

Enhancing Brem Packaging at Suling Indah Jaya Madiun: A Quality Function Deployment (QFD) Application

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Abstract

Packaging plays a crucial role in attracting consumers and preserving product quality. Within the food industry, particularly for brem, innovative and functional packaging can enhance market competitiveness. This research employed the Quality Function Deployment (QFD) methodology to develop brem packaging at Suling Indah Jaya in Madiun, Indonesia. QFD was utilized to identify consumer needs and translate them into technical specifications to generate optimal packaging. Data were collected through customer questionnaires and interviews with company representatives. The House of Quality (HoQ) analysis generate five primary packaging attributes: product information, visual design, packaging functionality, form and size, and packaging material. The findings indicate that the product information aspect requires the most significant improvement, specifically concerning the halal label, logo, and composition details. The visual design focused on a combination of brown and white colors. Furthermore, the packaging should effectively protect the product from outdoor air, with an appropriate form and size. The materials utilized consist of plastic as the primary layer and cardboard for supplementary protection.

Key words: *Quality function deployment, house of quality, packaging, product development*

INTRODUCTION

The increasingly competitive business environment necessitates a strategic focus on quality management for companies seeking enhanced competitiveness and long-term business sustainability (Ariani, 2020). Quality management plays a pivotal role in ensuring operational efficiency, adherence to stringent quality standards, and the mitigation of risks

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associated with defects and waste (Nabila et al., 2020). Moreover, the implementation of robust quality management systems facilitates process innovation aimed at improving overall production performance, including critical aspects such as packaging, thereby safeguarding business continuity (Sales et al., 2022).

Product packaging plays a crucial element of quality management, functioning not merely as a point of differentiation from competitors but also as a means of preserving product integrity and providing essential protection (Astiti et al., 2023). Furthermore, packaging is designed in diverse shapes and sizes to effectively contain and safeguard products against potential damage (Ermawati, 2019). Attractive and functional packaging enhances product value, significantly influences consumer purchasing decisions, and fosters increased customer loyalty (Pratama et al., 2023). Consequently, the quality of packaging is as important as the quality of the product itself in shaping positive consumer perceptions.

Brem, recognized as an intangible cultural heritage of Indonesia (dutaindonesia.com, 2023), has garnered consumer interest. However, brem has experienced a significant decline in sales since 2004, leading numerous producers to cease operations. Consequently, innovative measures, including enhancements to packaging design, are imperative to ensure brem remains competitive in the market. According to dpmd.jatimprov.go.id (2024), Kaliabu Village is home to 47 brem producers, including Suling Indah Jaya, which serves as the subject of this research. Suling Indah Jaya continues to utilize conventional plastic packaging that lacks the appeal observed in competing brem products and does not reflect modern packaging standards, which necessitate consideration of aesthetics, functionality, and sustainability (Pulungan et al., 2019). Preliminary qualitative data obtained from interviews with five consumers via WhatsApp suggests that the current packaging is perceived as impractical and aesthetically unappealing, particularly with regard to its visual design and color palette. Furthermore, while the producer acknowledges the necessity for an updated packaging design, they encounter difficulties in comprehensively ascertaining prevailing customer preferences.

Quality Function Deployment (QFD) is a structured methodology employed to translate customer needs and desires into specific technical specifications for products or services (Heizer et al., 2020). The QFD method can be applied in designing the packaging for Suling Indah Jaya's brem based on customer preferences and the company's capabilities, while simultaneously enhancing consumer confidence (Ginting et al., 2022). Prior research conducted by Rohmatin, Wahyuni, and Raharja (2023); Susanti, Ma'arif, Nurhayati, Zulmarihana, and Dharu (2023); Handayani, Nadya, and Zuhra (2021); and Pulungan, Hastari, and Dewi (2019) has successfully identified optimal packaging designs aligned with consumer preferences to enhance product quality through the application of QFD. However,

none of these studies have specifically addressed the packaging of brem products. Consequently, this research aims to address this gap in the literature concerning quality management development for brem product packaging and to contribute to the competitiveness of brem products through the implementation of QFD.

LITERATURE ANALYSIS AND METHODOLOGY

Quality refers to the extent to which a product fulfills the needs and expectations of customers; a higher level of product quality typically correlates with greater customer satisfaction (Ariani, 2020). Quality management represents an organizational approach to formulating and establishing target standards with the aim of effectively managing available resources (Ariani, 2020). In conclusion, quality management can be defined as the concerted effort to ensure that products or services align with the needs, expectations, and desires of consumers, thereby enhancing customer satisfaction and meeting the expectations of all stakeholders, including both producers and consumers. Quality Function Deployment (QFD) represents a structured methodology designed to prioritize the needs and desires of prospective or existing consumers during the formulation of design specifications (Rahmayanti et al., 2018). Ginting et al. (2020) define QFD as a strategic planning process that facilitates organizations in the optimal and coordinated development and application of various supporting tools, thereby enabling the effective prioritization of pertinent issues. As a component of broader quality improvement methodologies within a business context, QFD falls under the domain of quality management.

Research concerning quality in relation to product packaging utilizing the Quality Function Deployment (QFD) method has been previously undertaken by several researchers. The study conducted by Sales et al. (2022) finds that, beyond price, quality constitutes a primary determinant in fostering customer loyalty. The systematic organization and correlation of themes inherent in QFD facilitate a swift and pragmatic comprehension and implementation of the concept by companies. Furthermore, the findings of Bahia et al. (2023) indicate that, in addition to the company's perspective on product quality assessment, customer satisfaction serves as a crucial benchmark for evaluating the product quality of a company, a metric that can be effectively measured through the application of the QFD methodology. Research on the packaging of "terasi" (shrimp paste) reveals that, in accordance with the QFD method, enhancements to the product packaging can be achieved through the inclusion of product expiration dates, halal labels, product composition details, net weight information, appealing logos, manufacturer addresses, the adoption of a standing pouch format, a strategic color combination, the utilization of aluminum foil, direct printing of the design onto the packaging, appropriate typographic

layout for the logo, and consistency between the product's contents and weight (Handayani et al., 2021). Concurrently, an evaluation of "gudeg jogja" (young jackfruit stew) packaging by Susanti et al. (2023) offer a canned packaging solution featuring animated images of jackfruit and batik motifs as distinctive characteristics of Yogyakarta, the inclusion of the product brand, a halal label, production date, and other pertinent information.

The design employed in this research is an action research design (Clark et al., 2020). The population for this study comprised all customers of Brem Suling Indah Jaya Madiun. Subsequently, a sample of respondents was selected using a non-probability sampling technique, specifically accidental sampling, whereby any Suling Indah Jaya consumers encountered or known to the researchers were eligible to participate as respondents (Abdullah et al., 2022). The sample size was determined based on the Linear Time Function, a method applicable when the total population size is not precisely known (Pulungan et al., 2019). The calculation provide a sample size of 75 respondents who served as sources for assessing the level of attribute importance. This sample size aligns with the generally accepted range of 30 to 500 individuals for such studies (Sahir, 2021). Concurrently, 15 respondents were involved in eliciting the Voice of Customer, which was subsequently formulated as product attributes (Rohmatin et al., 2022). Furthermore, interviews were conducted with two individuals: the owner of Suling Indah Jaya and a packaging supplier. This research utilized a survey to gather consumer input regarding product packaging aspects (VoC) and their perceived importance. The survey employed a Likert scale to measure individual opinions or perceptions (Ardhini, 2023).

The data obtained from the identification process will subsequently be analyzed through the implementation of the Quality Function Deployment (QFD) method. The QFD process typically comprises three distinct stages: eliciting the voice of the customer, constructing the House of Quality (HoQ), and the subsequent analysis and interpretation of the generated data (Susanti et al., 2023).

1. Eliciting the Voice of Customer

This stage involves the dissemination of questionnaires to 15 respondents (Rohmatin et al., 2022) to obtain the Voice of the Customer, which is subsequently articulated as product attributes. VoC represents the process of identifying or capturing consumer needs or preferences concerning the products or services utilized in the implementation of QFD (Mubarok & Sasongko, 2023).

2. The Construction of the House of Quality (HoQ)

This stage entails several sequential steps, as outlined by Pulungan et al. (2019):

- a. Development of the Customer Needs Matrix

This stage involves organizing the previously elicited voice of the customer into salient customer importance attributes, which are subsequently translated into actionable technical improvement efforts.

b. Development of the Planning Matrix

This matrix incorporates the calculation of the importance to customer value, the assessment of current customer satisfaction performance value, the establishment of goal values, the determination of improvement ratios, the identification of sales points, and the subsequent calculation of raw weights and normalized raw weights.

c. Formulation of Technical Responses

This stage involves the transformation of non-technical customer needs into quantifiable technical data based on the identified product attributes.

d. Establishment of the Relationship Matrix

This step focuses on determining the strength of the interrelationship between the formulated technical responses and the articulated customer needs, typically employing a symbolic representation for assessment, as exemplified in Tables 1 and 2.

Table 1. Symbols of the Attributes Relationship between “What’s” and “How’s”

Symbol	Information	Grade
●	Strong Relationship	9
○	Medium relationship	3
△	Weak relationship	1
Blank	No connection	0

Source: Pulungan, *et al* (2019)

Table 2. Symbols of Relationships between Technical Responses

Symbol	Information	Grade
++	Strong Positive Relationship	+9
+	Positive Relationship	+3
Blank	No connection	0

-	Negative relationship	-3
--	Strong Negative Relationship	-9

Source: Pulungan, *et al* (2019)

e. Determination of Difficulty Level and Technical Correlation

This stage involves mapping the relationships and the degree of importance among the identified substitute quality characteristics or technical responses. Subsequently, the direction of goodness is determined, contribution values are calculated, and rankings are established.

f. Benchmarking

In this phase, comparative values are utilized to ascertain which technical responses should be prioritized by the Small and Medium-sized Enterprise (SME) and what specific improvements will be implemented based on direct customer feedback. The aim is to effectively meet consumer needs regarding the *Brem* packaging at Suling Indah Jaya.

g. Establishment of Target Values

The business owner will set specific target values deemed favorable and capable of attracting purchasing interest, often informed by references or improvement suggestions provided by the researcher.

3. Analysis and Interpretation

This stage refers to the improvements to be implemented based on the output of the HoQ matrix developed in the preceding stage.

RESEARCH AND RESULTS

From the total of 75 respondents designated for attribute evaluation, a subset of 15 respondents within the Voice of Customer (VoC) sample was strategically selected to represent the heterogeneity of customer perspectives. The VoC data thus obtained were subsequently analyzed to identify consumer preferences and requirements concerning *Brem* packaging, with the resultant findings presented in Table 3. Furthermore, interviews were conducted with a key informant, namely Ibu Endang from Suling Indah Jaya, to corroborate and align the insights derived from the VoC analysis with the producer's perspective. Based on the outcomes of these interviews, mutually agreed-upon packaging attributes, congruent with consumer desires, were established and are presented in Table 4.

Tabel 3. The result of *Voice of Customer*

No	Customer Requirement	Number of Respondents
1	Product packaging must incorporate essential product information, such as halal certification, composition details, expiration date, and the manufacturer's logo	15
2	The visual design of the packaging should exhibit a more modern aesthetic.	15
3	The packaging material must possess properties that protect the product from humidity or external conditions.	15
4	The packaging should adopt a rectangular form congruent with the shape and dimensions of the <i>brem</i> .	14
5	The packaging dimensions should be commensurate with the product size	13
6	The packaging should be environmentally sustainable.	11
7	The packaging should incorporate a resealable zipper closure.	11
8	The <i>brem</i> packaging must possess adequate structural to resist damage.	10
9	The color scheme of the packaging design should employ a combination of brown and white.	8
10	The material utilized for the packaging should be plastic.	7
11	The color scheme of the packaging design should employ a combination of red and orange.	6
12	The <i>brem</i> packaging should exhibit sufficient durability to prevent damage, although excessive strength is not a requirement.	5
13	The packaging should utilize paper as the primary material.	4
14	The material utilized for the packaging should be laminated (cardboard and plastic).	3
15	The packaging should include visual elements, specifically the business logo and city identification.	2
16	The material utilized for the packaging should be laminated (cardboard and aluminum paper).	1
17	The packaging should adopt a jar-like form.	1
18	The color scheme for the packaging design should employ a combination of green and white.	1

19	The packaging should incorporate the product brand's slogan.	1
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Sources: Processed data

Tabel 4. Brem Packaging Attributes

No	Customer Attributes	Technical Response
1	Product information	Includes halal label, ingredients, expiration date, and producer's logo. Adds slogan and city identity.
2	Visual design	Uses specific brown and white colors. More modern visual appearance.
3	Functional packaging	Able to protect from humidity/outside air.
4	The shape and size of the packaging.	Box packaging matches product shape. Size is the same as the product
5	Packaging materials	Sufficiently strong and not easily damaged. Cardboard + plastic.

Sources: Processed data

The product packaging attributes for *brem* Suling Indah Jaya, elicited from the Voice of Customer (VoC) analysis, were subsequently evaluated by both existing and potential consumers of *brem* Suling Indah Jaya. The results of the packaging attribute importance assessment were obtained through the offline distribution of questionnaires to 25 existing Suling Indah Jaya consumers and 50 potential consumers. The collected data underwent validation and reliability testing. The results indicated that all statement items exhibited a calculated correlation coefficient (r-value) exceeding the critical r-value and demonstrated a Cronbach's alpha coefficient above 0.60, thereby confirming the validity and reliability of all questionnaire items for use in this research.

Results obtained from the questionnaire distribution to existing Suling Indah Jaya consumers and potential *brem* consumers then generate a planning matrix. This planning matrix identifies the attributes warranting improvement through the inclusion of improvement goals for the *brem* Suling Indah Jaya packaging. The planning matrix was derived through a multi-stage analytical process based on Voice of Customer (VoC) data and product attribute evaluations, encompassing the following parameters: Importance to Customer, Customer Satisfaction Performance, Goal, Importance Ratio, Sales Point, Raw Weight, and Normalized Raw Weight, as detailed in Table 5.

Table 5. Results of the Planning Matrix

Atribut	Importance to Customer	Customer Satisfaction Performance	Goal	IR	Sales Point	Raw Weight	Normalized Raw Weight (%)
Product information	4.82	2.50	3.00	1.20	1.5	8.676	23.30%
Visual design	4.12	3.12	3.59	1.15	1.2	5.6856	15.72%
Functional packaging	4.77	2.71	3.25	1.20	1.5	8.586	23.06%
The shape and size of the packaging.	4.35	3.00	3.45	1.15	1.2	6.003	16.12%
Packaging materials	4.60	2.83	3.40	1.20	1.5	8.280	22.23%

Sources: Processed data

The subsequent stage involved the compilation of technical responses derived from the customer needs survey and interviews conducted with representatives from *brem Suling Indah Jaya*. The analysis of the technical responses indicated that the attribute "product information" received the highest relative importance (23.30%). The remaining attributes exhibited the following relative importance values: "functional packaging" at 23.06%, "packaging material" at 22.23%, "the shape and the size of packaging" at 16.12%, and "visual design" at 15.72%. Furthermore, the relationship matrix between customer needs (What's) and technical responses (How's) is detailed in Table 6. Meanwhile relationships between technical response are described in Table 7.

Table 6. Attributes Relationship between "What's" and "How's"

Customer requirements	Detailed information	More modern visual appearance & white and brown colors	Sufficiently strong materials	Able to protect from humidity/ outside air.	Box packaging matches product shape & its size
Product information	●	○	△ △	△ △	△
Visual design					

	○	●			○
Functional packaging	Δ	Δ	●	●	Δ
The shape and size of the packaging.	Δ	○	Δ	Δ	●
Packaging materials	Δ	Δ	●	○	Δ

Sources: Processed data

Table 7. Relationship between Technical Responses

Technical Response	Detailed information	More modern visual appearance & white and brown colors	Sufficiently strong materials	Able to protect from humidity/ outside air.	Box packaging matches product shape & its size
Product information	++	+	-	-	
Visual design	+	++		-	+
Functional packaging	-		++	+	
The shape and size of the packaging.	-	-	+	++	
Packaging materials		+			++

Sources: Processed data

Table 8. Attribute Target Value of Brem Packaging

Packaging aspect	Current Value	Ideal target value	Target reason
Product information	3.5/5	4.8/5	Reorganization of the halal label, selection of appropriate font for product

			information, and inclusion of the "Suling Indah Jaya" business logo.
Visual design	3.0/5	4.7/5	Development of a more modern visual packaging design incorporating a harmonious color palette suitable for the new packaging concept..
Functional packaging	4.4/5	4.6/5	mplementation of laminated packaging (plastic + cardboard) for all product variants.
The shape and size of the packaging.	4.4/5	4.5/5	Enhanced consideration of storage convenience to ensure product protection from humidity and outdoor air
Packaging materials	4.0/5	4.6/5	Current packaging shape and size are excessively large, rendering the product susceptible to damage during extended transportation.

Sources: Processed data

The next step involves the determination of the difficulty level associated with implementing the technical responses derived from interviews with Suling Indah Jaya. The difficulty levels are categorized as "Easy" (1), encompassing attributes such as product information, and the shape and size of packaging; "Moderate" (3), including packaging material and visual design; and "Difficult" (5), which pertains to functional packaging. Following this, a benchmarking phase is conducted in the development of *Brem* packaging at Suling Indah Jaya by comparing the existing packaging design with the novel packaging concepts developed based on consumer preferences. Subsequent to benchmarking, the next step is to establish target values aimed at generating packaging that is more appealing, functional, and aligned with consumer preferences. The determination of these target values (Table 8) is based on the outcomes of interviews with Suling Indah Jaya, which established a maximum value of 5 and a minimum value of 1 as primary references for packaging development.

The last stage involved the completion of the House of Quality (HoQ) construction, based on the data acquired. The final outcome of the HoQ analysis is illustrated in Figure 5. Based on the planning matrix (table 5), significant overhauls to the packaging are not

deemed strictly necessary, as the majority of aspects already meet the anticipated standards. Nevertheless, continuous improvement efforts should be undertaken to optimize packaging quality, thereby enhancing both the appeal and consumer satisfaction associated with Brem Suling Indah Jaya products. The "importance to customer" assessment indicates that product information, packaging material, and functional packaging are the attributes of highest importance to consumers. While visual design is not the primary concern for consumers, this aspect still warrants attention to enhance product attractiveness and ensure visual coherence with the product information. Regarding Customer Satisfaction Performance, the attribute of product information received a higher rating compared to the other four attributes, specifically encompassing the inclusion of a halal label, composition details, expiration date, and the producer's logo. Furthermore, the Improvement Ratio calculations, with values of 1.2 and 1.15 for relevant attributes, suggest that improvements of 20% and 15% from the current Customer Satisfaction Performance are sufficient to achieve the desired goals for enhancing the packaging quality of Brem Suling Indah Jaya. Gradual and less drastic modifications should still be considered to potentially elevate the desired goals in alignment with consumer expectations. The primary areas of improvement for Suling Indah Jaya should focus on product information, visual packaging design, packaging material, and functional packaging. The shape and size of the packaging require adjustment, although no radical changes are necessary compared to the previous packaging.

Figure 1. The House of Quality Matrix

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Jaya packaging development, the Column Weight aids in determining the technical features that exert the most significant influence on customer satisfaction, while the Column Number systematically organizes each characteristic within the QFD process.

CONCLUSION AND RECOMMENDATIONS

The Voice of the Customer (VoC) analysis provide 19 distinct requests from consumers, which were subsequently synthesized in consultation with the company into five key packaging attributes, as several of the initial requests exhibited thematic convergence. The prioritized packaging attributes are as follows:

- a. Product Information, encompassing the inclusion of a halal label, composition details, and the packaging logo.
- b. Functional Packaging, aimed at safeguarding the product from external atmospheric conditions and physical damage.
- c. Packaging Material, primarily consisting of plastic as the primary layer, supplemented by cardboard for enhanced protection.
- d. The size and shape of the packaging, matched to the specific dimensions and shape of the product.
- e. Visual Design, characterized by a more modern aesthetic employing a brown and white colors.

Notably, this prioritization of changes does not entirely align with the current emphasis of Suling Indah Jaya, as the producers initially favored a significant improvement of the visual design, an aspect that received the lowest percentage of positive ratings from consumers. Nevertheless, Suling Indah Jaya approved the proposed packaging improvements. This agreement was predicated on the established technical responses, thereby enabling the implementation of the new packaging design in subsequent production runs.

The findings of this research offer practical guidance for Brem producers, particularly Suling Indah Jaya, in the design and development of more appealing, functional packaging that aligns with consumer preferences. Furthermore, this study highlight the strategic importance for Brem producers of conducting periodic packaging evaluations to ensure the continued relevance of their packaging in the face of evolving market. Such regular assessments are crucial for maintaining product quality, enhancing brand image within the market, and supporting the sustainability of the business as a producer of distinctive regional souvenirs. This can contribute to an enhanced competitive advantage for their products in the marketplace.

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