

The Implementation of Quality Function Deployment (QFD) Method to Improve Pasteurized Milk Product Quality

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Abstract

Pasteurized milk products in Malang Regency hold a significant opportunity to be developed. The number of existing dairy farmers is a supporting factor for the producers in obtaining raw milk supplies. The X milk cooperative unit is one of the producers of pasteurized milk in Malang Regency, in addition to other dairy business competitors. The intense competition forces the X milk cooperative unit to maintain and improve the quality of its milk product to satisfy consumers' demands. The objectives of this research are to determine consumers' demand and formulate corrective actions to improve consumers' satisfaction. QFD is a method of structured product planning and development to ensure that customers' needs and demands can be accommodated in a product. The results of data processing suggest that some quality attributes of milk products that need to be improved based on their degree of importance were milk composition consistency and halal assurance from "Majelis Ulama Indonesia" (MUI) an Indonesian Ulema Council. The right composition of milk keeps the milk taste preferred by the customers consistent, the smell less fishy and the shelf life constant. The second rank attribute was registering to MUI certification, as this certification will increase the product's competitiveness.

Keywords: cow milk, house of quality, quality function deployment

INTRODUCTION

Milk is an important ingredient to encourage body growth, from childhood to adulthood phase (Kosasih, Soenandi, & Celsia, 2013). Beside for healthy bones and teeth, milk can also optimize melatonin release in human's body. Melatonin is a hormone released by pineal gland at night. The existence of melatonin causes us to feel sleepy so that our body can rest well. Milk contains a lot of amino acid tryptophan as a precursor of melatonin. For this reason, it is suggested to drink milk before sleeping so that our body can rest well. Milk also has the ability to bind any metal spread as a result of pollution. Thus, milk is beneficial to minimize any impacts of heavy metals poisoning that enters human's body.

East Java is one of the provinces with the highest production of fresh cow milk. This can be seen on the data of Department of National Education of East Java in 2016, which mentioned that amount of dairy cattle in this province is around 265,002 with the total of dairy milk yields as many as 492,460,620 kg in 2016. Pasteurization is one of the ways to process milk. Pasteuri-

zation is an attempt to deactivate enzymes and extend shelf life (Sabil, Malaka & Yuliati, 2015). Pasteurization is a process to extend shelf life of milk without changing its physical characteristic (Kristanti, 2017). Pasteurization is a process of heating food to destroy harmful microorganisms such as bacteria, viruses, protozoa, molds and yeasts. This is a process of exterminating pathogenic microbes that may still be present in milk. Pasteurized milk is another form of fresh milk and also an effort to extend its durability.

Pasteurized milk products in Malang Regency has high opportunity to develop. The numbers of the existing dairy farmers are a supporting factor to ease the producers to get supplies of raw milk. X milk cooperative unit is one of the producers of pasteurized milk in Malang Regency. Besides this cooperative unit, there are also other dairy business competitors. The intense competition forces X milk cooperative unit to retain and improve the quality of their milk product to satisfy consumers'. Consumers' satisfaction is a function of perception or impression for performance and expectation encompassing some differences in expectation and performance

perceived by the consumers (Putra, Arifin & Sunarti, 2017). This is post-selection evaluative assessment caused by specific purchase selection and the experience in using/consuming those goods or services. Overall, consumers' sense on consumption experience will influence their evaluation on product independently in terms of actual product quality. Product's post-purchase evaluation is closely related to the development of satisfaction or dissatisfaction expression on the exchanging process. The factors influencing customers' satisfaction are the quality of product and service.

Any effort carried out by the company to satisfy the consumers is aimed to get loyal consumers for their product, brand or service. Loyalty is not established in a short time, but through learning process and based on the experience result of the consumers. Establishing consumers' loyalty is a crucial aspect for the company to maintain their business continuity since loyal consumers is the fundamental aspect of the market share stability and growth. Aaker (1996:5) in Heyzon and Maylina (2003:103) defined brand loyalty as "a key consideration when playing a value on a brand that is to be bought or sold, because a highly loyal customer base can be expected to generate a very predictable sales and profit stream".

To figure out how far the producers know, understand and meet consumers' desire, an analysis is conducted to determine consumers' desire and formulate corrective actions to improve consumers' satisfaction. The relationship between quality and consumers' satisfaction is that "customer satisfaction will be influenced product or service features by perception of quality is an important predictor of customer satisfaction. Several studies support the causal chain that suggest quality satisfaction" (Wilson, Zeithaml, Bitner, & Gremler, 2012). Quality perceived by the consumers is a vital guide in determining consumer's satisfaction. According to Kotler and Armstrong (2003:310), high quality level will generate high satisfaction (Kurriwati, 2015). Quality Function Deployment method can be used to find out producers' priority for improving consumers' satisfaction against products' quality (Rahman & Supomo, 2012). Kosasih et al. (2013) used QFD method in developing wafer products in PT. Indo Sari Abadi. Today, the advantage of QFD for the company can improve competitiveness through continuous quality and productivity improvement (Trenngonowati, 2017). Some researches related to the use of QFD

method to improve the quality of product and improve customers' satisfaction have been carried for yoghurt (Dolgun & Köksal, 2018), noodles (Suryaningrat, Djumarti, Ruriani, & Kurniawati, 2010) and batik product (Noviana & Hastanto, 2014). The objective to be achieved in this research was to determine consumers' desire and formulate corrective actions to improve consumers' satisfaction by applying the concept of quality function deployment in pasteurized milk product produced by X milk cooperative unit.

METHODS

Product quality is an action given by the company to win the market competition by establishing a set of significant differences of the product or service offered to distinguish company's product with competitor's product (Putra et al., 2017). The main issue in assessing product performance is the dimension used by the consumers to evaluate it. Part of the product policy is about product quality. The quality of a product, both in goods and service, needs to be defined through its dimension. Therefore, this research defined seven dimension used in assessing product quality that become the object of this research, those were performance, features, reliability, conformance, durability, aesthetics and perceived quality

Consumers' satisfaction is any function of perception or impression of the performance and expectation encompassing any difference between a expectation and performance or result perceived by the consumers (Putra et al., 2017). This is post-selection evaluative assessment caused by specific purchase selection and the experience in using/consuming those goods or services. Overall, consumers' sense on consumption experience will influence their evaluation on product independently in terms of actual product quality. Product's post-purchase evaluation is closely related to the development of satisfaction or dissatisfaction expression on the exchanging process. Any factors influencing customers' satisfaction is the quality of product and service.

Quality Function Deployment (QFD)

Quality Function Deployment (QFD) is any structured planning and development method of product/service which allow the development team to define the necessity and expectation clearly and evaluate the ability of product or service systematically to fulfill any needs and expectation (Cardoso, Filho, & Miguel, 2015).

The objective of QFD is to ensure that customers' needs and desire can be fulfilled (Trenghonowati, 2017).

The main instrument of QFD is matrix, where its results were achieved through the use of cross department or functional team by collecting, interpreting, documenting and prioritizing customers' needs (Chan & Wu, 2002). The starting point of QFD is customers and their needs as well as their desire. In QFD, this is called "voice of the customer" (Suwana, Tuningrat & Satriawan, 2015). QFD team has responsibility to carefully listen to the voice of customers.

Implementation Stages of Quality Function Deployment

In general, there are three phases of Quality Function Deployment (QFD) stages (Figure 1).

1. First phase (Collecting Voice of Customer)

General procedures in collecting voice of customers includes:

- Determining the attributes that become customers' priority (in the form of qualitative data) and this data is usually generated from interview and observation of consumers.
- Measuring attributes' level of importance.

2. Second Phase (Establishing House of Quality)

Some steps in establishing house of quality include:

- Arranging Matrix of Consumers' Desire
- Arranging Technical Parameter
- Determining The Relationship between Technical Parameter and Consumers' Desire

d. Technical Correlation

e. Benchmarking and Target Setting

3. Third Phase (Analysis and Interpretation)

The final stage is the analysis of each stage above. Beside the three stages above, there is another stage that should be firstly performed, that is planning and preparation (phase 0/pre-phase). This stage includes:

- Preparing organizational support which includes any support from management, functional support and QFD technical support.
- Determining the objectives and expected advantages of QFD activity.
- Determining the customers. Since in QFD process, the assessment is mostly performed by the customers.
- Determining scope of the product. In this case, certain part of the product or service should be determined whether it is included in the QFD activities or not.
- Completing any facility and material that supports QFD implementation.

These are some explanations of the research method flowchart in Figure 2.

1. Problem Identification Stage

First stage was formulating the inspected problems. This was the most important stage in research since all the ongoing research will be guided by the formulation of the problem. This was to avoid losing direction when research is performed.

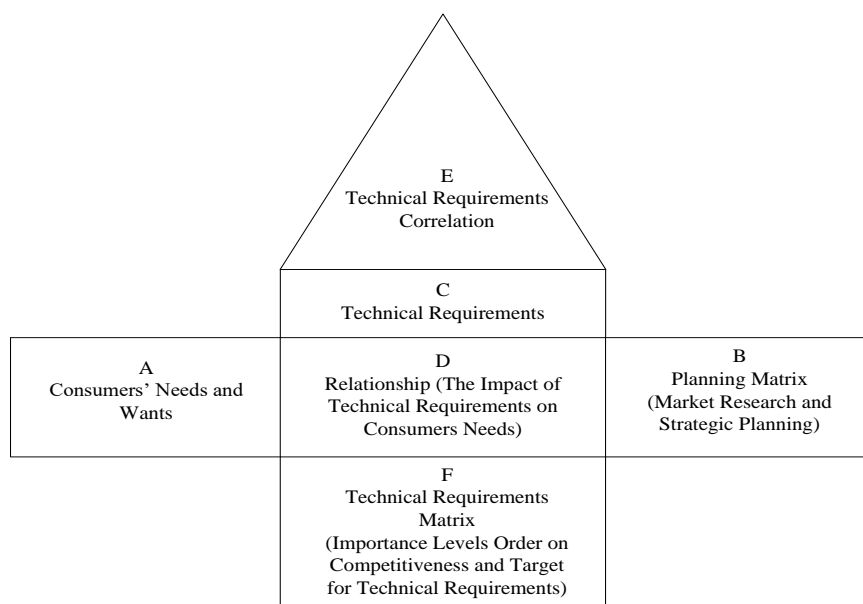


Figure 1. The House of Quality (Cohen, 1995)

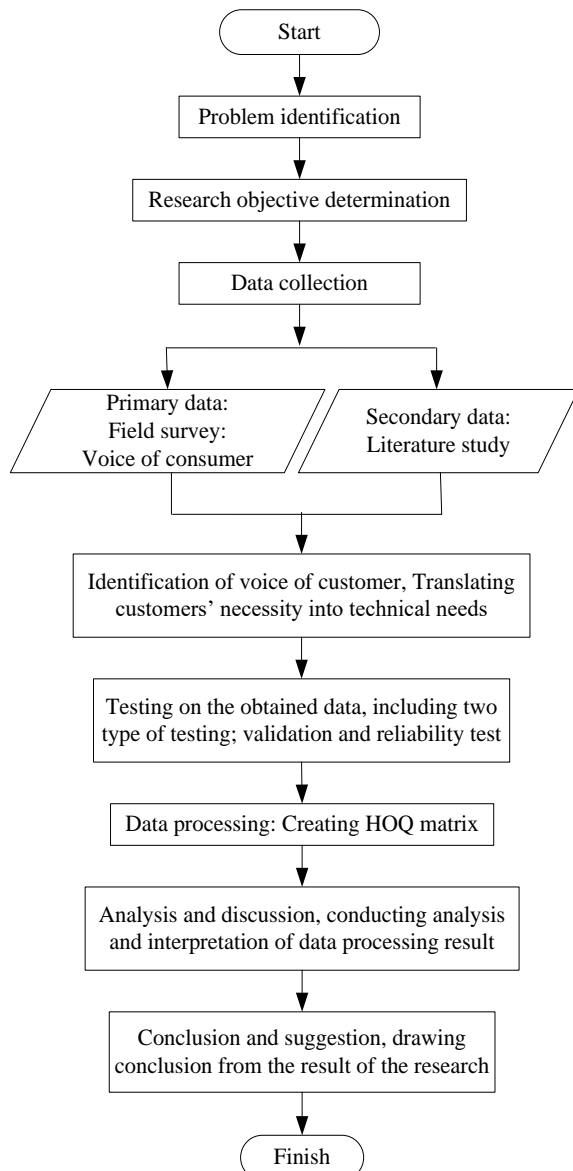


Figure 2. Flowchart of Research Method

In the problem identification, there were seven product quality dimensions that will be discussed, those are:

- a. Dimension of Performance
 - Sweet flavor of milk
 - Affordable price
 - Milk density produced
 - Less fishy flavor/aroma
- b. Dimension of Feature
 - Have many flavors
 - Available in various bottle volume
 - Eco-friendly bottle/packaging
- c. Dimension of Reliability
 - Product availability in various location
 - Having safe seal
- d. Dimension of Conformance to Specifications
 - Proper ingredient composition

- Correct expired date
- “Badan Pengawas Obat dan Makanan” (BPOM), an Indonesian National Agency of Drug and Food Control
- Halal Label
- Nutrition Facts
- e. Dimension of Durability
 - Product durability based on expired date
- f. Dimension of Aesthetics
 - Having attractive packaging design
- g. Dimension of Perceived Quality
 - Memorable product name

2. Data Collection Step

The next step was data collection step. The data was obtained by doing observation, experiment or measurement of the inspected indication. Collected data was primary data derived from field survey and secondary data from literature study. The first thing to do was initial identification of consumers' desire. Then, questionnaire was made and distributed. Questionnaire was compiled based on dimension of Performance, Feature, Reliability, and Conformance to Specifications, Durability, Aesthetics and Perceived Quality. Respondents were the consumers who had ever consumed pasteurized milk of X milk cooperative unit.

3. Data Processing Step

In this step, validity and reliability test was performed from questionnaire result. After the data was considered valid and reliable, the next step was calculating the value of importance to customer, customer satisfaction performance, competitive satisfaction performance, goal, target, improvement ratio, raw weight, sales point. After the result of data processing was obtained, the next step was arranging planning matrix.

4. Analysis and Discussion

In this stage, the analysis and interpretation on the result of data processing obtained from the previous step were elaborated, that was the analysis on the house of quality. Customer satisfaction level can be measured through the amount of attributes that have more priority than another attribute that can be fulfilled.

5. Conclusion and Suggestion Stage

In this step, the conclusion of the research result on the customers' satisfaction regarding the product quality of X Milk cooperative unit using QFD method was drawn.

Some suggestions were made to improve the quality of the product.

RESULTS AND DISCUSSION

Result of Validity and Reliability

The validity and the reliability of the data obtained from the questionnaire was tested before being processed into the next stage. From the result of the validity test, r value obtained was exceeded the r value of the table for each attribute of voice of customer. The data is considered as reliable if the result of the reliability test is more than 0.6. The data is considered as reliable if its Cronbach's alpha value is more than 0.6 (Ghozali, 2006).

Analysis of Voice of Customers

Based on the questionnaire result distributed to the respondent, the variable created become voice of customers. Voice of customers attribute can be seen in Table 1.

Analysis of Planning Matrix

Planning Matrix consists of several values (Table 2), namely:

1. Importance to Customers (IoC) is a column containing certain values that explain how important the attribute of necessity requested by the customers. The data was taken from their assessment questionnaire.
2. Customers Satisfaction Performance, is a column explaining how satisfied the customers on the quality provided. The data was taken from questionnaire and direct identification to

the customers. Competitive Satisfaction Performance is a column containing customers' satisfaction on the quality of competitor's milk product. In this research, Susu Murni Nasional was used as competitor.

3. Goals explains the target value made by the company to complete any problems arising from customer's complaint. Goals value includes objective value of QFD team. The only choice is keeping the existing product quality and making better quality than the competitors. The author decided to keep the existing quality product.

4. Sales Point

Sales Point is the information on the ability to sell products based on how good each customer's needs is fulfilled. The value used is as follows:

1. Having low or weak sale value.
- 1.2 Having medium sale value.
- 1.5 Having high or strong sale value.

5. Improvement Ratio (IR) is a column containing scale of any effort needed for changing satisfaction level in order to achieve the expected goals.

$$IR = \frac{\text{Goals}}{\text{Customers Satisfaction Performance}} \quad (1)$$

$$IR = \frac{3.4}{3.8} = 0.895$$

6. Raw Weight is a column containing value that reflects the overall importance level of each customer's needs based on IoC and IR.

$$\text{Raw Weight} = \text{IoC} \times \text{IR} \times \text{Sales Point} \quad (2)$$

$$IR = 3.4 \times 0.895 \times 1.2 = 3.651$$

7. Normalized Raw Weight

Is raw weight column stated in the form of

Table 1. Variable of voice of customers

Attribute	Importance to Customers	Customers Satisfaction Performance
Sweet flavor of milk	3.4	3.8
Affordable price	4.4	4.2
Milk density produced	3.7	3.5
Less fishy flavor/aroma	4.6	3.9
Have many flavors	4.4	3.8
Available in various bottle volume	3.8	3.7
Eco-friendly bottle/packaging	4.4	3.6
Product availability in various location	4.3	3.2
Having safe seal	4.5	3.8
Proper ingredient composition	4.2	3.8
Correct expired date	4.6	3.8
BPOM Label	4.4	3.9
Halal Label	4.5	3.9
Nutrition Facts	4.6	3.9
Product durability based on the expired date	4.1	3.9
Attractive packaging design	3.7	3.2
Memorable product name	3.5	3.6

Table 2. Planning matrix

Attributes	Importance to Customers	Customers Satisfaction Performance	Gap	Competitive Customers Satisfaction Performance	Sales Point	Goals	Improvement Rating	Raw Weight	Normalized Raw Weight
Sweet flavor of milk	3.4	3.8	0.4	3,3	1.2	3.4	0.895	3.651	0.035
Affordable price	4.4	4.2	-0.2	3,1	1.2	4.4	1.048	5.531	0.052
Milk density produced	3.7	3.5	-0.2	3	1	3.7	1.057	3.911	0.037
Less fishy flavor/aroma	4.6	3.9	-0.7	4,4	1.5	4.6	1.179	8.138	0.077
Have many flavors	4.4	3.8	-0.6	4,4	1.2	4.4	1.158	6.114	0.058
Available in various bottle volume	3.8	3.7	-0.1	3,4	1	3.8	1.027	3.903	0.037
Proper ingredient composition	4.4	3.6	-0.8	4,1	1.2	4.4	1.222	6.453	0.061
Correct expired date	4.3	3.2	-1.1	4,5	1	4.3	1.344	5.778	0.055
Having safe seal	4.5	3.8	-0.7	4,4	1.5	4.5	1.184	7.993	0.076
Product availability in various location	4.2	3.8	-0.4	4,2	1.2	4.2	1.105	5.571	0.053
Eco-friendly bottle/packageing	4.6	3.8	-0.8	4,5	1.5	4.6	1.211	8.353	0.079
BPOM Label	4.4	3.9	-0.5	4,4	1.5	4.4	1.128	7.446	0.071
Halal Label	4.5	3.9	-0.6	4,5	1.5	4.5	1.154	7.788	0.074
Nutrition Facts	4.6	3.9	-0.7	4,5	1.5	4.6	1.179	8.138	0.077
Product durability based on expired date	4.1	3.9	-0.2	4	1.5	4.1	1.051	6.465	0.061
Attractive packaging design	3.7	3.2	-0.5	3,4	1.2	3.7	1.156	5.134	0.049
Memorable product name	3.5	3.6	0.1	3,5	1.5	3.5	0.972	5.104	0.048

percentage or fraction (Patmawan, Setyanto & Sari, 2015).

$$\text{Normalized Raw Weight} = \frac{\text{Raw Weight}}{\sum \text{Raw Weight}} \times 100\% \quad (3)$$

$$\text{Normalized Raw Weight} = \frac{3.651}{105.473} \times 100\% = 0.0346$$

Technical Response Determination

The process of technical priority response was begun with determining contribution and normalized raw weight value and determining the correlation value between consumers' needs and technical response. Formulation used in determining contribution is by multiplying each correlation value in technical response column (SQC) with the resulted normalized raw weight value.

$$\begin{aligned} \text{Contribution} &= (\text{Raw Weight}) \times (\text{Numerical Value}) \quad (4) \\ \text{Contribution} &= (3.651 \times 3) + (3.911 \times 1) + (8.138 \times 3) + \\ &+ (5.571 \times 9) + (8.353 \times 1) + (8.183 \times 3) + (6.465 \times 1) = 128.65 \end{aligned}$$

Meanwhile, normalized contribution value was obtained from the result of normalization of

contribution value against the total of contribution value obtained. After the contribution value was obtained, the next step was making priority on that value, started from the highest value to the lowest value.

$$\begin{aligned} \text{Normalized Contribution} &= \frac{\text{Contribution}}{\sum \text{Contribution}} \quad (5) \\ \text{Normalized Contribution} &= \frac{128.65}{602.21} = 0.2136 \end{aligned}$$

After contribution value and normalized contribution were obtained, the next step was then determining the priority. This priority was used as an improvement recommendation that firstly performed by the management of Susu Sae Pujon. Bigger contribution showed the biggest technical response in completing voice of customer.

Relationship Matrix

This step determined how strong the relationship between technical response and customer's requirement. The relationship of those aspects were usually in the form of strong, medium, weak or has no correlation. Relationship matrix showed in Table 3. This is presented by relationship matrix where any symbols used are as listed in Table 4 (Cohen, 1995).

Table 4. Relationship matrix

	Consistency of milk composition	Choosing supplier	Providing various size	Providing various flavors	Using eco-friendly bottle/package	Opening some outlets in various places	Checking milk quality and durability	Having BPOM Label	Conducting halal certification	Choosing attractive name
Sweet flavor of milk	△									
Affordable price	△	○								
Milk density produced	○									
Less fishy flavor/aroma										
Have many flavors				●						
Available in various bottle volume			○							
Eco-friendly bottle/packaging					●					
Product availability in various location						●				
Having safe seal		○								
Proper ingredient composition	●									
Correct expired date	○						○			
BPOM Label								●		
Halal Label	○								●	
Nutrition Facts		△	○				○			
Product durability based on the expired date	△									
Having Attractive packaging design		△								
Memorable product name										●
Contribution	128.6	53.8	27.1	55.02	58.08	52.00	44.45	67.01	70.09	45.93
Normalized Contribution	0.213	0.089	0.045	0.091	0.09	0.086	0.074	0.111	0.116	0.076
Ranking	1	6	10	5	4	7	9	3	2	8

Table 3. Description of some symbols in relationship matrix




Symbol	Value	Definition
<empty>	0	Has no relationship
	1	Probably has relationship
	3	Has medium relationship
	9	Has strong relationship

Table 5. Ranking in technical response priority

Technical Response	Priority
Consistency of milk composition	1
Conducting Halal certification	2
Having BPOM Label	3
Using eco-friendly bottle/package	4
Providing various flavors	5
Choosing supplier	6
Opening outlets in various places	7
Choosing attractive name	8
Checking milk quality and durability	9
Providing various size	10

Based on the result of priority value of the technical response in Table 5, the solution that can be given to the X Milk cooperative unit can be seen in these 3 highest priorities: 1) Keep the composition of the milk. The solution of keeping milk composition is expected to fulfill consumers' needs so that the company can retain their quality and it can compete with other milk brands. This improvement should be carried out as it has the biggest influence on the other complaints. So far, changing product composition is commonly found in the production process. To solve that problem, it is suggested to make SOP related to the material composition so that it assures the consistency of raw material composition. 2) Performing halal certification, cooperative unit must carry out that improvement so that the consumers can trust more in the milk product especially that the ingredients composition used for milk products are halal. Halal certified label legalized by the associated party will increase the competitiveness of the products in market share. In connection with halal certification, the cooperative unit can enquire related service to obtain the information on halal certification procedure. Currently, halal assurance of a product becomes main issue in choosing food products. This is in accordance with the law Number 33 Year 2014 on the Halal Product Assurance. 3) Register to get BPOM label certification since this license is one of the ways to extend market share. BPOM certification can also increase

consumers' trust against the product and also assure product safety.

CONCLUSION

The conclusion taken from this research is that there are seventeen customer needs which then categorized into seven product quality dimensions, those are dimension of Performance, dimension of Feature, dimension of reliability, dimension of Conformance to Specifications, dimension of Durability, dimension of Aesthetics and dimension of Perceived Quality. From those seventeen customer needs, big gap value will be obtained in the attribute of correct expired date, ingredient composition, eco-friendly packaging and less fishy flavor/aroma. Based on the ranking contribution, the main priority of the improvement is the consistency of milk composition. By keeping the consistency of milk composition, consumers' favorite milk flavor will stay the same, without any fishy flavor/aroma and also assure that milk durability is in accordance with the expired date determined. Second and third rank attribute are carrying out halal certification and BPOM certification. Halal and BPOM certified symbol in the packaging will increase customers' trust. Both certification will prove that the ingredients used are good and safe for the consumers.

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