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Implementation of Quality Function Deployment (QFD) in Product Development of Jicama Starch-Coriander Leaf Extract Peel-off Gel Mask

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Abstract

Product development of the jicama starch-coriander leaf extract peel-off gel mask that meets customer needs can be done by implementing the Quality Function Deployment (QFD) method. This research aims to identify customer needs and compile a House of Quality (HOQ) matrix as a basis for improving product quality. Data on customers' wants and needs were obtained from expert interviews and by distributing questionnaires to 80 respondents. The data obtained from the distribution of questionnaires were tested for validity and reliability. Data that is declared valid and reliable is used as input in the preparation of the HOQ matrix. Technical requirements were determined based on the results of expert interviews. Based on the results of applying the QFD method and HOQ matrix, priority technical improvements for the development of jicama starch-coriander leaf extract peel-off gel mask include: (1) informative and safe packaging selection technique, (2) the use of strandardized ingredients, (3) product marketing technique, (4) proper packaging technique, (5) proper mixing technique, and (6) proper ingredient dissolution technique.

Keywords: Gel mask; customer needs; technical requirement; QFD method; HOQ.

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1. Introduction

Peel-off gel mask is one type of mask that has advantages in terms of practicality of use. Once applied and left to dry, this type of mask can be exfoliated without the need to rinse off, leaving skin clear without residue. Other than that, the peel-off gel mask's high stickiness allows it to remove dead skin cells, oil, dirt, and blackheads from the skin surface. The use of peel-off gel masks also helps improve and treat facial skin from skin aging problems, acne, cleansing skin pores, and moisturizing your skin [1]. However, the formulations of peel-off gel masks on the market generally use active substances from synthetic ingredients, as antimicrobial, antioxidant, and anti-inflammatory.

The development of new active ingredients with antimicrobial, antioxidant, and anti-inflammatory properties in peel-off gel mask preparations has been widely researched, such as the use of jicama and coriander leaves [2]. Jicama contains vitamin C, calcium, phosphorus, and fiber, as well as high water content [3]. Jicama contains skin-beneficial components such as flavonoids, vitamin C, antioxidants, and antibacterials. The function of each chemical compound contained in jicama is to brighten the skin, maintain skin health, inhibit the process of premature aging of the skin, and potentially cure acne. Jicama is generally extracted first to extract the starch, because jicama starch can be used as a basic ingredient for making cold powder [4]. Based on its functional properties, coriander leaves are also no less competitive with jicama because coriander leaf extract has antioxidant activity derived from flavonoids, alkaloids, saponins, and tannins [5], which have potential as antibacterial and anti-inflammatory [6].

The combined use of jicama starch and coriander leaf extract in peel-off gel mask preparations has been reported to have antioxidant activity ranging from 50,24-76,14% and antibacterial activity in the strong category with inhibition values against Staphylococcus aureus bacteria of 11,47-15,86 mm [2]. However, the benefits of the jicama starch-coriander leaf extract peel-off gel mask were not followed by widespread market development. The jicama starch-coriander leaf extract peel-off gel mask is a new product that has not been developed, so efforts are needed to increase customer preference by researching to find out the needs and desires of customers as a basis for further production planning using the Quality Function Deployment (QFD) method (QFD).

QFD is a method that helps development teams systematically plan and develop products or services based on customer needs and expectations. QFD works by translating customer needs into relevant technical requirements, so that every part in the organization, from different levels and functions, can understand them and act accordingly. This process involves identifying customer needs, wants, and expectations, which are then summarized in a tool called the House of Quality (HOQ), which is a matrix that links customer needs with the technical aspects of the product. The main principle of QFD is to ensure that product improvement or development not only meets customer needs but also creates innovative responses to improve the production process. This method has proven successful in various industries because it makes customer satisfaction a top priority, which ultimately results in better quality products that are relevant to the market [7]. Therefore, this method can support the achievement of maximum effectiveness in the development of jicama starch-coriander leaf extract peel-off gel mask products. This study aims to determine the needs and desires of customers used as a basis for improving the quality of jicama starch-coriander leaf extract peel-off gel mask products, analyze the

improvements that need to be made, and determine the attributes that must be improved on the product in order to compete in the market.

2. Materials and methods

2.1. Data types and sources

This research is a quantitative and qualitative study. The quantitative data obtained is used to determine the priority of customer needs and the relationship between technical requirements interpreted in the House of Quality (HOQ) matrix. Qualitative data is used to deeply understand customer needs and translate them into technical requirements in the form of narrative and descriptive explanations of the results of quantitative data. The types of data used are: (1) primary data obtained from expert interviews and distributing questionnaires to respondents; and (2) secondary data obtained from literature studies.

2.2. Population and sample

The population in this study was women or men with an age range of 17 to 60 years who were in the Andalas University environment and its surroundings as many as 80 respondents. This population was chosen because it is considered to represent the customer group that is the main target of the product.

2.3. Data analysis methods

2.3.1. Data quality test

Data quality tests include validity and reliability tests. The validity test was carried out using the Pearson Correlation method, which measures the correlation between the score of each question and the total score. The question is declared valid if the significance value is <0,05 [8]. The reliability test was carried out using the Cronbach's Alpha method, where a value of ≥ 0.7 indicates that the instrument is consistent, reliable, and suitable for use in research [8].

2.3.2. Preparation of House of Quality (HOQ) matrix

The stages in the preparation of the HOQ matrix are [9]:

a. The planning submatrix includes the importance and satisfaction level of each attribute for customers, the goal column, and the ratio between the goal and the satisfaction level of customers, analyzing the advantage of the product in the market, and calculating the row weight, which describes the priority of each attribute for customers.

b. Technical requirements are determined based on the results of expert interviews. Experts also determine the relationship between each technical requirement and the relationship between customer needs and wants and technical requirements.

c. Determines the planning matrix, which consists of eight columns of data, namely:

1) The level of customer importance is measured using a numerical scale that starts from 1 = very

unimportant to 5 = very important.

2) The level of customer satisfaction with the jicama starch-coriander leaf extract peel-off gel mask product was also measured using a numerical scale of 1 to 5.

3) The level of customer satisfaction with competing products is also measured using a numerical scale of 1 to 5.

4) Goal is the target value to be achieved. This value is determined from the highest value on the numerical scale used to measure the level of customer satisfaction.

5) Improvement ratio (IR) is the goal of customer satisfaction from a customer perspective, which is formulated as follows:

$$IR = \frac{Goal}{Customer\ satisfaction\ level} \quad (1)$$

6) Sales point is the stage of selecting the need factors that have the most influence on increasing profits. The higher a factor's value, the more likely it is to provide profit for the company, with a definition of value that is: 1 = no sales point; 1,2 = medium sales point; and 1,5 = strong sales point.

7) Raw weight (RW) is used to make decisions in the planning matrix, which is calculated using the following formula:

$$RW = IR \times Customer\ interest \times Sales\ point \quad (2)$$

8) Normalized Raw Weight (NRW) aims to find out what the most important customer needs. NRW is calculated using the following formula:

$$NRW = \frac{Raw\ weight}{Raw\ weight\ total} \times 100\% \quad (3)$$

d. The in-depth analysis stage of the House of Quality (HOQ) is used to ensure that every decision in product development is based on clear and relevant data. If this process is continued to the production stage, it will result in products with strong characteristics, specifically designed to better meet the wants and needs of customers.

3. Result and Discussion

3.1. Identify customer wants and needs

The results of interviews with lecturers from public universities in Padang City are used as customer needs attributes. The results of the interviews are interpreted as Costumer Needs Level 1, then at this level are broken down again at each of their needs. The fractional results of Costomer Needs Level 1 get more specific results on consumer needs or what is called Costumer Needs Level 2. Demended quality deployment chart of peel-off gel masks, namely:

1) Price of product (Level 1)

a. Affordable product prices (Level 2)

2) Quality of product (Level 1)

a. Safe and hygienic product packaging (Level 2)
b. Product is easy to apply (Level 2)
c. Product scented with natural ingredients (Level 2)
d. Product does not give side effects (Level 2)
e. Product quality is in accordance with the standard (Level 2)
f. Product benefits the skin (Level 2)

3) Variable of product innovation (Level 1)

a. Attractive product (Level 2)

3.2. Evaluation of technical characteristics

Technical characteristics were obtained from interviews with 5 experts, namely lecturers from public universities in Padang City, West Sumatra, Indonesia. The technical characteristics of peel-off gel masks are:

1) Internal Aspects (Production Process)

a. The use of standardized ingredients; This is very important in creating a product, because the use of quality raw materials according to standards will produce safe and quality products.
b. Proper ingredient dissolution technique; The key to making peel-off gel masks is the dissolving process of the active ingredients that make up the gel base, such as PVA, HPMC, and jicama starch. These ingredients must be dissolved with proper procedures to produce a homogeneous peel-off gel mask preparation with good stability.
c. Proper mixing techniques; The different properties of the ingredients require special treatment and proper procedures to produce a quality peel-off gel mask preparation.
d. Proper packaging techniques; Related to the safety and hygiene of the product inside.

2) External Aspects (Product Outputs)

a. Informative and safe packaging selection techniques; This is very influential on the branding of the product that will be created. Informative and safe packaging will attract consumers to buy the product.
b. Product marketing techniques; Related to the target market to be achieved.

3.3. Test validity and reliability of data

3.3.1. Validity test

Each dataset has an instrument of 8 question items using 80 respondents. Each data uses 80 respondents with an instrument of 8 statement items, namely:

S1: Affordable product prices

S2: Safe and hygienic product packaging

S3: Product is easy to apply

S4: Product scented with natural ingredients

S5: Product does not give side effects

S6: Product quality is in accordance with the standard

S7: Product benefits the skin

S8: Attractive product

In the validity test, the correlation value of each data instrument is tested. The validation criteria are divided into five categories, namely if r count has a value of 0,8-1, then the validity is very high. If the r-count value is 0,6-0,799, the validity is high. If the r-count value is 0,4-0,599, the validity is quite high. If the calculated r value is 0,2-0,399, the validity is low. If the r-count value is 0-0,199, it means that the validity is very low or can be said to be invalid [10]. The correlation value of customer satisfaction data on jicama starch-coriander leaf extract peel-off gel mask can be seen in Table 1.

Table 1: Correlation value of the validity data of customer satisfaction with the peel-off gel mask

Instruments	r-table	r-count	Description
Affordable product prices	0,220	0,421	High validity
Safe and hygienic product packaging	0,220	0,492	High validity
The product is easy to apply	0,220	0,501	High validity
The product is scented with natural ingredients	0,220	0,422	High validity
The product does not provide side effects	0,220	0,513	High validity
Product quality is in accordance with standard	0,220	0,448	High validity
Product benefits for the skin	0,220	0,525	High validity
Attractive product	0,220	0,482	High validity

Table 1 shows that there is a valid correlation between the correlated variables, which is the value of r-count > r-table. The correlation value of customer interest data on peel-off gel masks can be seen in Table 2.

Table 2: Correlation value of the validity data of customer interests in peel-off gel mask

Instruments	r-table	r-count	Description
Affordable product prices	0,220	0,421	High enough validity
Safe and hygienic product packaging	0,220	0,492	High enough validity
The product is easy to apply	0,220	0,501	High enough validity
The product is scented with natural ingredients	0,220	0,422	High enough validity
The product does not provide side effects	0,220	0,513	High enough validity
Product quality is in accordance with standard	0,220	0,448	High enough validity
Product benefits for the skin	0,220	0,525	High enough validity
Attractive product	0,220	0,482	High enough validity

Table 2 shows that there is a valid correlation between the correlated variables, which is the value of r-count> r-table. The correlation value of customer satisfaction with competing products can be seen in Table 3.

Table 3: Correlation value of the validity data of customer satisfaction with competing products

Instruments	r-table	r-count	Description
Affordable product prices	0,220	0,421	High validity
Safe and hygienic product packaging	0,220	0,492	Very high validity
The product is easy to apply	0,220	0,501	Very high validity
The product is scented with natural ingredients	0,220	0,422	High validity
The product does not provide side effects	0,220	0,513	Very high validity
Product quality is in accordance with standard	0,220	0,448	Very high validity
Product benefits for the skin	0,220	0,525	Very high validity
Attractive product	0,220	0,482	Very high validity

Table 3. shows that there is a valid correlation between the connected variables, which is the value of r-count> r-table.

3.3.2. Reliability test

The results of the reliability test on each instrument of customer satisfaction data on jicama starch-coriander leaf extract peel-off gel mask products, data on customer interests in peel-off gel mask products, and data on customer satisfaction with competing products can be seen in Table 4.

Table 4: Reliability value of data

Statement items	Cronbach's Alpha	Descriptions
Customer satisfaction	0,853	Reliable
Customer interest	0,854	Reliable
Customer satisfaction with competitors' products	0,934	Reliable

Table 4. shows that data on customer satisfaction with jicama starch-coriander leaf extract peel-off gel mask products, data on customer interests in peel-off gel mask products, and data on customer satisfaction with competing products are reliable because the Cronbach's alpha obtained is greater than 0,6 (5% significance).

3.4. Calculation of planning matrix weight

3.4.1. Customer satisfaction and interests

The results of the data analysis of the questionnaire on the level of customer satisfaction with the jicama starch-coriander leaf extract peel-off gel mask product can be seen in Table 5.

Table 5: The results of the level of customer satisfaction with the peel-off gel mask

Customer Needs Attributes	Satisfaction Level
Affordable product prices	4,35
Safe and hygienic product packaging	4,49
The product is easy to apply	4,44
The product is scented with natural ingredients	4,41
The product does not provide side effects	4,56
Product quality is in accordance with standard	4,48
Product benefits for the skin	4,55
Attractive product	4,46

Table 5. shows that the attribute most favored by customers is "Product does not provide side effects" with a satisfaction level of 4,56. Then for the attribute with the lowest value is "Affordable product prices" with a value of 4,35. The results of data analysis on the level of customer interest in peel-off gel mask products can be seen in Table 6.

Table 6: The average results of the level of customer importance of peel-off gel mask products

Customer Needs Attributes	Satisfaction Level
Affordable product prices	4,45
Safe and hygienic product packaging	4,51
The product is easy to apply	4,51
The product is scented with natural ingredients	4,49
The product does not provide side effects	4,65
Product quality is in accordance with standard	4,50
Product benefits for the skin	4,58
Attractive product	4,46

Table 6. shows that the most important attribute to improve is "Product does not give side effects", and the attribute with the lowest level of importance is "Affordable product prices". This indicates that customers are more concerned with peel-off gel mask products that do not have side effects, compared to the affordable price of peel-off gel mask.

3.4.2. Benchmarking

Benchmarking is a way to find out the level of satisfaction of competitors. Data collection is the same as taking Current Satisfaction Performance data, except that it replaces it with the opinion of customer satisfaction with competing products, using a Likert scale of 1 to 5.

Based on the results of temporary observations, there are no peel-off gel mask products that use coriander leaf extract, but peel-off gel mask products with jicama starch as raw material and using other plant extracts can be used as competing products. So, a similar commercialized product was chosen, namely brand X's matcha green tea peel-off gel mask. This product is selected based on its similarity in type and also contains plant extracts. The value of customer satisfaction with competitor's product in this study is presented in Table 7.

Table 1: The average result of the level of customer satisfaction with competitor's product

Customer Needs Attributes	Satisfaction Level
Affordable product prices	4,23
Safe and hygienic product packaging	4,08
The product is easy to apply	4,15
The product is scented with natural ingredients	4,09
The product does not provide side effects	4,15
Product quality is in accordance with standard	4,18
Product benefits for the skin	4,06
Attractive product	4,13

Table 7. shows that competing products get satisfaction scores ranging from 4,06-4,23. A comparison of the

level of customer satisfaction between jicama starch-coriander leaf extract peel-off gel mask products and competing products can be seen in Table 8.

Table 2: Comparative value of customer satisfaction level of peel-off gel mask and competing products

Customer Needs Attributes	Jicama Starch-CLE* Peel-off Gel Mask	Competitor Product
Affordable product prices	4,35	4,23
Safe and hygienic product packaging	4,49	4,08
The product is easy to apply	4,44	4,15
The product is scented with natural ingredients	4,41	4,09
The product does not provide side effects	4,53	4,15
Product quality is in accordance with standard	4,48	4,18
Product benefits for the skin	4,55	4,06
Attractive product	4,46	4,13

Desc: CLE = Coriander leaf extract

Table 8. shows that the value of all attributes of customer interests and needs for jicama starch-coriander leaf extract peel-off gel mask products is superior to competing products. This indicates that this peel-off gel mask product has a probability of being commercialized.

3.4.3. Goal

The goal value is taken from the highest value based on the value of the level of customer satisfaction with the product, which uses a Likert scale of 1 to 5. Based on this point, the goal value of each customer requirement attribute is 5.

3.4.4. Improvement ratio

Improvement ratio can be classified into four categories, namely [8]:

Category 1 : skor < 1 = no change (light)

Category 2 : skor 1-1,2 = moderately difficult improvement

Category 3 : skor 1,2-1,5 = difficult improvement

Category 4 : skor > 1,5 = very difficult improvement

The results of the calculation of the improvement ratio value of customer needs for jicama starch-coriander leaf extract peel-off gel mask products can be seen in Table 9.

Table 9: The value of improvement ratio

Customer Needs Attributes	Improvement Ratio
Affordable product prices	1,15
Safe and hygienic product packaging	1,11
The product is easy to apply	1,13
The product is scented with natural ingredients	1,13
The product does not provide side effects	1,10
Product quality is in accordance with standard	1,12
Product benefits for the skin	1,10
Attractive product	1,12

Based on Table 9. the attribute "Affordable product prices" gets the highest improvement ratio value. This shows that this attribute is the hardest effort for producers to improve and develop. This is followed by "Product is easy to apply to the skin" and the attribute "Product is scented with natural ingredients", which also shows that manufacturers also need to work hard to improve these two attributes.

3.4.5. Sales point

At this stage of determining the sales point, management is faced with the decision to choose the most influential and least influential demand variables for increasing profits, where the greater the scale value, the greater the profit obtained [11]. Sales points have a value of one of the following three values:

1 = no sales point, 1,2 = medium sales point, 1,5 = strong sales point

The sales point value of customer needs for jicama starch-coriander leaf extract peel-off gel mask products can be seen in Table 10.

Table 10: The value of sales point

Customer Needs Attributes	Sales Point
Affordable product prices	1,5
Safe and hygienic product packaging	1,5
The product is easy to apply	1,5
The product is scented with natural ingredients	1,2
The product does not provide side effects	1,5
Product quality is in accordance with standard	1,5
Product benefits for the skin	1,5
Attractive product	1,5

Table 10. shows that the attributes of customer needs for jicama starch-coriander leaf extract peel-off gel mask products have sales point values that are in the range of 1,2 (influential on sales value) and 1,5 (very influential

on sales value).

3.4.6. Raw weight

The results of the calculation of raw weight for customer needs for jicama starch-coriander leaf extract peel-off gel mask products can be seen in Table 11.

Table 11: Value of raw weight

Customer Needs Attributes	Sales Point
Affordable product prices	7,67
Safe and hygienic product packaging	7,54
The product is easy to apply	7,63
The product is scented with natural ingredients	6,10
The product does not provide side effects	7,71
Product quality is in accordance with standard	7,54
Product benefits for the skin	7,54
Attractive product	7,50

Table 11. shows that the need for the attribute "Affordable product prices" gets the highest raw weight value, and the attribute "Products are scented with natural ingredients" gets the lowest value. The higher the raw weight value, the more important the customer's need is. Raw weight provides an overall business strategy at the level of importance from customer needs to the success of the planned product or service [12].

3.4.7. Normalized Raw Weight (NRW)

Determining the most important customer needs for peel-off gel mask products can be determined from how much the total raw weight. Total raw weight is obtained from the calculation of Normalized Raw Weight (NRW). The results of the NRW calculation can be seen in Table 12.

Table 3: Normalized Raw Weight (NRW) Calculation Results

Customer Needs Attributes	NRW (%)
Affordable product prices	12,95
Safe and hygienic product packaging	12,73
The product is easy to apply	12,88
The product is scented with natural ingredients	10,30
The product does not provide side effects	13,01
Product quality is in accordance with standard	12,73
Product benefits for the skin	12,73
Attractive product	12,66

3.5. Compilation of relationship matrix between technical characteristics

The preparation of a matrix regarding the relationship between technical characteristics aims to identify technical characteristics that support each other and relate to each other with the following symbol description:

⊕ : Strong relationships between technical characteristics

\+ : Relationships between technical characteristics that are being

<blank> : No relationship between technical characteristics

Each relationship of technical characteristics is assessed with the provisions as described above; the relationship matrix between technical characteristics can be seen in Figure 1.

Figure 1: Relationship Matrix between Technical Characteristics

Figure 1. shows the relationship between each engineering characteristic obtained from the interviews with experts, summarized as follows:

a. The use of standardized ingredients

"The use of standardized ingredients" has a strong relationship with "Proper ingredient dissolution techniques" and "Proper mixing techniques". This is because the ingredients used in making peel-off gel masks have special physical and chemical properties that require special treatment in the dissolution and mixing process to produce a stable, homogeneous, and easy-to-apply final product. If the dissolution or mixing is done incorrectly, it can produce a peel-off gel mask that lacks quality even though the raw materials meet the standards. Therefore, the relationship between the use of standardized ingredients and the dissolving and mixing techniques is very strong in the process of making peel-off gel masks.

"The use of standardized materials" has a moderate relationship with "Proper packaging techniques" and "Informative and save packaging selection techniques". Although the selection and application of packaging does not directly affect the properties of the materials, it still needs to be tailored to the characteristics of the materials in order to maintain product quality. For example, materials that are sensitive to light or air need to be packaged in specific containers that are impermeable and protected. In addition, the information on the packaging should also reflect the content and benefits of the ingredients used. However, since this relationship is

more of an adjustment than a direct interdependence, its strength is categorized as moderate.

“The use of standardized materials” has no relationship with “Product marketing techniques”. This is because marketing strategies focus more on how products are introduced and sold to consumers, such as through promotional media, pricing, or market segmentation. Although the quality of materials can be a selling point, marketing techniques are not directly influenced by the type of materials used. Therefore, the relationship between the two is considered irrelevant in a technical context.

b. Proper ingredient dissolution techniques

“Proper ingredient dissolution technique” has a strong relationship with “Proper mixing technique”. This is because both are core processes in the stages of making peel-off gel masks. Proper dissolution ensures that the active ingredients and additives are well dispersed and do not clump or settle. If the dissolving process is not done properly, further mixing will be ineffective, resulting in an inhomogeneous product, poor texture, or even unsafe to use. Therefore, these two techniques have a strong relationship and support each other in shaping the final quality of the peel-off gel mask product.

However, “Proper ingredient dissolution techniques” has no direct relationship with “Packaging techniques”, “Informative packaging selection techniques” or “Product marketing techniques”. Packaging techniques focus more on how the final product is packaged to make it safe and secure, whereas dissolving is part of an internal process that occurs long before the packaging stage. Similarly, the selection of informative packaging relates to the communication aspect of the product to consumers, not to how the material dissolves. The marketing technique is an external strategy that focuses on the promotion, distribution, and sales of the product, which is not directly related to the technical stages such as dissolving the ingredients. Therefore, although dissolving is an important aspect of production, its relationship with packaging and marketing is considered insignificant in a technical context.

c. Proper mixing techniques

“Proper mixing techniques” has no relationship with “Proper packaging techniques”, “Informative packaging selection technique”, or “Product marketing technique”. Mixing technique is the part of the manufacturing process that focuses on how the various ingredients can be mixed evenly in order to produce a product with a homogeneous, stable, and effective texture. This stage is very important to ensure the physical and functional quality of the peel-off gel mask product. However, once the mixing process is complete and the product has been formed, the next stages such as packaging and marketing are separate and focus more on the protective aspects of the product as well as its delivery to consumers.

“Informative packaging techniques and packaging selection” focuses more on how products are packaged to maintain their quality during distribution and use, and how important information such as composition, usage, and benefits are clearly conveyed to consumers. They do not directly affect the blending process. Marketing techniques, on the other hand, relate to strategies for introducing and selling products, such as through promotion, branding, or pricing. Since there is no technical interrelationship between mixing ingredients and

these three aspects, the relationship between them is categorized as non-existent or technically insignificant.

d. Proper packaging techniques

"Proper packaging techniques" has a strong relationship with "Informative packaging selection techniques" and "Product marketing techniques". Good packaging not only protects the product, but should also be able to convey important information to consumers in a clear and attractive manner. In addition, the right packaging can enhance the visual appeal and image of the product, which is highly influential in marketing strategies. Therefore, these three aspects support each other and have a strong relationship in the technical and commercial context of peel-off gel masks.

e. Informative packaging selection techniques

"Informative packaging selection techniques" has a strong relationship with "Product marketing techniques". Informative packaging not only serves as a product protector, but also as a medium of direct communication with consumers. Information such as ingredient composition, benefits, how to use, product advantages, and certifications listed on the packaging greatly influences consumer perception and trust in the product. In marketing, the clarity and attractiveness of information on packaging can increase purchase interest and strengthen brand image. Therefore, the selection of packaging that presents information appropriately and attractively has a strong relationship with the success of the marketing strategy of peel-off gel mask products.

3.6. Analysis of relationship matrix and absolute importance

The relationship matrix has customer needs with technical characteristics can be seen in Figure 3.

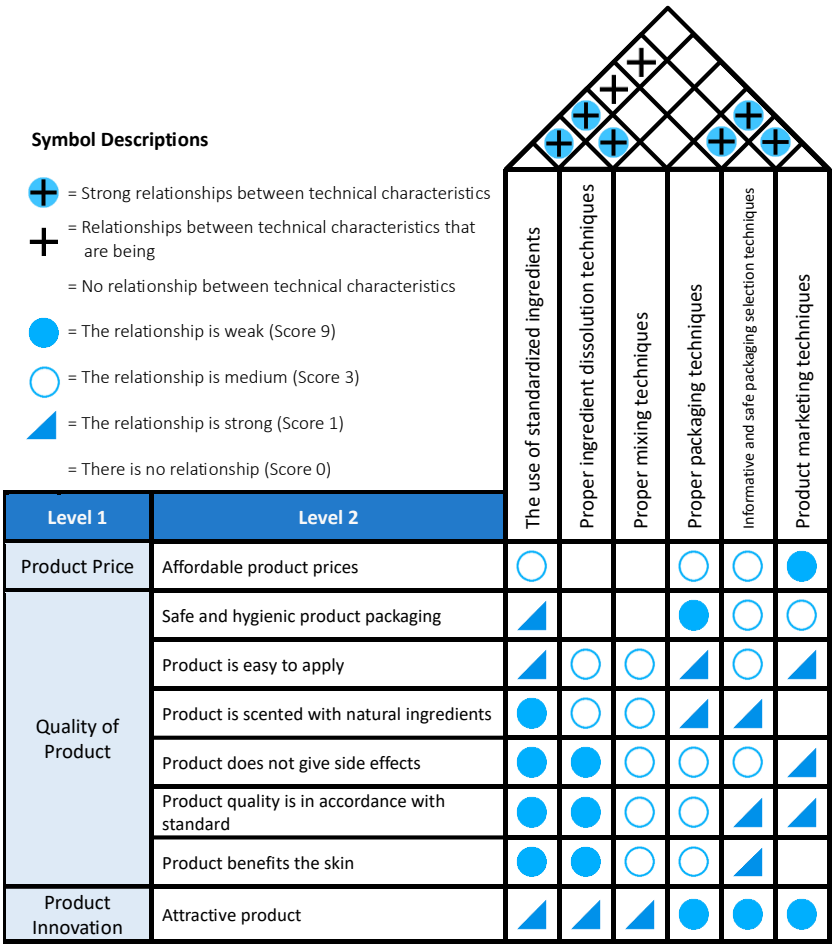

Figure 2: Relationship Matrix of Customer Needs with Technical Characteristics

Figure 2. shows the results of the relationship between technical characteristics and customer needs. Furthermore, calculations are carried out to obtain absolute importance, which aims to show the priorities that must be implemented to realize customer desires. The results of the calculation of absolute importance can be seen in Table 13.

Table 13: Absolute Importance Result

Technical Characteristics	Absolute Importance	Ranking
The use of standardized ingredients	4,3207	2
Proper ingredient dissolution techniques	2,2196	6
Proper mixing techniques	2,9892	5
Proper packaging techniques	3,8828	4
Informative and safe packaging selection techniques	4,8927	1
Product marketing techniques	4,1139	3

Table 13. shows that the technical characteristics that urgently need to be improved and enhanced are “The techniques for selecting informative and safe packaging”. This is because packaging plays an important role in

protecting the quality of peel-off gel masks and conveying the information needed by customers. Safe packaging prevents product damage, while informative packaging helps build trust and drives purchase decisions. Improving these aspects also supports regulatory compliance and strengthens product competitiveness in the market. Meanwhile, the technical characteristic that has the lowest importance to be improved is "Proper ingredient dissolution techniques". This is because these processes are generally basic techniques that have been mastered and standardized in the formulation of peel-off gel masks. Therefore, in terms of development priorities, improving dissolving techniques is considered less urgent than other technical characteristics that have more influence on final quality and market acceptance.

3.7. House of Quality (HOQ)

House of quality (HOQ) is made based on the combination of data from determining the level of importance to the interaction of technical responses. HOQ can be seen in Figure 3.

Symbol Descriptions

- = Strong relationships between technical characteristics
- = Relationships between technical characteristics that are being
- = No relationship between technical characteristics
- = The relationship is weak (Score 9)
- = The relationship is medium (Score 3)
- = The relationship is strong (Score 1)
- = There is no relationship (Score 0)

Level 1	Level 2	The use of standardized ingredients	Proper ingredient dissolution techniques	Proper mixing techniques	Proper packaging techniques	Informative and safe packaging selection techniques	Product marketing techniques	The level of customer importance	The level of customer satisfaction	Competitor's product	Goal	Improvement Ratio	Sales Point	Raw Weight	Normalized Raw Weight (NRW)
Product Price	Affordable product prices	○			○	○	●	4,45	4,35	4,23	5	1,15	1,5	7,67	12,95
Quality of Product	Safe and hygienic product packaging	◢			●	○	○	4,51	4,49	4,08	5	1,11	1,5	7,54	12,73
	Product is easy to apply	◢	○	○	◢	○	◢	4,51	4,44	4,15	5	1,13	1,5	7,63	12,88
	Product is scented with natural ingredients	●	○	○	◢	◢		4,49	4,41	4,09	5	1,13	1,2	6,10	10,30
	Product does not give side effects	●	●	○	○	○	◢	4,65	4,53	4,15	5	1,10	1,5	7,71	13,01
	Product quality is in accordance with standard	●	●	○	○	◢	◢	4,50	4,48	4,18	5	1,12	1,5	7,54	12,73
	Product benefits the skin	●	●	○	○	◢		4,58	4,55	4,06	5	1,10	1,5	7,54	12,73
Product Innovation	Attractive product	◢	◢	◢	●	●	●	4,46	4,46	4,13	5	1,12	1,5	7,50	12,66
	Absolute Importance	4,3207	2,2196	2,9892	3,8828	4,8927	4,1139								
	Relative Importance	0,1972	0,0990	0,1333	0,1732	0,2182	0,1835								
	Ranking	2	6	5	4	1	3								

Figure 3: House of Quality (HOQ) Matrix of Jicama Starch-Coriander Leaf Extract Peel-off Gel Mask

Figure 3. shows that the main technique that needs to be improved is the technique of selecting informative packaging. This is because packaging is the main medium to explain the benefits and advantages of natural ingredients from jicama starch-extra coriander leaf peel-off gel mask products to customers. The use of these

ingredients in facial skin care products, especially coriander leaf extract, is not widely known, so clear, attractive, and educational information on the packaging is needed so that customers understand the benefits for the skin. In addition, informative packaging also builds trust, demonstrates product professionalism, and helps meet regulatory standards for skincare products. In addition, informative packaging also builds trust, demonstrates product professionalism, and helps meet regulatory standards for skincare products. That way, the product is more easily accepted by the market and has a stronger selling point.

The second technical characteristic that needs to be considered is the use of standardized raw materials. The use of raw materials that meet the standards is the main key in creating quality peel-off gel mask products that are accepted by the market, because natural ingredients such as jicama starch and coriander leaf extract require consistent quality standards to be safe, effective, and stable when used in peel-off gel mask formulations. Without standardized raw materials, the quality of products produced will vary and decrease customer confidence.

Furthermore, product marketing techniques ranked third because customers are not familiar with the benefits of the natural ingredients used, especially coriander leaf extract. Therefore, proper marketing techniques are needed to introduce the benefits, advantages, and uniqueness of the jicama starch-coriander leaf extract peel-off gel mask product in order to attract market interest. In addition, proper packaging techniques ranked fourth because packaging serves to protect the product as well as add visual appeal. Proper packaging ensures that masks remain hygienic, easy to use and practical when distributed. Therefore, the technical ranking order configures a strategic move in ensuring the product is not only quality in terms of materials, but also well-received by the market.

4. Conclusion

Based on the results of the Quality Function Deployment method description, the technical requirements that need to be improved in developing the jicama starch coriander leaf extract peel-off gel mask product that has been designed with the House of quality (HOQ) matrix with the most important improvement priorities are: (1) Informative and safe packaging selection techniques, (2) Use of raw materials according to standards, (3) Product marketing techniques, (4) Proper packaging techniques, (5) Proper mixing techniques, and (6) Proper material dissolution techniques.

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