Re-design of apple pia packaging using quality function deployment method

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Abstract. This study was aimed to identify the attributes for premium apple pia packaging, to determine the technical response to be carried out by Permata Agro Mandiri Small and Medium Enterprise (SME) and to design a new apple pie packaging acceptable by the SME. The Quality Function Deployment (QFD) method was employed to improve the apple pia packaging design, which consisted of seven stages in data analysis. The results indicated that what’s attribute required by the costumers include graphic design, dimensions, capacity, shape, strength, and resistance of packaging. While, the technical responses to be conducted by the SMEs were as follows: attractive visual packaging designs, attractive colors, clear images and information, packaging size dimensions, a larger capacity packaging (more product content), ergonomic premium packaging, not easily torn, and impact resistant packaging materials. The findings further confirmed that the design of premium apple pia packaging accepted by the SMES was the one with the capacity of ten apple pia or 200 g weight, and with rectangular or beam shape form. The packaging material used was a duplex carton with 400 grammage (g/m²), the outer part of the packaging was coated with plastic and the inside was added with duplex carton. The acceptable packaging dimension was 30 cm x 5 cm x 3 cm (L x W x H) with a mix of black and yellow color in the graphical design.

1. Introduction
Packaging is one of the factors that can influence a selling price of a product on the market. In Malang, one of the food products known as Malang’s special souvenirs is apple pia. The apple pia is packed with plastic for primary packaging and duplex carton for secondary packaging. Currently, the secondary packaging of apple pia has an unattractive shape, appearance and color, as well as has a small capacity (i.e. each packaging contains 6 apple pia). Therefore, this packaging was classified as a small packaging and this was made due to its market segmentation of middle to lower class customers. In recent years, the apple pia SMEs, particularly Permata Agro Mandiri SME, want to expand their market segmentation to middle and upper class customers. In addition, there are market demands for the SME to make a more attractive and larger packaging. Therefore, to expand market segmentation, to fulfill the customer desire and to increase the apple pia sales, the apple pia packaging design is necessary to be improved and re-designed.

Thus, changing the current packaging into a premium packaging is necessary for attracting middle and upper class customers. For that purposes, the premium apple pia packaging design was made in a larger size to increase the capacity. Also, a stronger material and a more interesting graphical design
than the previous packaging will be used, aiming at increasing the consumer buying interest in apple pia.

In the research, Quality Function Deployment (QFD) method was used to obtain attribute level of consumer interest, which then will be adjusted with the technical responses from the manufacturer. QFD method can reduce the length of product development cycle, as well as can improve the quality and the marketing of products in the market [1]. In addition, with QFD method consumers can be involved prior the re-designing process of apple pia packaging to ensure that the new packaging meets the consumers’ needs. The purposes of this study are to identify the costumer interest attributes for premium apple pia packaging, to determine technical response to be performed by the SME, and to design a new packaging of apple pia acceptable by the SME.

2. Method
The attribute level of customer interest (whats or needs) questionnaire was given to consumers who have purchased/consumed apple pia with the age of 17 years old or over. The questionnaires was distributed in two Malang’s souvenirs store (i.e. Lancar Jaya and Burung Swari), with a total of 40 questionnaires were filled. The questionnaire results were tested using the validity and reliability test.

2.1 Identification of Variable
Identification of variables aimed at determining customer attributes (whats) and technical capabilities possessed by Permata Agro Mandiri SME to meet their customer needs. The customer attribute of Permata Agro Mandiri SME was obtained through an interview during the preliminary survey with the owner. This activity, conducted after whats attributes were identified, was carried out to identify the consumers’ satisfaction level of the existing apple pia products, particularly on the customer needs and interests of the SME. The whats attributes can be seen in Table 1.

| No. | Attributes          | Technical Response (Hows)                                |
|-----|---------------------|----------------------------------------------------------|
| 1.  | Graphical Design    | Innovation for a new premium apple pia packaging          |
| 2.  | Dimension           | The compatibility of the packaging size to the product     |
| 3.  | Capacity            | Premium apple pia packaging capacity                      |
| 4.  | Shape               | Ergonomic premium apple pia packaging                      |
| 5.  | Strength            | Premium apple pia packaging is not easily torn             |
| 6.  | Resistance          | Premium apple pia packaging is impact resistant            |

2.2 Data Analysis
Data analysis for re-design of apple pia packaging was carried out using QFD method. QFD is a way to improve the quality of goods or services by understanding the needs of consumers and then connecting with the technical responses in its production process [2]. The use of QFD method enable to increase customer satisfaction, reduce implementation time, improve teamwork, and assist the company in re-developing a product or service [3]. According to Suryaningrat et al. [4], the stages of QFD data analysis are as follows:

1. Voice of customer collecting phase
2. Phase of creating house of quality
3. Making a technical responses
4. Determining the relationship of technical responses and customer needs
5. Determination of technical relations
6. Calculation of technical weight and priority
7. Calculation of benchmarking and target values
3. Result and Discussion

3.1 Creating House of Quality
The result of creating house of quality is shown in Figure 1.

![Figure 1. House of Quality](image-url)
Table 2. Sales Point

| No. | Attributes      | Importance to Customer | Sales Point |
|-----|----------------|------------------------|-------------|
| 1.  | Graphical Design | 4.43                   | 1.5         |
| 2.  | Dimension       | 4.03                   | 1.2         |
| 3.  | Capacity        | 3.95                   | 1.2         |
| 4.  | Shape           | 3.73                   | 1.2         |
| 5.  | Strength        | 4.45                   | 1.5         |
| 6.  | Resistance      | 4.50                   | 1.5         |

Table 2 shows that there were three attributes have a high sales point value of 1.5, namely graphical design, strength and resistance of packaging. This result indicated that those attributes have been highlighted as the marketing focus for re-designing the packaging of apple pia. Bangun [5] stated that attributes with a high sales point value (i.e. 1.5) need to be selected as the focus of marketing and profit improvement for the company.

For the priority of re-designing packaging, the top three weight of technical responses were thicker packaging materials, impact resistant packaging materials and attractive visual packaging graphical designs (Figure 1). These technical responses have a large contribution to meet consumer needs. This is in agreement with Putri [6] who said that a priority shall be given based on the relationship of technical response, the service attributes and the attributes weight. Therefore, a technical response with a higher weight compared to other technical responses needs to be prioritized first due to its major contribution to the product quality.

For benchmarking values, the technical responses of larger capacity (more product contents) and thicker packaging materials were higher than the target values. These results confirmed that changes in the new packaging is acceptable and further improvement is not recommended. However, for other technical responses, the benchmarking values were lower than the target values, indicating that the new packaging improvement is still needed to fit with the SME targets and requirement. According to Rahmatika [7] the value of the target becomes a reference to make changes.

3.2 Designing of New Packaging

Designing of the new packaging was conducted based on the data analysis results of QFD method and House of Quality. In re-designing a new packaging, the relationship between whats and hows attributes and relationships between hows attributes should be considered. Attributes of whats and hows with strong relationships should be prioritised, followed by those with moderate and weak relationships. Similarly, for hows attributes with strong positive and positive relationships should also be prioritised.

The graphical design of premium apple pia packaging was made of two color choices: a mix of blue and pink, and a mix of yellow and black. These color were selected because many consumers of apple pia are young adults who prefer a modern and exclusive look. Furthermore, some new information (i.e. halal logo and year of the SME establishment) were added into the new packaging design. Also, a transparent section with triangular shape was made on the top of the new packaging.

The packaging dimension was designed with the size of 30 cm x 5 cm x 3 cm (L x W x H). In terms of the packaging capacity, it was increased to 200 g per package, containing 10 apple pia. The shape of the premium apple pia packaging was remained as a rectangular or beam, but the packaging material was replaced by a duplex carton with 400 g/m². The outer part of the premium packaging will be wrapped by plastic and the inner part will be added with a duplex carton functioned to protect against shock or collision with other objects.

3.3 User Verification

User verification was carried out to find out the response from the Permata Agro Mandiri SME to the new apple pia packaging designed by the researcher. For graphical design, two recommendation of the color choices were given and should be chosen by the SME. The results showed that a mix of black
and yellow color was selected by the SME for the premium apple pia packaging. While, for other packaging attributes, only one recommendation was provided, and those have been agreed by the SMEs. The comparison of the current and the premium packaging design are shown in Figure 2 and 3. The differences between the current and the new packaging design are the color combination, the image, the information on packaging, and the dimensions of packaging.

![Figure 2. Current packaging design of the apple pia](image)

![Figure 3. New premium packaging design of the apple pia](image)

4. Conclusion
The *whats* attributes (i.e. graphical design, dimensions, capacity, shape, strength, and resistance) provided by the consumers contributed to the re-designing process of the premium apple pia packaging. In combination with the identified technical responses, a new design for premium packaging of apple pia was created and accepted by the Permata Agro Mandiri SME. This new packaging design composed of a mix of black and yellow color as graphical design, a bigger size dimension enable to contain 200 g capacity (or equivalent with 10 apple pia in each package), a rectangular or beam shape, a 400 g/m² duplex carton material, as well as additional packaging materials such as plastic for wrapping the packaging and a duplex carton as an inner part for protecting the product.

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