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Analysis Quality Control of Tiga Bintang MSME Snack Stick Product Using Statistical Quality Control (SQC)

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Abstract

UMKM Tiga Bintang is one of the household-scale agro industries that processes roa fish, duo fish, moringa, and purple sweet potatoes as the basic ingredients into various kinds of snacks in the form of sticks. To get the best quality in accordance with the standards desired by consumers, quality control is needed, which aims to minimize deviations that are not in accordance with the standards set by the industry itself. The purpose of this study is to see whether quality control in the production process by UMKM Tiga Bintang is controlled. The type of data used in this study is primary data. The analysis process carried out in this study uses the Statistical Quality Control (SQC) approach. Statistical Quality Control is a statistical technique that is widely used to control the quality of a product, by evaluating quality in terms of compliance with specified specifications. The SQC analysis results show that the number of products examined was 24800, where the average product damage was 0.095121 or 9.5121%, with the most type of damage occurring there was a brownish product colour. The upper control limit (UCL) and the lower control limit (LCL) for each production are various. Quality control of UMKM Tiga Bintang is not well controlled because of uncontrolled production time within the upper and lower control limits.

INTRODUCTION

The quality of a product is very important for the development of a company and is the main key for the company in order to obtain sales and large profits. However, problems often arise in the production process, usually there are damaged or defective products. So that requires steps or efforts to solve these problems so that product quality can be maintained well.

The product quality is a matter that became the basis of a company in the manufacture of a product to be marketed. The purpose of product quality is to satisfy customers, this is also reinforced from several theories, according to Heizer & Render (2015), quality can be defined as follows: Quality is the overall features and characteristics of a product both goods or services that aim to satisfy consumer needs promised by the company.

Quality control that is carried out properly will have an impact on the quality of the products produced by the company. According to Assauri (2016), quality control is a process for measuring the output relative to a product standard, and perform corrective action if there is output that does not meet the standards.

Tiga Bintang MSME is one of the household-scale agro industries that processes roa fish, duo fish, moringa and purple sweet potato as a basic

ingredient into various kinds of snacks in the form of sticks. This MSME is located at Jalan Kijang II Utara Block A No. 17C, Palu City, Central Sulawesi. The results of the production of these Tiga Bintang snacks will later be distributed to several souvenir shops in the city of Palu such as Haji Mbok Sri, Sri Rejeki, and Sofie. To satisfy the needs of consumers, Tiga Bintang MSME tries to minimize the damage caused by the lack of supervision and control over the quality of the products produced. The criteria for declared defective products are broken products (usually occurring during slicing and during storage), and brownish color (usually due to the frying time being too long and the fire used is too large). The step in reducing the level of defects is to carry out quality control in the production process to determine the factors that cause the greatest level of disability and to know the process is in a controlled state or not. This can be done by making improvements and improving product quality during the production process. In the end, it will provide input for the company or industry, not only in terms of quality or better product quality but also in terms of productivity (Widiaswanti, 2014).

Referring to the description above, it can be seen that the problem of quality control of product quality produced by a company or industry is an important thing, so a quality control study is needed. One method that can be used is a statistical tool that is Statistical Quality Control (SQC). According to Rully & Nurrohman (2013) the purpose of SQC in quality control is to supervise products to comply with established standards. SQC is a problem solving technique that is used to monitor, control, analyze, manage, and improve products using statistical methods so that it can contribute to improving the quality of stick snack production and expanding the market share of Tiga Bintang MSME.

Research conducted by Hairiyah et al., (2019) that there are four types of damage namely burnt defects (A), size defects (B), outbound content defects (C), and peeling skin defects (D). The results of the analysis with cause-effect diagrams indicate the causes of poor quality of bread, namely labor, method, and machine factors. Seen from the Pareto diagram, the type of product damage is more dominant in the size defect of 38.55%, the results of the control chart analysis for the total exit amount of 60% indicate quality control at Aremania Bakery is still out of control.

Thus, the authors are interested in conducting research with the title "Analysis of Quality Control of Tiga Bintang MSME Stick Snack Products Using Statistical Quality Control". The problem raised from this study is whether the quality control of Tiga Bintang MSME has been well controlled or not. The implementation of a quality control system on MSME is expected to minimize product damage to the level of zero damage.

MATERIALS AND METHODS

The data used in this study are primary data obtained from direct observation and interviews with parties related to the research conducted, the owners of Tiga Bintang MSME. The acquisition of data used in the preparation of this study is the number of production and the number of defective products from February 24, 2020 to March 22, 2020.

Table 1. Damaged Products produced by Tiga Bintang MSME.

i-th Production	Roa Fish Sticks	Sweet Potato Sticks	Moringa Duo Sticks	Total
1	60	50	90	200
2	60	60	110	230
3	90	60	100	250
4	120	70	90	280
5	60	50	60	170
6	45	30	50	125
7	40	30	30	100
8	50	40	58	148
9	55	40	65	160
10	75	45	80	200
11	60	50	20	130
12	75	60	20	155
13	50	40	30	120
14	40	20	31	91
Total				**2359**
Average				**168,5**

The method used for data analysis in this study is Statistical Quality Control. Broadly speaking, Statistical Quality Control (SQC) can be interpreted as a system used to assist companies in controlling their quality so that the final results of goods or services produced can be in accordance with its specifications and can minimize production and inspection costs.

The Statistical Quality Control (SQC) method uses three quality control tools to analyze Tiga Bintang MSME snack stick products, namely check sheets, Pareto diagrams, and U-chart maps.

Check Sheet or sheets of the examination is a tool used to collect data and analyze the data presented in tabular form, containing data on the number of goods produced and the type of mismatch along with the resulting amount (Fakhri & Kamal, 2010).

Pareto diagram is a bar graphs that are joined together by line graphs that illustrate the comparison of each type of data to the whole (Iham, 2012). The function of Pareto diagram is to identify or select the main problem for quality improvement from the largest to the smallest.

The U control chart is part of control chart for non-conformities per unit. U-Chart is formed from 100% product inspection. In fact, the products produced are always not the same, so the sample size is not constant. As a result, variations in control limits will be in accordance with the sample size of each subgroup (Montgomery & Woodall, 2008).

The stages of data analysis in this study are as follows:

a. Describing the data of inspected products and damaged products using the Check Sheet.
b. Determining the priority of improvement using Pareto Diagram.
c. Making U control chart
   - Calculate the average product damage
   - Calculate the center line (CL)
   - Calculating the upper control limit (UCL)
   - Calculating the lower control limit (LCL)
d. Interpretation

RESULT AND DISCUSSION

Before analyzing the data, the data was first grouped based on the product categories that were considered defective. In this study, a product is considered defective if it does not meet the standards or specifications that have been determined, namely broken or crushed products, and brown. Defective products found are grouped into Table 1.

Table 1 shows that the number of defective products produced by the Tiga Bintang MSMEs from the fourth week of February to the third week of March is not the same. The average production of damaged products during the four weeks of observation was 168.5 grams, with a total of failed products produced by Tiga Bintang MSME of 2359 grams.

Table 2 shows that the number of products produced by Tiga Bintang MSME since the fourth week of February until the third week of March is not the same. The average production during the four weeks of observation is 1771.429 grams, with the number of products produced by Tiga Bintang MSME as much as 24800 grams.

Table 2. Number of Products produced by Tiga Bintang MSME.

i-th Production	Roa Fish Sticks	Sweet Potato Sticks	Moringa Duo Sticks	Total
1	500	450	600	1550
2	640	520	850	2010
3	620	620	850	2090
4	910	650	1000	2560
5	250	550	750	1550
6	500	350	500	1350
7	450	375	500	1325
8	550	400	600	1550
9	650	400	750	1800
10	650	405	910	1965
11	750	650	900	2300
12	650	450	900	2000
13	460	510	650	1620
14	490	190	450	1130
Total				**24800**
Average				**1771,429**

Table 3. Data on the Number of Production and Damaged Products produced by Tiga Bintang MSME.

i-th Production	Total Production	Damaged	Percentage (%)
1	1550	200	12,90
2	2010	230	11,44
3	2090	250	11,96
4	2560	280	10,94
5	1550	170	10,97
6	1350	125	9,26
7	1325	100	7,55
8	1550	148	9,55
9	1800	160	8,89
10	1965	200	10,18
11	2300	130	5,65
12	2000	155	7,75
13	1620	120	7,41
14	1130	91	8,05
Total	**24800**	**2359**	**132,50**
Average	**1771,429**	**168,5**	**9,46**

Table 3 shows that the amount of production carried out by Tiga Bintang MSME is not the same every time. That is because in determining the number of products to be produced by Tiga Bintang MSME based on the order received. The average production for four weeks of observation was 1771,429 grams with an average damaged product of 168.5 grams or around 9.46% of total production. To identify the dominant mistakes in the stick snack production process made by Tiga Bintang MSME, it can be seen through the Pareto diagram.

Table 4 shows that the characteristics of the most defective products during the fourth week of February until the third week of March is a brownish color products as many as 1387 grams or as much as 58.80%. For more details, the types of errors per type of damage are as follows:

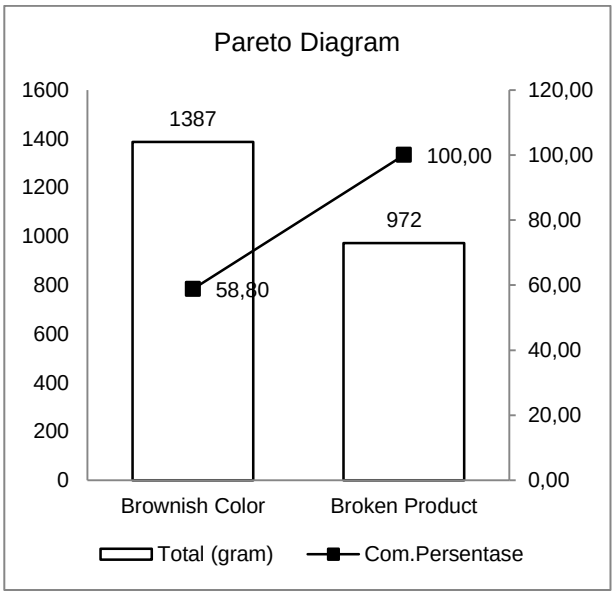

Fig. 2. Environmental temperature (°C) in cowpeas farm study sites

Based on Figure 1 it can be seen that damaged products produced in the production process tend to be dominated by brownish product colors with a percentage of damage reaching 58.80% of the total damaged products. This condition reflects that the control process carried out needs to be optimized considering the brownish product results will reduce the quantity sold and the quality of production results which will have an impact on business profits.

Statistical method that can be used for control is the control chart. This map contains a center line which is the average value of quality characteristics related to the controlled state (CL), two horizontal lines called the upper control limit (UCL) and the lower control limit (LCL).

Calculations to determine the average nonconformity per inspected product are:

$$u_i = \frac{x_i}{n_i} \quad (1)$$

where:

u_i : defective product every production

x_i : i-th broken product

n_i : number of i-th production

The formula used to calculate the amount of CL, UCL and LCL are as follows:

1. The CL value is calculated by the formula:

$$CL = \acute{u} = \frac{\sum x_i}{\sum n_i} \quad (2)$$

where:

$\acute{u}$: average of product damage

$\sum x_i$: total of i-th broken product

$\sum n_i$: total number of i-th production

2. The UCL value is calculated by the formula:

$$UCL = \acute{u} + 3\sqrt{\frac{\acute{u}}{n_i}} \quad (3)$$

where:

$\acute{u}$: average of product damage

n_i : total number of i-th production

3. The LCL value is calculated by the formula:

$$LCL = \acute{u} - 3\sqrt{\frac{\acute{u}}{n_i}} \quad (4)$$

where:

$\acute{u}$: average of product damage

n_i : total number of i-th production

By using formula (1), (2), (3), and (4), the percentage value of product damage (u), center line (CL), upper control limit (UCL), and lower control limit (LCL) on each production, as in Table 5.

Based on the results of the calculation of the value of the center line (Center Line), the upper control limit (UCL), and the lower control limit (LCL) in Table 5, the control map U is obtained as in Figure 2.

Based on the U control chart (U-Chart) in Figure 2, it can be seen that from 14 times of production there are 3 production times that are outside the quality control limits: 1st and 3rd production that exceeds the upper control limit, and the 11th production that exceeds the lower control limit. Because of the uncontrolled production time within the upper and lower control limits, it can be concluded that the quality control of the Three Stars MSME is not well controlled.

Table 4. Data Type of Product Damage, Number of Damaged Products, and Percentage of Damaged Products

Type of Damage	Total (Gram)	Percentage (%)
Brownish color	1387	58,80
Broken product	972	41,20
Total	**2359**	**100,00**

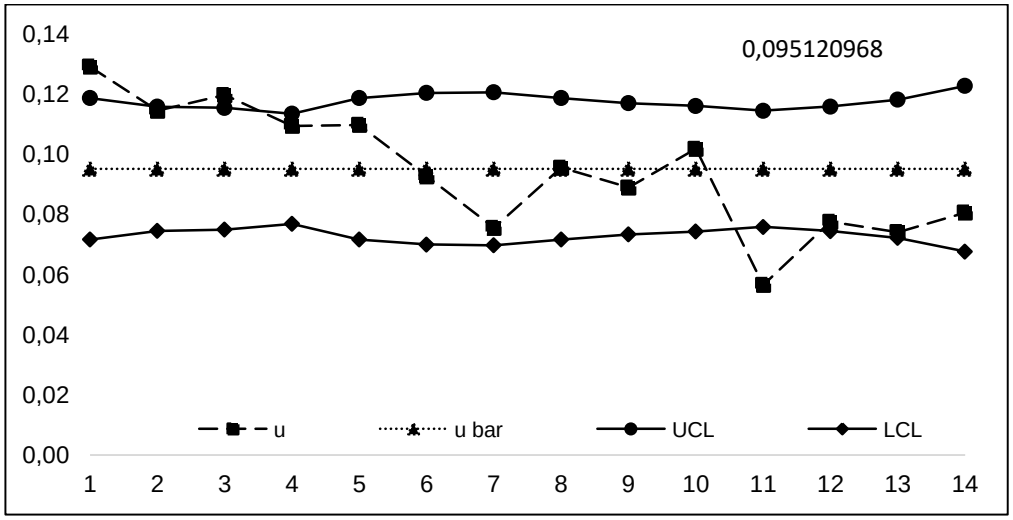

Fig 2. U Control Chart

Table 5. The values of CL, UCL, and LCL for each production

i-th Production	Total Production	Damage Product	*u*	$\acute{u}$ (CL)	UCL	LCL
1	1550	200	0,13	0,095	0,119	0,071
2	2010	230	0,11	0,095	0,116	0,074
3	2090	250	0,12	0,095	0,115	0,075
4	2560	280	0,11	0,095	0,113	0,077
5	1550	170	0,11	0,095	0,119	0,072
6	1350	125	0,09	0,095	0,120	0,070
7	1325	100	0,08	0,095	0,120	0,070
8	1550	148	0,10	0,095	0,119	0,072
9	1800	160	0,09	0,095	0,117	0,073
10	1965	200	0,10	0,095	0,116	0,074
11	2300	130	0,06	0,095	0,114	0,076
12	2000	155	0,08	0,095	0,116	0,074
13	1620	120	0,07	0,095	0,118	0,072
14	1130	91	0,08	0,095	0,122	0,067

CONCLUSION

Based on the results of the analysis and discussion it can be concluded that the average production of damaged products during the four weeks of observation was 168.5 grams, with a total of failed products produced by Tiga Bintang MSME is 2359 grams. The average production during the four weeks of observation is 1771.429 grams, with the number of products produced by Tiga Bintang MSME as much as 24800 grams. The most quality characteristic that produces damaged products during the fourth week of February to the third week of March is the brownish color of the product, which is 1387 grams or 58.80%. Based on the U control chart, quality control of Tiga Bintang MSME is not well controlled due to uncontrolled production time within the upper and lower control limits.

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