard of an average of 8.46%, which the company should have determined the standard level of disability is 3%. The product price from Robusta Wani / kg is Rp. 180,000, from the data above, the defect of the product for each time of production is an average of 11.04 / kg. The total loss experienced by Roastery X during the 2016-2018 production period due to defective goods was IDR 12,780,000.

Quality control is a method to reduce production failures. Therefore Roastery X needs to carry out quality control. By controlling the quality, the company is expected to be able to determine what actions should be taken to reduce defects during the production process. Thus quality control is very influential on the running of the production process. A defective product will certainly have an impact on the company. Quality standards affect consumers because consumers can judge the company's products as good quality.

2. Purpose of Research

In carrying out quality control activities, the company must be able to plan and determine the implementation of quality control activities to reduce product failure, so the problems in this study identified the factors that affect product failure at Roastery X. then the problems in this study were identified as follows :

1. What is the description of the production process at Roastery X?
2. What factors influence product failure at Roastery X?
3. How is the implementation of quality control carried out by Roastery X?
4. What actions should the company take to reduce product failures at Roastery X?

3. Literature

A. Quality

According to **Tampubolon (2014: 96)**, the definition of quality is the ability of a product, both goods and services / services to fulfill the desires of its customers. According to **Heizer and Render (2014: 244)** Quality (*quality)* is "the overall features and characteristics of a product or service that is able to satisfy visible or disguised needs". According to **Zulian Yamit** in **Refaldy (2015), the** definition of the quality of a product is "a relative term that is very dependent on the situation from a consumer's point of view, subjectively people say quality is something that suits your taste (*fitness for use*)".

The equation of the three experts above can be concluded again that quality is a good product or service which is expected to be able to meet consumer needs and can provide satisfaction for consumers. Where consumers feel satisfied with the product or service that the consumer gets is fulfilled and feels satisfied that has been obtained.

The quality dimension is a measurement factor used to assess quality. According to **Douglas C. Montgomery** in **Refaldy (2015)**states that there are eight dimensions of quality. The eight dimensions of quality are:

1. *Performance* (Performance) are the basic characteristics of a product.
2. *Durability* is the length of time a product lasts before it has to be replaced. The greater the frequency of consumer use of the product, the greater the durability of the product
3. *Conformance* , performance and product quality with standards, minimizing product defects
4. *Perceived Quality* and perceived by consumers
5. *Features* is a product characteristic that is designed to enhance product functionality or increase consumer interest in the product.

6. *Aesthetic* (aesthetics) is the appearance of a product that can be seen from the appearance, taste, smell, and shape of the product.
7. *Reability* is the probability that a product will perform satisfactorily or not within a certain period of time. The less likely it is that damage, the reliable the product is.
8. *Serviceability* (Ease of Repair)

According to **Heizer and Render (2014: 245)**, there are three reasons for the importance of quality for a company to continue to survive in a market, namely:

a. Company reputation The

quality of a product greatly affects the company's reputation. Good product quality will make the company's reputation increase and vice versa, poor quality will make the company's reputation become bad.

b. Product Reliability

Good and reliable product quality will be favored and liked by its consumers. Consumers who like products made by companies will usually return to buy these products. Product reliability is an important factor for companies to increase consumer loyalty.

c. Global Involvement

In today's technology, quality is an international concern. For companies and countries that wish to compete effectively in the global economy, their products must meet global quality, design and price expectations.

B. Quality Control

According to **Koontz and O'donell** in **Fattah (2007: 175)** "*controlling is the measuring and correcting of activities of subordinates to assure that events conform to plants" or* control is the measurement and correction of performance in order to ensure company goals and the designed plan is achieved. Meanwhile, according to **Siagian** in **Fattah (2007: 176**) "control is the process of observing the implementation of all organizational activities to ensure that all work that is being carried out goes according to a predetermined plan".

According to **Evans and Lindsay (2007; 236)** control is needed for 2 reasons, namely:

1. Control is the basis for effective daily work management for all levels
2. Long-term improvement cannot be applied to a process unless the process is well controlled.

A *system* control has 3 components, **Evans and Lindsay (2007: 236),** namely:

1. Standard or objective
2. Ways to measure success
3. Comparison between actual results and standards, and bait to form the basis for corrective action.

From the explanation above, it can be concluded that control is part of the basis of management and a tool that can be used to observe and measure all activities so that all work can run well and in accordance with company objectives**.**

According to **Ernie and Saefullah (2005: 327)**, the types of supervision are divided into 3, namely:

1. Initial

Supervision Supervision is carried out at the commencement of work implementation. This is done to prevent irregularities in the implementation of work.

2. Supervision of the Process

Supervision is carried out when a work process is in progress to ensure whether the work carried out is in accordance with the stated objectives.

3. Final

Supervision Supervision is carried out at the end of the work process.

In controlling there are 4 steps used by **Evans and Lindsay (2007: 236),** namely:

1. Determining *standards*

Determining cost quality standards *(cost quality),* work quality standards *(performance quality), standards* safety quality *(safety quality), standards* the quality of reliability *(reliability quality)* required for a product.

2. Assessing conformance

Comparing the conformity of products made with predetermined standards.

3. Acting when necessary

Correcting the problem and its causes through factors that include *marketing, design, engineering* , production, and maintenance of factors that affect customer satisfaction.

4. Planning for improvement

Planning a continuous effort to improve standards of cost, performance, safety and reliability.

C. Benefits and Objectives of Quality Control

According to Tampubolon (2014: 96), the task for operations is to determine the critical point to focus attention in the production process, so that the quality of the production results can be met. Achieving quality targets will benefit the company in placing its position in the market (*market position)*. Thus the quality of projects for the company in the determination of:

1. Reputable companies*(companyReputation);*if the company's position can be as a market leader (*market leader)*, this condition shows that the quality of the company is compared to other competitors. Conversely, if the company is only a*market follower* , the company must try to control the quality of its products to be even better (*market reposition)*. Thus quality is very useful in shaping a company's reputation, through the quality of its production.
2. Product liability*(productliability),* is a challenge for companies in the marketing of a product, if the product cause problems for customers or markets, is the responsibility of the company materially and morally.
3. Global aspects (*Global Implication),* in the era of globalization which observes that every product or service marketed internationally must be able to compete in quality, and in terms of lower prices, as well as designs that are in accordance with international market demands, the result is that the global aspect will directly affect the quality of a result of the operational process.

Wignjosoebroto in **Refaldy (2014)**, By implementing quality management as well as possible, there are many benefits that can be obtained by the company, including:

1. Increasing work efficiency and productivity.
2. Reducing *losses* in the work process carried out, such as reducing *waste products* or eliminating unproductive times.
3. Reducing costs and saving *money.*
4. Keeping sales *(sales)* will continue to increase, so that profits can still be obtained (increase the potential for competitiveness).
5. Increase the reliability of the resulting product.
6. Improve worker morale to keep it high.

Based on the definition above, the purpose of quality control is a way for companies to develop their goals in order to obtain satisfaction from consumers so that they can increase profits through the results of quality control.

D. *Statistical Process Control* (SPC)

Statistical Process Control is a statistical technique that is widely used to ensure that processes meet standards. In other words, other than *Statistical Process Control* is a process used to monitor standards, make measurements and take corrective action while a product or service is being produced. (Heizer and Render, 2014). Meanwhile, according to Assauri in Miramsyah (2017) argued that the notion of *Statistical Process Control (SPC)* is a system developed to maintain a uniform standard of production quality, at a minimum cost level and apply assistance to achieve efficiency.

Based on the understanding according to the experts, it can be concluded that statistical quality control is a system to maintain the standard of quality of production at the minimum cost level which is designed to evaluate quality in terms of conformity with specifications.

Quality control statistically by using *Statistical Process Control* (SPC) has 7 tools that are useful in measuring and controlling the quality as mentioned by Heizer and Render (2014), 7 aids in measuring and controlling the quality of, among others:

1. Sheets check*(CheckSheet)*.
2. Histogram.
3. Pareto chart.
4. Flow diagram.
5. Scatter Chart.
6. Control Chart.
7. (*Fishbone DiagramFishbone DiagramDiagram*-Cause and Effect)

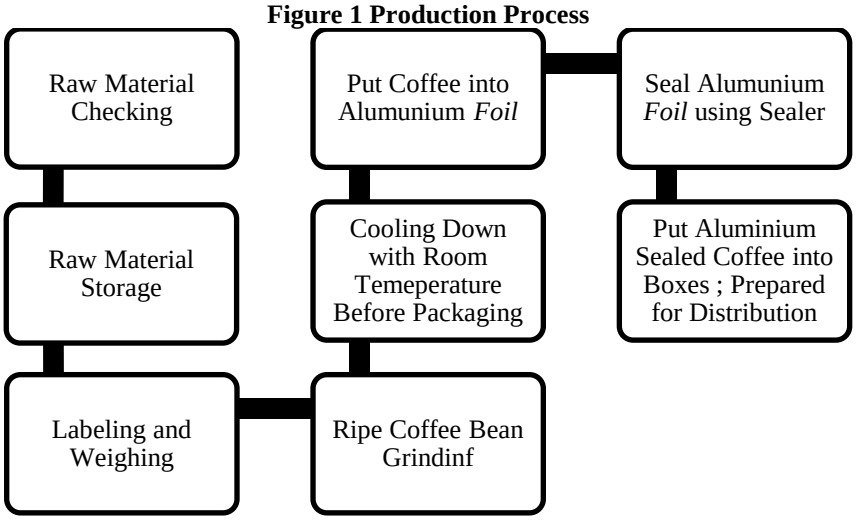
4. Discussion

A. Stages of Coffee Production at Roastery X

The production process is carried out based on the production planning that has been set by the company. Inspection of incoming goods by Roastery X. Storage of raw materials for 3 days and labeling and weighing of coffee. The coffee is put into aluminum *foil and is* immediately cooled to room temperature before entering the

packaging. Ripe coffee beans are ground using amachine *grinding*. The aluminum *foil is* sealed using amachine *sealer*, the last step is to put it in a box / closed place and the coffee is ready to be distributed to consumers.

Figure 1 Production Process



Source: Data Roastery X

B. Factors Influencing Product Defect

The company's production activities are certainly not in accordance with the plans that have been implemented by the company. Even though the company has implemented general quality control, the fact is that there are always problems that result in defective products or not according to specifications. These problems are of course caused by several factors, including:

1. Raw Materials

The quality of the raw materials used by companies is very important and fundamental, because if the raw materials are of good quality, of course it will affect the products produced. The following are the raw materials needed in producing coffee:

Table 2
Raw Material Data for Coffee Making

No	Name of Raw Material
1.	West Java Robusta
2.	CoffeeWest Java Arabica Coffee

Source: Roastery XData

2. Labor

Labor is a factor that can affect product defects . Physical and psychological factors of each workforce affect the capacity and level of work performance.

a. Physical factors, namely the physical condition of the workforce concerned, such as age and health.

b. Psychological factors, namely the mental state of the workforce concerned, such as motivation and daily life of workers.

In addition, factors of education and work experience also greatly affect performance. Thus, in relation to the quality of production results, the workforce must have the awareness to maintain and improve the quality of the products produced.

3. Machinery and Equipment

Machines and equipment are very important tools in the running of the production process. Become one of the supporting factors to produce quality products. However, it can also be a cause of product failure if its use is not appropriate and there is no proper maintenance. Here are a means of supporting the existing production processes in Roastery X:

Table 3
Machinery and Equipment Used by Roastery X

N O	Machinery and equipment

1	Machine *Roasting*
2	*Grinder*
3	machines *Sealer*
4	Scales Digital

Source: Data Roastery X

4. Environmental Conditions Working

A good working atmosphere will affect employee performance. Good air circulation, clean workplaces and adequate lighting will make workers feel comfortable in doing their jobs. In addition, things that need to be considered are the treatment and assessment of work results received by employees. For example, in giving gifts and wages that are fair and in accordance with the work performance achieved by employees. Thus, workers will feel more valued and motivated to work harder.

C. Types of Coffee Product Defects What Happened At Roastery X

1. There was a *crack* in coffee.

Crack in coffee beans affects the taste of the coffee to be served, therefore *crack is* considered a defect. *Crack is* caused by the type of coffee that is too light or too heavy when roasting. In addition, another factor that causes *crack* is the coffee processing itself, starting from *pulping* (peeling the skin of the coffee fruit), *hulling* (peeling the coffee beans). Because *crack* in coffee affects the taste of coffee and creck makes the coffee beans look bad (cracked and perforated).

Figure 2
***Crack* (in Coffee Beans**

2. Differences in *roasting profiles* that are not suitable or overripe (burnt).

Roasting is a very important factor in making coffee products because it can affect the taste of coffee. The profile *roasting* or coffee maturity level has been adjusted for the needs of the product. The profile level given to the Robusta wani product is *medium to dark*, if the maturity level is above medium *to dark* then the item is a defective item. This is due to the difference in water content in raw coffee beans which is not evenly distributed so that in theprocess *roasting* there are coffee beans that are too ripe (burnt). Another factor that causes overripe (burnt) is human negligence.

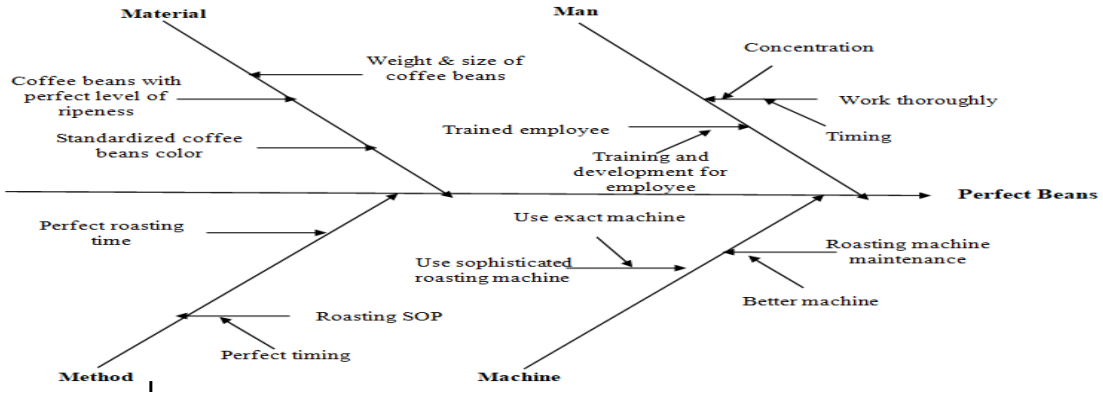


Figure 3
Fishbone Diagram in Coffee Roasting of Roastery X

D. Analysis Using Pareto Diagram

Paretto diagrams are a method for managing errors, problems, or defects to help focus attention on problem solving efforts. With this diagram, it can be seen that the most dominant types of defects in production during the

period 2016 - 2018. To make a Pareto diagram, a table containing the number of defects of each type of disability from the results of the research that has been done is drawn up first.

Table 4
Amount and Percentage of defects in Koffie products Period 2016 to 2018

No	Type of Defects	Number of Defects	% Freq.	% Cumulative Frequency
1	Cracks in coffee beans	62.49	88%	88%
2	Difference levels in *Roasting*	8.52	12%	100%
Total		71		

overripeSource: Koffie Kadautan Data

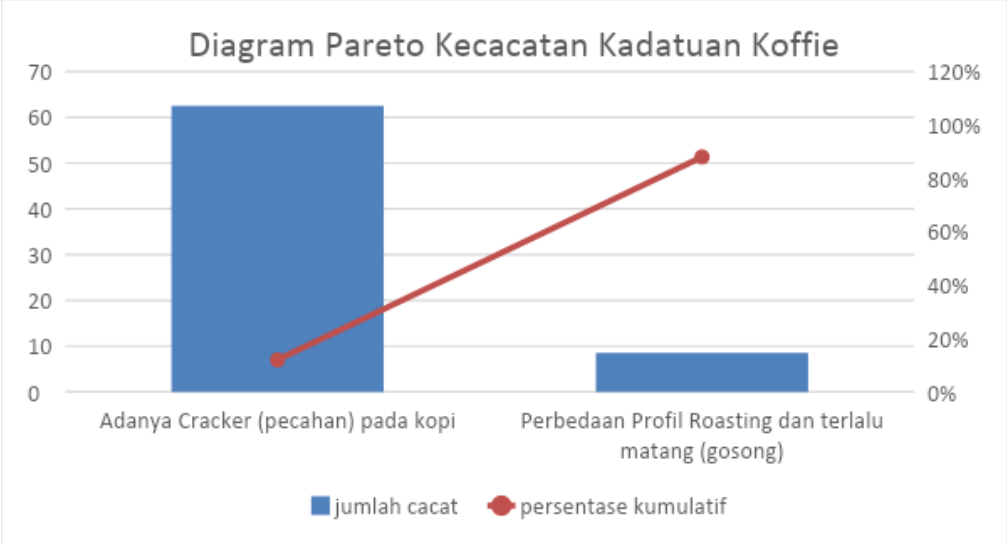


Figure 4
Pareto Diagram Types of Defects Coffee Products

From the data above it can be seen that the production process during the period 2016 to 2018 the number of defects that occurred was 55.91 kg. Visible to control the order of priority in the search for factors and problem solving where the largest to the smallest is as follows:

1. *Crack* in the coffee bean much as 49.20 kg.
2. Type of failure The difference betweenprofile is *Roasting* and overripe (burnt)6.71 kg.

5. Summary

1. The production process starts from the inspection of incoming goods to Roastery X. Storage of raw materials for 3 days and labeling and weighing of coffee. The coffee is put into aluminum *foil and is* immediately cooled to room temperature before entering the packaging. Ripe coffee beans are ground using amachine *grinding. Aluminum The foil is* sealed using amachine *sealer*, the last step is to put the packaged coffee into a box / closed place and the coffee is ready to be distributed to consumers.
2. The factors that cause damage or defects in the production of Roastery X company come from *human error* or human error, machines, equipment and methods. The types of defects are as follows:
   a. The presence of *cracks* (fragments) in coffee.
   b. Differences inprofiles *roasting* that are not suitable or overcooked (burnt).
3. In this case, Roastery X always checks and selects each incoming raw material before it is used for the production process. For control of finished products, the company carries out quality control by identifying and dividing which products cannot be delivered or in other words, defects. The implementation of quality control

from Roastery X is still not very good because defective products are still more than the standard set by the company.

4. Actions that can be taken by the company to overcome product defects caused by several factors, namely conducting intensive supervision of employees, providing understanding to employees that quality control is important, and providing training to new employees. Apart from that, another factor is the machine and equipment factor. The company should carry out regular maintenance and also replace machines that are no longer suitable for use. The company must be able to provide direction with better communication to its employees and also improve communication in providing work instructions both orally and in writing.

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