

Product Quality Analysis of *Pia Edamame* Using Quality Function Deployment Method

Analisis Mutu Produk Pia Edamame *Menggunakan Metode Quality Function Deployment*

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Abstract

Pia edamame attracts consumers as a typical food of Jember Regency. However, its development involves a high level of competition because of various types and quality of similar products with competitive prices. It then improves the opportunities for consumers in selecting the product according to their expectations to meet the satisfaction. *Pia edamame* of Said's Roti (SR), therefore, needs to develop its product to achieve high competitiveness as a typical food of Jember. This study aims to know the consumers attributes requirements and strategies to improve the competitive predominance of *pia edamame* SR. One of the methods used to assess and interpret consumer expectation is Quality Function Deployment (QFD). Application of QFD in this research, in the context of the process of quality improvement of *pia edamame* SR, provides various important information regarding consumer expectations and requirement. The results show that the goal values of attributes for consumer demand on packaging and flavor variant of *pia edamame* SR have not met the target, thus require improvement. Besides, the value of benchmarking was lower than its two competitors on the several technical responses. Hence, *pia edamame* SR requires a planning of competitive strategies by improving packaging and increasing the flavor variant.

Keywords: *pia edamame*, quality, Quality Function Deployment, strategy

Abstrak

Pia edamame sebagai makanan khas Jember memiliki daya tarik tersendiri bagi para konsumen. Potensi tersebut mengakibatkan tingginya tingkat persaingan antar pelaku bisnis serta munculnya berbagai macam produk sejenis dengan mutu dan harga yang bersaing. Hal tersebut memberikan peluang pada konsumen untuk lebih selektif memilih produk sesuai dengan selera dan kebutuhannya, sehingga konsumen mendapatkan kepuasan tersendiri. Oleh karena itu, *pia edamame* Said's Roti (SR) perlu terus dikembangkan agar mampu bersaing di pasar sebagai makanan ciri khas Kabupaten Jember. Tujuan penelitian ini adalah untuk mengetahui atribut kebutuhan yang diinginkan oleh konsumen serta mengetahui strategi yang perlu dilakukan untuk meningkatkan keunggulan bersaing *pia edamame* SR. Salah satu metode yang dapat digunakan untuk menilai dan menerjemahkan keinginan konsumen adalah metode quality function deployment (QFD). Penerapan QFD pada penelitian ini terkait dengan proses peningkatan kualitas *pia edamame* SR yang dapat memberikan berbagai macam informasi penting mengenai kebutuhan dan keinginan konsumen. Hasil penelitian menunjukkan bahwa nilai goal atribut kebutuhan konsumen terhadap kemasan dan varian rasa *pia edamame* SR belum mencapai target sehingga perbaikan harus dilakukan pada kedua atribut tersebut. Nilai benchmarking *pia edamame* SR juga masih di bawah kedua pesaingnya pada beberapa respon teknis sehingga diperlukan perancangan strategi bersaing *pia edamame* SR dengan memperbaiki kemasan dan menambah varian rasa.

Kata kunci: kualitas, *pia edamame*, Quality Function Deployment, strategi

INTRODUCTION

Edamame (*Glycine max L. Merrill*) is a well-known Japanese originated soybean in Indonesia. The structure of plant, bean, and pod is bigger than

the ordinary soybean. It is a potential product in Indonesia, particularly in Jember (Kurniasanti, Sumarwan, & Kurniawan, 2014). Commonly, it is usually boiled prior to consumption. It can also be processed into other food products such as, frozen

edamame, edamame milk, edamame pudding, fried edamame, *pia edamame*, etc. *Pia edamame*, as a product of agroindustry, is potential for product development in response to the growth of traditional snack market in Jember. Hence, conducting a research related to the consumers can be utilized to improve the quality of *pia edamame* so that it could meet consumer expectation.

Said's roti (SR) is the first *pia edamame* producer in Jember. *Pia edamame* has become a typical food that attracts several food companies to produce it. A significant potential market results in a high level of competition among producers because of various kinds and quality of the products with competitive prices. Preceding research conducted by Prasidya, Deoranto, & Silalahi (2014) states that attributes for quality of typical pia product in Yogyakarta are price, flavor, variant, texture and product durability. Priyadi & Samboro (2018) that conducted their research in Malang, moreover, mentions that packaging aspect as the characteristics and attractiveness are also the product attributes for consumers consideration to purchase the product. Initial discussion of the research is consumer expectation regarding attractive packaging, reasonable price, good taste, durable packaging, unique, hygienic and various flavors. These competitive conditions provide consumer a privilege to select product according to their needs.

One of methods to assess and interpret consumer expectation is Quality Function Deployment (QFD). The use of QFD on the action of quality improvement of *pia edamame* could provide various crucial information regarding consumer requirement and expectation. QFD is a method to interpret consumer need on product that will be developed with certain specifications. It is a big matrix that connects what consumer expects are and how product will be designed and produced so as it meets consumer expectation (Nasution, 2005). It functions to explain service attribute and identify the priorities of quality development on a product (Chen et al., 2018). This method has been applied in several industrial sectors including food industry. Jambrak et al. (2018) mentioned that food industry has applied QFD to provide suggestion on product quality development and identify consumer expectation on a product and to determine characteristics of product quality. On the other hand, on the edamame-based agro industry, QFD was used to determine attribute as customer highest expectation and the most crucial point in achieving

product quality of frozen edamame expected by customer (Wardani, Marimin, & Kasutjaningati, 2015). On the other traditional product, QFD was used to identify consumer need for quality product development of smoked fish, jenang (Indonesian traditional confectionary) and cassava chips (Izzhati, Talitha, & Mastriswadi, 2018; Effendi, Arifa, & Mustaniroh, 2018; Umami et al., 2017).

Based on the background, it is urgently required to do a research regarding consumer expectation whether it has met consumer expectation in an attempt to improve quality of *pia edamame* SR as typical food in Jember using QFD method. This method, again, can interpret consumer expectation and demand to improve and increase the quality of product attributes.

METHODS

The research was conducted in Jember as a production place of some brands of *pia edamame*. Several foods souvenir outlets around Jember were the places for conducting observation. The competitors' products in this research are *pia edamame* Anis (K1F2) and *pia edamame* Purnama Jati (K1F3). Those several brands of *pia edamame* are well-known typical food products in Jember. The analysis of QFD is shown briefly in Figure 1. The diagram explained the phases of QFD analysis of edamame product.

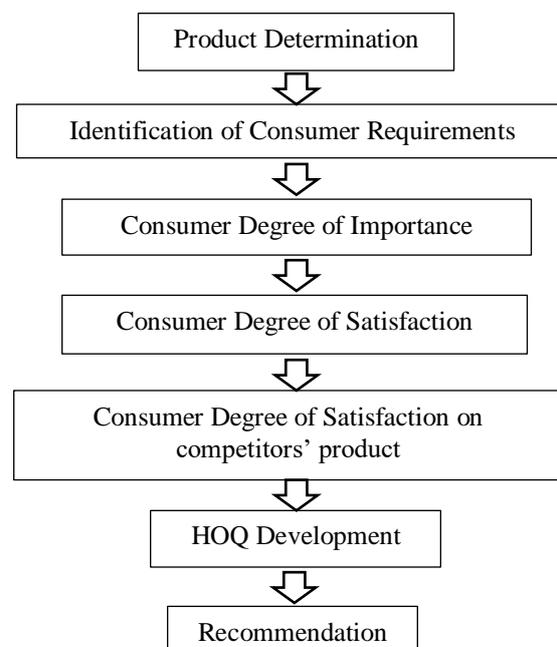


Figure 1. Diagram of QFD (Quality Function Deployment) Analysis on Edamame Product

Research Phase

Identification of Consumer's Requirement

The identification was conducted by collecting the data through open questionnaire distribution to the three different food souvenir shops in Jember. The open questionnaires were provided to answer customer requirement without being bound by the answers that have been set. The questionnaires were distributed to respondents that were chosen accidentally. The questionnaire contains questions regarding consumer requirement on food souvenir including flavor, shape, uniqueness, portion, appearance, etc. The parts of products that must met consumer requirement were derived from consumer suggestions about attributes of the product they expect.

Analysis of Consumer Degree of Importance

Analysis of consumer degree of importance was conducted to know what consumer most crucial attributes of the product is (Halim & Ekawati, 2014). Data regarding consumer degree of importance were obtained by distributing questionnaires to respondents (N). It is a closed questionnaire and consists of questions about consumer needs adapted from the foregoing questionnaire, i.e. texture, flavor, packaging and price. Moreover, Likert assessment was used to complete the questionnaire of consumer degree of importance. The Cronbach's Alpha value was then used to determine several items related to consumer degree of importance. The results of the consumer degree of importance in the form of attributes were then used as a reference in developing *pia edamame*. The degree of importance (DoI) was computed using the following formula (1):

$$\text{DoI} = \frac{\text{Total score of each attribute}}{N} \quad (1)$$

Analysis of Customer Satisfaction

The analysis of customer degree of satisfaction is conducted to find out how customer degree of satisfaction on products compare with its competitors' products is (Halim & Ekawati, 2014). This data was obtained through questionnaire of 33 respondents, as number of respondents (N). The questionnaires given were a closed questionnaire consisting of questions regarding consumer expectation or product attributes and technical responses to determine the quality according to consumer expectation. Meanwhile, Likert scale assessment was used to fill the answers in the customer degree of satisfaction questionnaire.

Data of the questionnaire were used to fill the planning matrix of the House of Quality (HOQ). The customer satisfaction (CuS) (2) and competitive satisfaction (CoS) (3) then were computed using following formulas:

$$\text{CuS} = \frac{\text{Total score of Csp}}{N} \quad (2)$$

$$\text{CoS} = \frac{\text{Total score of Csc}}{N} \quad (3)$$

Csp = customer satisfaction on product
Csc = customer satisfaction on competitor product
N = number of respondents.

Development of House of Quality (HOQ)

HOQ (house of quality) was developed by interpreting data of interview results and questionnaire on several consumers or customers that become respondents. Data or information of every phase are inserted into matrix that available in HOQ. HOQ is an analytical mean of QFD method. It contains several matrices that are related to each other (Suryaningrat, 2013). Priority data obtained regarding *pia edamame* was then analyzed to create several recommendations of strategies to improve the quality of *pia edamame* SR as a typical food souvenir of Jember.

Methods of Analysis

Data analysis used matrices according to house of quality requirement such as consumer need, technical response, planning matrix, relationship and technical matrix. The relationship among the matrices is presented in Figure 2.

Consumer Requirement

Consumer requirement is data of what things are needed by consumer on *pia edamame* (Halim & Ekawati, 2014). *Pia edamame* products being discussed are *Pia edamame* SR, Anis (K1F2) and Purnama Jati (K1F3).

Technical Response

Technical response contains several factors that influence attributes of *pia edamame*. Those factors obtained through consultation and interview with *pia edamame* producers regarding sorting of *pia edamame* crust and stuffing ingredients, formulation and production process of *pia* crust, production process of stuffing, baking duration, flavor formulation, store display, storage, temperature, packaging, packaging material and design, and labelling.

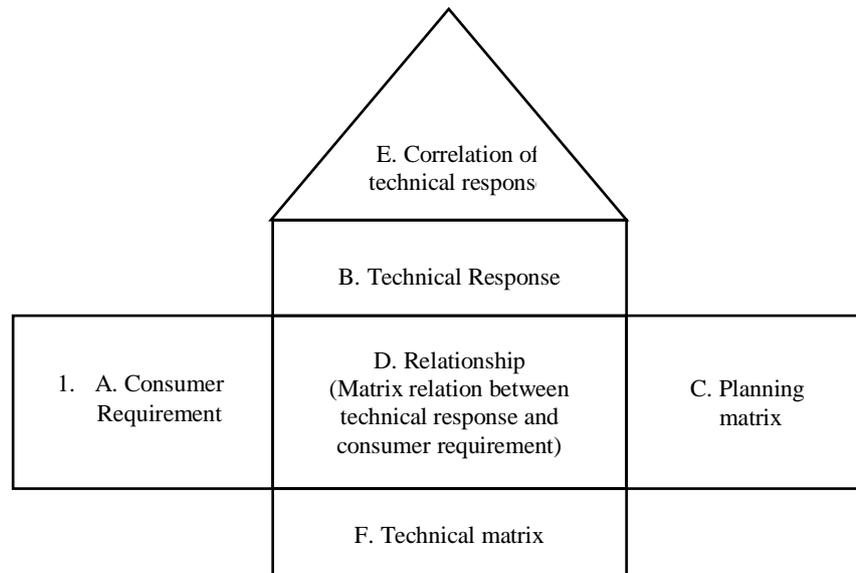


Figure 2. House of Quality

Planning Matrix

The matrix contains product degree of importance for consumer to know attributes of consumer requirement which is the most crucial according to them (Halim & Ekawati, 2014). It, moreover, also includes consumer degree of satisfaction on competitor, goal, improvement ratio (IoR) (4), sales point, raw weight and normalized raw weight (NoRW) (5) using the following formulas:

$$\text{IoR} = \frac{\text{Goal}}{\text{Customer Satisfaction Performance}} \quad (4)$$

$$\text{NoRW} = \frac{\text{Raw Weight}}{\text{Total Raw Weight}} \quad (5)$$

Relationship

Kosasih, Soenandi, & Celsia (2013) mentioned that relationship contains relation between technical response and attribute of consumer requirement obtained by directly interviewing producer. The relationship is symbolized by these following symbols: strong (●), moderate (◐), and weak (△), with its value of 9, 3, and 1 respectively.

Correlation of Technical Response

Correlation of Technical Response contains relationship between each technical response (Kosasih et al., 2013). This relationship helps determining technical response that provided positive effect on the other technical responses' improvement.

Technical Matrix

Technical matrix contains several information regarding contribution, benchmarking, and targeting. Contribution (C) (6) contains the strength of technical response on overall consumer satisfaction. It determines priority of producer response towards consumer response. Normalized contribution (NoC) (7) firstly calculates contribution of i^{th} technical response by using formula as follow.

$$C = \text{Technical Response Score of } i \times \text{NoRW of } i \quad (6)$$

$$\text{NoC} = \frac{\text{Contribution}}{\text{Total Contribution}} \quad (7)$$

Benchmarking

Benchmarking is a determination to know the industry with the best performance. It is a method to know degree of technical response conducted by competitors and using formula as follow:

$$\text{Benchmarking} = \frac{\text{RTCn } i \times \text{CLS } i}{\text{Total RTCn}} \quad (8)$$

$\text{RTCn } i$ = score of relationship between technical response and consumer needs of i

$\text{CLS } (i)$ = consumer level satisfaction if i

Total RTCn = total amount of its relationship

Targeting is an expected goal to be achieved by the company to be able to meet the degree of consumer requirement by using the technical response they have. It uses the basic value found in benchmarking products and competing products. The highest value is the value used as the target.

RESULTS AND DISCUSSION

Identification of Customer Requirement

Data regarding consumer opinion on food souvenir was obtained based on the observation through questionnaire distribution to consumers. Attributes of customer need can be seen in Table 1. Table 1 shows 14 attributes of consumer opinion on food souvenir. Those attributes describe consumer expectation on a food souvenir. Another study conducted by Joefatha, Suhendra, & Wulandari (2015) showed that consumer requirement on attributes of food product generally are color, appearance, portion, shape, texture, aroma, level of doneness and flavor. It shows the difference of consumer expectation on food souvenir compared to other common food products.

Analysis of Consumer Degree of Importance

The analysis of consumer degree of importance is carried out to reveal which attribute of requirement is considered the most important by consumers (Halim & Ekawati, 2014). Several items related to consumer degree of importance were obtained by using the Cronbach's Alpha value (Table 2). The results of these consumer degree of importance were in the form of attributes which were then used as a reference in developing *pia edamame*.

Analysis of Consumer Degree of Satisfaction

Analysis of consumer degree of satisfaction is conducted to know how consumer degree of satisfaction on the product towards competitor products is (Suryaningrat, 2016). The results of the analysis of *pia edamame* is shown in Table 3. Degrees of satisfaction on *pia edamame* SR are higher on 5 attributes — than its competitors, i.e. price, flavor, durability of packaging, characteristics and hygiene. *Pia edamame* SR has a lower satisfaction than K1F3 on packaging attribute, but it has a higher satisfaction than K1F2. *Pia edamame* SR has the lowest satisfaction on flavor variant to all competitors. Hence, *pia edamame* SR ought to improve two attributes, packaging and flavor variant, so, consumer degree of satisfaction increased and comparable to the two competitors in order that it can compete in the market properly.

House of Quality (HOQ) of *Pia Edamame*

HOQ (house of quality) was made by interpreting the data generated from interview and questionnaire distributed to consumers as

respondent. All the data and information of every phase is inserted into matrix provided in HOQ. HOQ is an analytical tool of QFD method. It contains several interrelated matrices (Suryaningrat, 2013). The image of HOQ of *pia edamame* is presented in Figure 3.

Table 1. Attributes of consumer requirement

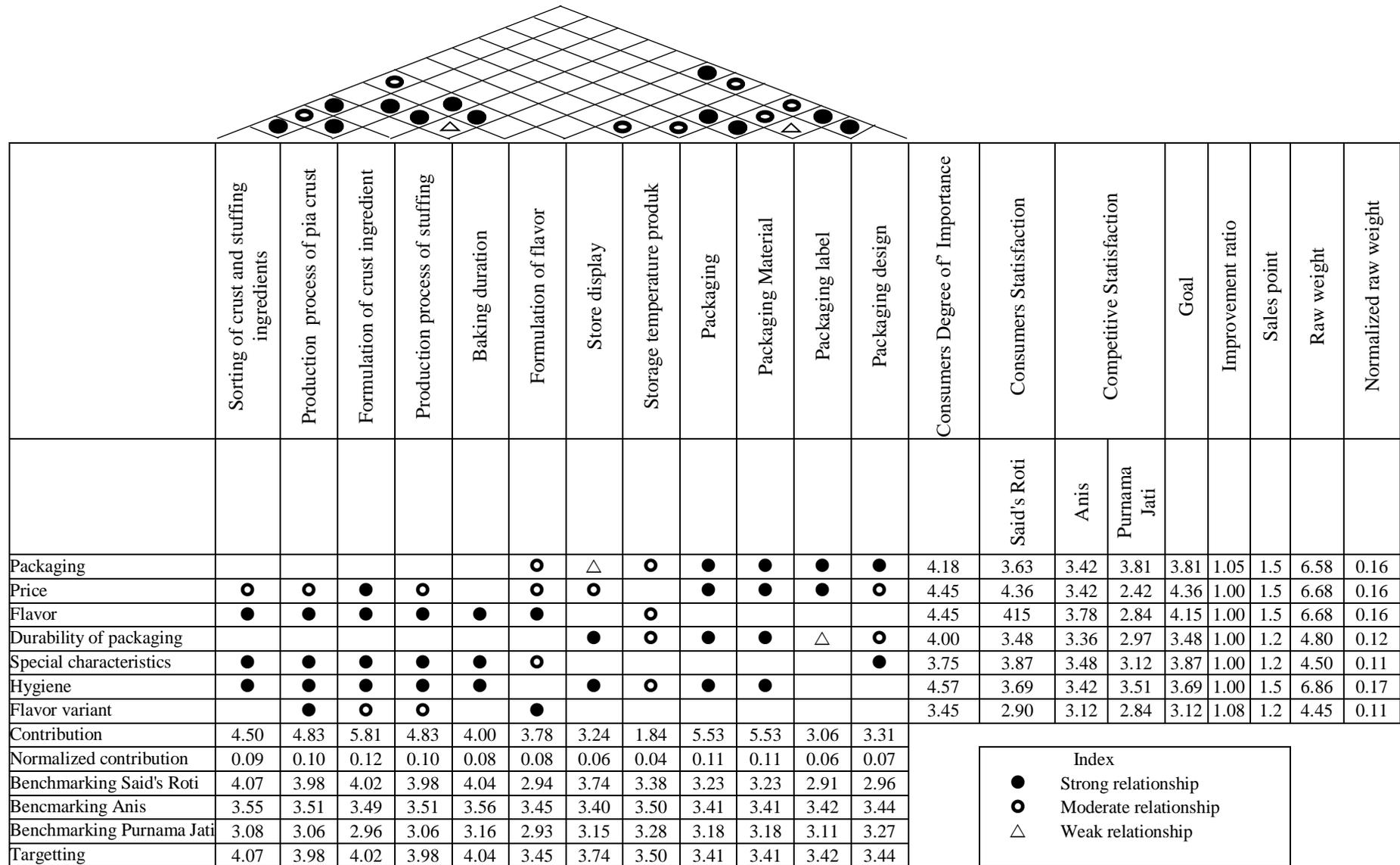
No.	Attributes of Consumer Requirement
1.	Attractive packaging
2.	Affordable price
3.	Long shelf life
4.	Good taste
5.	Easy to carry (for long distance)
6.	Special characteristics
7.	Not easily damaged (packaging)
8.	Hygienic
9.	Flavor variants
10.	Easy to get the product
11.	Unique
12.	Nutrients
13.	Not easily broken (product)
14.	Prestigious

Table 2. Results of attributes of consumer degree of importance

Item	Description	Value of r table	Value of r
F1	Attractive packaging	0.3440	0.386
F3	Affordable price	0.3440	0.425
F5	Good taste	0.3440	0.499
F6	Long shelf life	0.3440	0.595
F7	Special Characteristics	0.3440	0.666
F9	Hygienic	0.3440	0.449
F11	Flavor variants	0.3440	0.676

Table 3. Consumer of *pia edamame* degree of satisfaction

No.	Attribute	Brand		
		Said's Roti (SR)	K1F2	K1F3
1.	Attractive packaging	3.63	3.42	3.81
2.	Affordable price	4.36	3.42	4.36
3.	Good taste	4.15	3.78	2.84
4.	Long shelf life	3.48	3.36	2.97
5.	Special Characteristics	3.87	3.48	3.12
6.	Hygienic	3.69	3.42	3.51
7.	Flavor variants	2.9	3.12	2.84



(Source: Primary Data, 2018)

Figure 3. House of Quality (HOQ) *Pia Edamame*

Technical Response and Correlation of Technical Response

Technical responses presented in Figure 3 are producer's perception regarding technical factor of *pia edamame* production to consumer expectation (Suryaningrat, 2016). There were 12 technical responses existed in HOQ of *pia edamame* such as sorting of crust and puffing ingredient, production process of pia crust, formulation of pia crust, the production process of puffing, baking duration, flavor formulation, shop display, storage temperature, packaging, packaging material, packaging label, and packaging design. This relationship helps determining technical response which provides positive impact on other technical responses.

Relationship

Relationship in Figure 3 is the relationship between matrix of technical response and matrix of consumer requirement and is symbolized as strong (●), moderate (◐), and weak (△) with its value of 9, 3, and 1 respectively

Planning Matrix

The planning matrix is presented in Figure 3. The content of this matrix are as follows:

1. Consumer Degree of Importance
Hygiene was the most crucial attribute based on the calculation on consumer degree of importance. Price and flavor were at the second place of consumer degree of importance. It has been discussed in Akrom, Murwatiningsih, & Lestari, (2013) research that price affected consumer decision to buy a product. Furthermore, having good taste also took part on the consumer decision (Farida & Saidah, 2017). It is in line with those two research that price and flavor attributes are important things for consumer. Packaging, additionally, is at the third place of consumer importance in this research. Packaging principal, basically, is able to protect the product. Dhamera (2014), in her research proved that color of packaging generated visual attractiveness so as it is easily seen by eyes, made writing easier to read, attracted attention, and made consumers buy the product.
2. Consumer Satisfaction
Analysis of consumer degree of satisfaction is used to know how consumer degree of satisfaction on a product is (Halim & Ekawati, 2014). Figure 3 shows that degree of satisfaction on *pia edamame* SR was

dominant in 5 attributes of consumer requirement than its competitors, i.e. price, flavor, durability of packaging, characteristic, and hygiene. *Pia edamame* SR packaging, however, has lower satisfaction than K1F3 but higher than K1F2. Furthermore, flavor variant attribute obtained the lowest result than its two competitors. It could be concluded that *pia edamame* SR must improve its packaging and flavor variant attributes so that consumer satisfaction increased and could play dominantly in the market than its two competitors.

3. Goal
Goal value is obtained by comparing consumer degree of importance value to consumer degree of satisfaction then the highest value becomes goal value (Suryaningrat et al., 2010). Goal value then was used for requirement attribute development that had not reached the goal value. As provided in Figure 3, the attributes were packaging and flavor variant.
4. Improvement ratio
Improvement ratio (IR) is carried out to determine whether it is necessary to make improvements or not towards an attribute of consumer requirement (Halim & Ekawati, 2014). Attributes of requirement of *pia edamame* SR that must be improved were packaging and flavor variants, while the rest of consumer requirement attributes do not have to be improved.
5. Sales point
Sales point is determination on buying point to provide assessment on attributes which needs to be improved as an effort to increase product's ability to compete (Kossasih, 2013). Sales point value of 1.5, 1.2, and 1 means it significantly affected sales, it has weak effect on sales, and it has no effect on sales respectively Sales point provided in Figure 3 shows that attributes of packaging, price and hygiene have the value of 1.5 means that it significantly affects sales. Furthermore, attribute of packaging durability, characteristic and flavor variant have value of 1.2 that means they weakly affect sales. Those results are in line with the value of consumer degree of importance obtained through the questionnaires. Eventually, those attributes had lowest value of consumer degree of importance than other consumer requirement attributes.

6. Raw weight and normalized raw weight
Raw weight is the importance rate of each attribute of consumer requirements, while normalized raw weight is the percentage ratio of an attribute of consumer requirements to the overall attribute rate of the consumers requirement for each requirement attribute (Halim & Ekawati, 2014). The highest rate of attribute of requirement is price with value of 6.54. On the contrary, attribute that had the lowest score was flavor variants with value of 3.74 (Figure 3). It was comparable to the value of consumer degree of importance that price was the highest value of importance to consumer.

Technical Matrix

Several data in technical matrix are contribution, normalized contribution, bench-marking and targeting. Value of contribution explains about how strong the technical response contributes to consumer requirements. The highest contribution value in Figure 3 is the formulation of crust ingredient and production process of stuffing which showed that the technical response provides a huge contribution to the attributes of consumer requirements.

Benchmarking is the determination of an industry which has the best performance and is a way to find out the degree of technical response compared to competitors' technical responses. The biggest benchmark value of *pia edamame* SR in Figure 3 is the production process of pia crust and stuffing, with a value of 3.98. The value of the technical response is also greater than the two competitors.

Targeting is a goal to be achieved by a company to meet the degree of consumer requirement by using the existing technical response. It used the basic value found in benchmarking. The highest value used as the target value.

Recommended Competitive Strategies for *Pia Edamame* SR

The whole assessment of *pia edamame* product's quality according to HOQ showed that price, flavor, packaging durability, characteristic, and hygiene were expected aspects as consumer requirement. It showed that packaging and flavor variant aspects need further development regarding product quality improvement. It was also related to those two competitor's brands that showed predominance on quality attribute regarding packaging and flavor variant. Moreover,

the aspect of packaging has strong relationship on sales rate.

The results provided in HOQ served as fundamental in determining primary program or strategy of product development. It is in line with Cheng, Tsai, & Lin (2015) that stated result of QFD method used to determine primary program or strategy for product quality development. Recommended strategies planning for competitive predominance of *pia edamame* SR were by redesigning the packaging and adding flavor variant. Mukhtar & Nurif (2015) mentioned packaging is container of a product so that it is safe, attractive and having allure to consumers. The packaging of *pia edamame* SR has a function to keep the product, but it is unattractive display. *Pia edamame* SR, therefore, needs a new packaging design. Liu et al. (2016) also mentioned that changing the packaging as the result of QFD analysis is able to reduce consumer complaint and increase product's competitiveness. Additionally, Vanany, Maarif, & Soon (2019) have obtained from the analysis of QFD that program development priority is able to provide effort to company in decision making and allocation of existing resources.

CONCLUSION

The expected attributes of the requirements of consumers for *pia edamame* are packaging, price, taste, durability of the packaging, characteristics, hygiene, and flavor variants. The most important attribute of consumer need is hygiene with a value of 4.57. Consumers, generally, are satisfied with *pia edamame* SR compared to two competitor's products. *Pia edamame* SR has not met the goals of the packaging and flavor variants attributes. Therefore, it still needs improvement in both attributes. The strategies that need to be carried out to improve the competitive predominance of *pia edamame* SR are to redesign the packaging, without changing the selling price and reducing the product quality, and last but not the least, to add its flavor variants.

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