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Quality control using the failure mode effect and analysis to reduce defects in PT. NSP

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ABSTRACT

This research is to analyze service quality and customer satisfaction to find out the factors of consumer/customer complaints so that company performance can be improved and improved. This research uses the Servqual method, the company can then find out consumers' perceptions and expectations, while the company's AHP method is able to sort out which criteria are prioritized first to improve service quality so that the hospital becomes better. The results of the research were conducted with a sample of 100 respondents and 20 question items. In calculating the weighted servqual, the priority for improving the quality of service in the Tangible dimension is the criterion "The company has a clean, comfortable waiting room and air conditioning" with a weighted servqual value of -0.020, Reliability is the criterion "doctor's availability according to schedule" with a weighted servqual value of -0.058, Responsiveness is the criterion of "officer's thoroughness in providing services" with a weighted servqual value of -0.074, Assurance is the criterion of "guaranteeing timeliness of service" with a weighted servqual value of -0.096, Emphaty is the criterion of "officer's sincerity in handling consumers" with a weighted Servqual value of -0.072. The most satisfactory criterion is the Reliability dimension which has the criteria "fast and uncomplicated service procedures" with a weighted servqual value of -0.010.

Keywords: Red ginger powder; quality; defects; FMEA

1. INTRODUCTION

Ginger is also known to have healing properties for various diseases such as colds, coughs and diarrhea. From the ginger plant, it can be processed into powdered red ginger which comes from fresh red ginger and has gone through a grinding and drying process first. The quality of ground red ginger really needs to be considered because the distinctive taste and aroma are factors that everyone is looking for. Powdered red ginger is used as a food additive which provides a spicy taste and distinctive aroma and is also beneficial for health. This ground red ginger can be used as an additional ingredient in coffee products and other drinks. Established in 2000, PT. NSP is a leading supplier company in Indonesia specializing in the field of tea (all types of tea), herbal plants and spices. With the aim of presenting the enjoyment and quality of Indonesian nature, PT. NSP continues to be committed to producing innovative products of international standard. In maintaining reputation and credibility, PT. NSP believes that creativity and the use of technology are the keys to competing in the era of globalization. During the operation of the company, PT. NSP continues to update the development of technology and machines with the aim of improving product quality and company performance. Indonesia is known as the largest producer of tea, spices and herbal plants in the world,



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the advantage of this company is that it can produce products with a variety and best quality. This company is located in South Tangerang, Banten, Indonesia.

The implementation of product quality control is expected to produce quality output, reduce the number of defective or damaged products in the production process which will help reduce the number of defects, increase quality assurance and enhance the company's reputation by creating an image that the products produced have added value and high quality. Quality control can be carried out using methods, one of which is Failure Mode and Effect Analysis (FMEA). FMEA is which means it is an analysis carried out to find effects or impacts that are likely to cause errors in a product or in the production process. FMEA success indicators are measured by calculating the Risk Priority Number (RPN) value which is obtained from the results of Severity x Occurance x Detection calculations and existing failures. According to [1]–[3] the use of the failure mode and effect analysis (FMEA) method can be used as a quality control tool. FMEA also helps in improvement to determine priority improvements that need to be taken given the large number of problems [4], [5]. So it is more focused on improvement [6]. This method can identify the causes of product defects and the effects caused by product defects and avoid factors or influences that cause product defects [7] [8]. FMEA can also reduce costs in the process of loading finished goods in manufacturing companies [9]. One of the problems that occur in a company is controlling product quality to reduce the number of defective products. This research can use this method to achieve the target of product quality control efforts in a company [10]. Quality is one of the factors that can influence a company in achieving company success. The level of difficulty in making each product varies so that product defects are often found in the products produced. Products are produced with a target permissible defect percentage of 3%. The products produced are often above the permissible percentage of defects. It can be said that there are still many defective products produced, meaning that the company still lacks quality control over the products produced by the company. Based on the description of problems regarding existing product quality, further research needs to be carried out to identify factors and prevent causes of defects. According to Wu [11], [12] FMEA is a structured procedure to identify and prevent as many failure modes as possible. FMEA involves a series of considerations that cover as appropriate options for analysis. This method will make it easier to investigate product defect problems and try to fix them [13], [14]. The final goal of the FMEA process is to determine improvement priorities, to eliminate potential failures and reduce the opportunity for potential failures to occur, by providing improvement proposals using a fishbone diagram so that the risk priority number (RPN) value decreases. Table 1 below can be seen that the percentage of defects in red ginger products is still high, therefore the FMEA method is used in this research so that companies can control product quality by minimizing product defects.

Table 1. Number of production and product defects of powdered red ginger in 2022

Production month	Production quantity (Kg)	Number of products (Kg)	Percentage of defective products
Jan 2022	4000	1000	25.00%
Feb 2022	4000	600	15.00%
Mar 2022	4200	900	21.43%
Apr 2022	4100	1000	24.39%
May 2022	3500	600	17.14%
Jun 2022	3600	800	22.22%
Jul 2022	3900	700	17.95%
Agu 2022	3900	800	20.51%
Sep 2022	4000	600	15.00%
Okt 2022	3500	1000	28.57%
Total	38700	8000	20.67%

Table 1 shows that the defect rate for red ginger products is very high. This needs to be done as an improvement to reduce the defect ratio. Table 1 also shows that the percentage of defect values is very

high above the company target of 5%. Based on previous research references, this research will use the FMEA method to determine the level of production failure. The aim of this research is to control the quality of red ginger by reducing the level of defects.

2. METHOD

According to the explanation Aprianto [15] Failure Mode And Effect Analysis (FMEA) is a systematic model for identifying and preventing problems that exist in a system. Explained by Stamatis [16] that the use of FMEA is carried out through a discussion process from different divisions in the company to analyze the causes of failure of components and subsystems in a process or product. FMEA uses criteria for the probability of occurrence, detection and severity of damage to determine risk priority numbers (RPN) and Risk Score Value (RSV) so that they can later be used to determine actions for prioritized risks [17]–[19].

- a) Severity (S) 1-10 (the greater the severity number, the higher the severity level).
- b) Occurrence (O) 1-10 (the greater the occurrence number, the higher the chance of failure of a process)
- c) Detection (D) 1-10 (the greater the detection number, the lower the level of reliability in detecting a failure in a process).
- d) Proposed 5W+1H Improvements

The stage after knowing the relationship between the cause and effect of a defect to finding a solution by drawing the best decision regarding the implementation of appropriate action is to look for appropriate improvement proposals to overcome the cause of the effect [7], [20], [21]. This is done by conducting interviews with related parties and making direct observations at the production location [22]. The FMEA assessment stages and recommendations for improvement can be seen in Figure 1.



Figure 1. The FMEA stages

3. RESULT AND DISCUSSION

Based on the results of observations made, there are types of defects that exist in the production process of powdered red ginger. Following are the results of identifying the types of defects found in the production process of powdered red ginger, which can be seen in Table 2.

Table 2. Types of red ginger product defects July–December 2023

No.	Type of Defect	Number of Defects (kg)	Percentage (%)
1	Not spicy taste	460	15.70
2	Less aroma	420	14.33
3	Texture is too rough	350	11.95
4	Color too dark	100	3.41
5	Color too light	200	6.83
6	Ph is not appropriate	250	8.53
7	There's a Taste of Earth	300	10.24
8	There is fungus	350	11.95
9	There are impurities	500	17.06
Total		2930	100

Based on Table 2, it can be seen that the highest type of defect is the presence of impurities at 17.06%. The data used is primary data and secondary data collected from July-December 2023.

- a) Analyze the causes of the highest defects using the Failure Mode and Effect Analysis (FMEA) method and determine the Risk of Priority Number (RPN) value.

Table 3 shows an assessment of the type of failure that causes impurities using Failure Mode Effects Analysis (FMEA).

Table 3. Assessment using the Failure Mode Effects Analysis (FMEA) method

1	2	3	4	5	6	7	8
Expected product	Types of Failure	Cause of failure	The effects of failure	Severity (1-10)	Occurance (1-10)	Detection (1-10)	Risk of Priority Number (1-1000)
There are no impurities of any kind in powdered red ginger products	The presence of impurities	Wire mesh leaking	Some powders are rough	7	6	5	210
		Lack of maintenance	The machine filter is holed	7	7	4	196
		Area not clean	Entry of waste into the product	8	6	4	192
		There is sack yarn trash all over the area	Entry of thread into the product	7	7	4	196
		Ginger skin is still dirty	There is an earthy smell	6	6	5	180

Failure Mode Effects Analysis (FMEA) is a method that makes it possible to obtain the relationship between the causes and effects of defects to find solutions by describing the best decisions regarding the implementation of appropriate actions. The Failure Mode Effects Analysis method used is process because the data used is data for the production process section. The Failure Mode Effects Analysis (FMEA) method is used by weighting severity, occurrence and detection for each cause of failure, then finding the RPN value by multiplying the severity, occurrence and detection factors and then ranking them according to the largest RPN value. The first rank is the cause of the most critical problem and must be addressed immediately. The first rank is leaking mesh wire. The biggest problem with impurities is caused by mesh wire that leaks because it has a high RPN value. This indicates that in the production process there are failure modes that must be corrected. Repairs that will be carried out for this process are carried out based on the causes of failure which have been analyzed based on Failure Mode Effects Analysis (FMEA) so that the problems that occur are known so that repairs can be carried out.

b) Proposed Improvements

This research discusses proposed improvements to reduce defects in the production process Red Ginger Powder Products. Proposed improvements can be seen in Table 4.

Table 4. Proposed improvements using the 5W + 1 H method

No	Factor	What	Why	Where	When	Who	How
1	Leaking wire mesh	Replacing Wire Mesh	So that rough materials do not enter	Ginger room sieve machine	Before running	Production maintenance operator	The wire mesh is replaced with a new one
2	Garbage is scattered around	Provides hygiene warnings	So that waste does not contaminate the product	Ginger powder production room	Before running	Production operator	Remind operators to clean the area
3	The machine filter is	Replacing the engine filter	So that no foreign objects	Ginger grinding machine	Before running	Production maintenance operator	The engine filter was replaced with a new one

	holed		enter the product			
4	Machine maintenance is not timely	Scheduling machine maintenance	So that the machine is maintained	Ginger powder production room	On schedule	Production maintenance operator Remind the machine maintenance schedule
5	Lack of operator support facilities	Providing chair facilities operators	So that operators don't get tired easily	Powdered ginger packing room	During the packaging process	Operator packaging Providing chairs for operators to make them comfortable while working

This improvement proposal is analyzed by making direct observations at the production location and by conducting interviews with related parties such as operators, Section Head Production, Section Head Quality Control, Section Head Engineering, Department Head Production, Department Head Quality Control, Department The Head of Engineering and other parties provided suggestions for improvements for the production process up to the oven, namely, compiling and carrying out preventive maintenance activities consistently on each machine or tool so that the machines used for production do not lose their proper life time and do not hinder the production process if something happens. damage due to the machine not being properly maintained and maintaining the quality of the wire mesh so that it does not leak to reduce the presence of impurities.

Based on the results of research, discussion and analysis that have been carried out on company systems and quality control systems. Development to carry out evaluations deemed necessary to make it more ideal. Suggestions that can be useful for the company are as follows: conducting training for employees so they can operate the machine better, so as to minimize defects that occur due to operator factors. The company supervises the implementation of Standard Operating Procedures (SOP).

4. CONCLUSION

Based on the results of the observations, conclusions can be drawn regarding the causes of defects in Ginger Powder products as well as proposals for improving quality control in Ginger Powder products. The conclusions obtained based on observations and quality control of powdered ginger are as follows: there are causes of defects with the largest value, namely wire mesh leaks of 210 RPN which have an effect on the powder, some of which are rough. The proposed improvement that the company must make is to provide information verbally or in writing to the operator regarding how the machine works. Training on the use of sifting machines and milling machines for operators. Operators are given a manual for using the sifter and milling machine. Provided with tools to inspect machine components. There is additional rest tme for operators. There is supervision and control before and after the production process. Suggestions for further research to be carried out to find out and determine the main causes of defective red ginger powder products.

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