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(CASE REPORT)

Strategic packaging redesign of tempeh products using SWOT Analysis and Kansei Engineering: A Case Study of Tempeh Production House "C"

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Abstract

This research aims to redesign the packaging of tempeh products at Tempe Production House "C" to enhance competitiveness and consumer satisfaction. The methods used include SWOT analysis to identify internal and external conditions, as well as Kansei Engineering to translate consumer perceptions into packaging design. Data were analyzed using validity tests, reliability tests, and Principal Component Analysis (PCA). The results show that the main weakness of the product lies in the packaging, which is less attractive and informative. PCA analysis produced three main dimensions: safety and structure, clarity of information, and product identity. The new packaging design produced shows a significant improvement based on the Customer Satisfaction Score (CSAT), from a range of 20%–39% to above 84%. This indicates that the approach used is effective in enhancing packaging quality and consumer satisfaction.

Keywords: Kansei; Packaging; Redesign; Tempeh

1. Introduction

Tempeh is one of Indonesia's traditional food products that has a high nutritional content, a relatively affordable price, and a wide level of consumption in society [1,2]. With the increasing awareness of healthy food consumption patterns and the tendency to consume local products, tempeh has a great opportunity to develop and compete in a wider market, including the modern retail market [3,4]. However, the competitiveness of tempeh products is not only determined by the intrinsic quality of the product but also by external factors such as packaging, which plays a crucial role in attracting consumer attention and shaping perceptions of the product [1,2].

Packaging has a strategic function as a product protector and a communication medium that can convey information, build an image, and influence consumer purchasing decisions [4,5]. Optimally designed packaging can enhance the product's added value thru visual aspects, clarity of information, and brand identity [1,6]. However, in practice, many micro, small, and medium enterprises (MSMEs) still use simple packaging that is less attractive and does not optimally meet the aspects of informativeness and hygiene.

Based on initial observations and the identification of existing conditions at Tempe Production House "C," it is known that although the produced tempeh has good quality, affordable prices, and is well-known at the local level, the packaging aspect still has several limitations. The packaging used tends to be simple, lacks a clear brand identity, and does not present complete product information. In addition, the visual appearance of the packaging does not yet optimally represent the quality of the product. This condition has the potential to hinder the product's competitiveness, especially when facing similar products that already have more modern and informative packaging [7,8].

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Based on the aforementioned issues, a systematic approach is needed to identify internal and external factors that influence product development, while also formulating appropriate improvement strategies. SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) is used in this study to comprehensively evaluate the strategic condition of the product [9]. Next, the Kansei Engineering approach is applied to integrate consumer perceptions and emotional preferences into the packaging design process [10,11]. This approach allows for the translation of consumer needs into more targeted design elements that align with market expectations.

2. Methods

This study employed a sequential two-stage approach to analyze and improve the packaging design of tempe products in Tempeh Production House "C". The first stage focused on strategic analysis using SWOT, while the second stage involved packaging redesign based on Kansei Engineering and CSAT test

2.1. SWOT Analysis Stage

In the first stage, a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis was conducted to evaluate the internal and external conditions of the tempe product [1,9,12]. Data were collected through questionnaires distributed to consumers, interviews with the business owner, and direct observations of the product and its packaging.

The questionnaire utilized a five-point Likert scale to assess the importance and performance of each identified factor. Internal factors were categorized into strengths and weaknesses, while external factors were classified as opportunities and threats. All factors were then quantified using the Internal Factor Analysis Summary (IFAS) and External Factor Analysis Summary (EFAS) matrices [13,14]. Each factor was assigned a weight based on its relative importance, and a rating was given to reflect the current condition of the product. The weighted score for each factor was calculated by multiplying the weight and rating. The total scores of IFAS and EFAS were used to determine the strategic position of the product through a Cartesian diagram. Based on this positioning, appropriate strategic alternatives (SO, WO, ST, and WT) were formulated [15,16].

2.2. Kansei Engineering dan Customer Satisfaction Score (CSAT) test

In this study, the Kansei Engineering approach is applied to connect consumers' emotional perceptions with product characteristics [10,17]. The data obtained from respondents were analyzed using Principal Component Analysis (PCA) to reduce dimensions and identify the dominant factors influencing consumer perception [18,19]. Next, customer satisfaction levels are measured using the Customer Satisfaction Score (CSAT) method [20,21] . Based on those results, the product refinement stage is carried out as an effort to improve quality. The series of research processes is summarized in diagram shown in Figure 1.

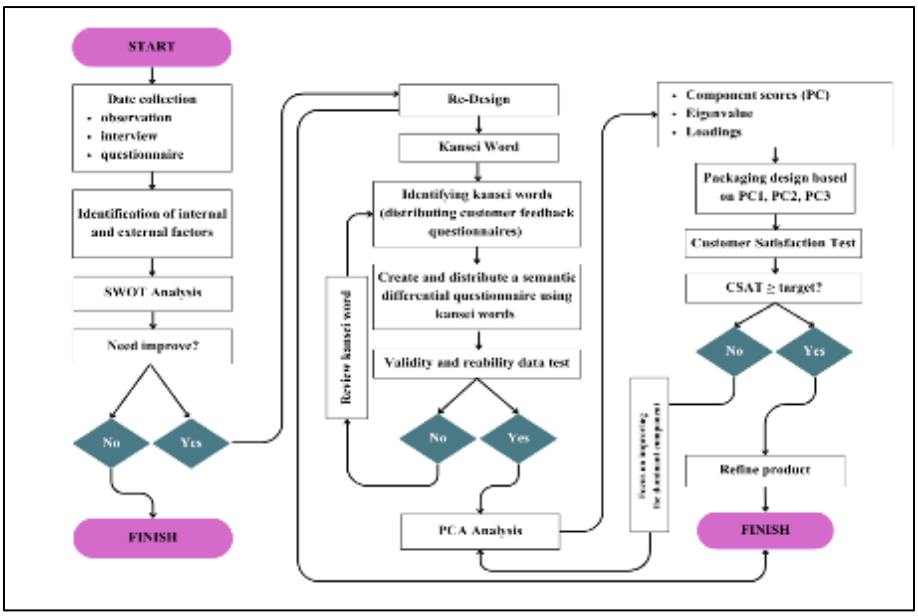

Figure 1 Research process

Kansei elements were determined through the categorization of variables. Grouping variables in the design involves identifying Kansei words (customer aspirations). Kansei words were acquired by the administration of questionnaires using Google Forms, employing a purposive judgment sample technique, comprising 70 respondents in the initial phase of the research and 50 respondents in the subsequent phase [22,23]. The results of the Kansei words were then tabulated and eliminated to determine the highest number of Kansei for each variable. The Kansei with the highest value is then analyzed using Principal Component Analysis (PCA) to identify the main factors influencing consumer perception. The results of the PCA analysis were then used as the basis for designing the packaging. The packaging redesign was then carried out using the Canva application. Then, then, the design was tested using the Customer Satisfaction Score (CSAT) method, as follows:

$$\text{CSAT} = \frac{\sum satisfied\ responses}{\sum total\ responses} x\ 100\% \qquad \ldots\ldots\ldots\ldots (1)$$

with a scale of 1 (very satisfied), 2 (satisfied), 3 (moderate), 4 (dissatisfied), 5 (very dissatisfied).

3. Result

3.1. SWOT Analysis

Based on observations, consumer interviews, and benchmarking of similar products, internal factors (strengths–weaknesses) and external factors (opportunities–threats) were obtained as follows on Table 1 and Table 2.

Table 1 Internal factor analysis summary

Attribute	No	Internal Factor	Bobot	Rating	Score
Strength	1	The quality of the tempeh is good	0,15	4	0,60
	2	The price is affordable	0,10	4	0,40
	3	The product is fresh	0,12	4	0,48
	4	It is already well-known locally	0,08	3	0,24
Total					1.72
Weakness	1	The packaging design is unappealing.	0,15	2	0,30
	2	There is no label information.	0,10	2	0,20
	3	The packaging is not hygienic.	0,15	2	0,30
	4	There is no brand identity.	0,15	2	0,30
Total			1.00		1.10

Table 2 External factor analysis summary

Attribute	No	External Factor	Bobot	Rating	Score
Opportunities	1	Healthy food trends	0.20	4	0.80
	2	Increased awareness of local products	0.15	3	0.45
	3	Potential in the modern market (retail)	0.15	3	0.45
	4	Innovative eco-friendly packaging	0.10	3	0.30
Total					**2.00**
Threats	1	Competing products are more modern	0.15	3	0.45
	2	Perception of tempeh as a cheap food	0.10	2	0.20
	3	Low product durability	0.10	2	0.20
	4	Food labeling regulations	0.05	2	0.10
Total			1.00		**0.95**

Strategies were developed in the SWOT matrix according to IFAS and EFAS, as illustrated in Table 3.

Table 3 SWOT Matrix

	Opportunity (O)	**Threat (T)**
Strength (S)	Strategy SO	Strategy ST
	Developing modern packaging designs to attract new markets	Highlighting product quality to compete
	Leveraging hygiene trends with food-grade packaging	Keeping prices competitive
	Rebranding local tempeh products	Differentiation from substitute products
Weakness (W)	Strategy WO	Strategy WT
	Re-design the packaging to make it more attractive and informative	Improving packaging quality to remain competitive
	Add labels (nutrition, halal, expiration)	Production cost efficiency
	Create a brand identity (logo, signature color)	Product and packaging innovation

Based on the results of IFAS and EFAS, a Cartesian Diagram analysis is performed to establish the priority of product attribute development in terms of importance and performance (Figure 2).

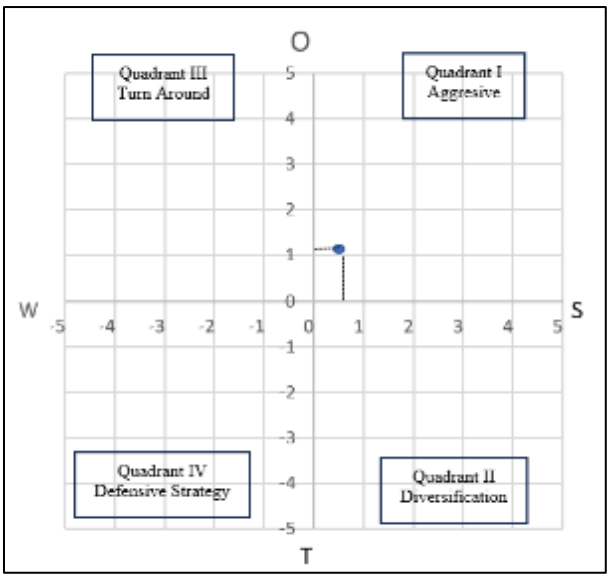

Figure 2 Cartesius SWOT diagram

Based on the results of the IFAS and EFAS analysis, the strategic position is in the aggressive quadrant, indicating that internal and external conditions strongly support product development [24,25]. One of the things that can be done is to maximize strengths in the aspects of packaging safety and product information clarity, thereby increasing the product's competitiveness in the market.

3.2. Kansei Engineering Analysis

Based on the results of the SWOT analysis, packaging is identified as a top priority that requires improvement to enhance the product's competitive position in the market. On the other hand, the Kansei Engineering approach provides guidance in designing packaging that aligns with consumer perceptions, emotions, and preferences[26].

3.2.1. Identifications of Kansei Element for packaging Design

Based on the consumer survey, the most dominant Kansei words are found in Table 4.

Table 4 Identification Kansei word and grouping

Atribute	Kansei Word	Frequency
Visual estetic	Creative	27
	Elegan	43
	Attractive font	56
	Traditional/ characteristic	8
	Clean	36
Safety and Trust	Safe	63
	Hygine	57
	Trusted	19
Clarity and Readability	Easy to understand	56
	Easy to read	12
	Clear	9
	Well Organize	35
	Informatif	19
Product Identity	Merk	66
	Date production	41
	Expired date	9
	Producen	12
	Weight	3
Functional Quality	Plastic	45
	Suitable for food	30
	Natural	15

Based on the questionnaire results, a reduction process was carried out on the Kansei words in Table 1, considering the selection frequency by the respondents. The Kansei words with the highest selection rates are retained, while those with lower frequencies are eliminated. In this study, Kansei words with the highest frequency were selected as the main representation of consumer perception (Table 5).

Table 5 Elimination of Kansei word

Atribute	Kansei Word	Frequency
Visual estetic	Attractive font	56
	Elegan	43
	Clean	36
Safety and Trust	Safe	63
	Hygine	57
	Trusted	19

Clarity and Readability	Easy to understand	56
	Well Organize	35
	Informatif	19
Product Identity	Merk	66
	Production date	41
	Producen	12
Functional Quality	Plastic	45
	Suitable for food	30
	Natural	15

3.2.2. Validity and Reliability Test

Validity and reliability testing were conducted using SPSS v26 software. The first step is to conduct a data validity test using the Bivariate Pearson method. The data validity test is conducted using a significance value of 0.05. Thus, the obtained r table value is 0.279 with a total of 50 respondents [27–29]. Based on the results of the validity test, it can be concluded that kansei words are considered valid if the Pearson Correlation value of each kansei word > r table (Table 6).

Table 6 Validity test results

No	Kansei Word	R calcultaion	R table	Summary
1.	Attractive font	0,308	0.279	Valid
2.	Elegan	0,361	0.279	Valid
3.	Clean	0,294	0.279	Valid
4.	Safe	0,343	0.279	Valid
5.	Hygine	0,404	0.279	Valid
6.	Trusted	0,411	0.279	Valid
7.	Easy to understand	0,433	0.279	Valid
8.	Well Organize	0,504	0.279	Valid
9.	Informatif	0,414	0.279	Valid
10.	Merk	0,409	0.279	Valid
11.	Production date	0,208	0.279	No Valid
12.	Producen	0,330	0.279	Valid
13.	Plastic	0,344	0.279	Valid
14.	Suitable for food	0,323	0.279	Valid
15.	Natural	0,082	0.279	No Valid

From the results of the validity test calculations, it can be concluded that 2 words in the Kansei Word are declared invalid, namely 'production date' and 'natural'. Meanwhile, for the reliability test of the questionnaire data, it is conducted by comparing the Cronbach's Alpha value. If the Cronbach's Alpha value ≥ 0.7, then the data is considered reliable [30,31].

Table 7 Cronbach's Alpha

Reability statistics	
Cronbach's Alpha	N of items
0.705	15

Based on the reliability test results of the semantic differential kansei words questionnaire data using SPSS v26 software, it was found that the Cronbach's Alpha value (0.705) ≥ 0.7 (Table 7). It can be said that the kansei words questionnaire data is reliable and further data processing can be carried out.

3.2.3. PCA Analysis

The design data analysis comes from a semantic differential questionnaire with validated Kansei words, which was then processed using PCA in R software. The principal components (PC) were selected based on the highest standard deviation values and cumulative proportion (Table 8).

Table 8 Standard deviation, variance, and cumulative variance of data

Component	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**	**PC6**
Std Dev	1.3795	1.2829	1.0262	0.7532	0.6577	0.6311
Proportion	0.3172	0.2743	0.1755	0.0945	0.0721	0.0664
Cumulative	0.3172	0.5915	0.7670	0.8615	0.9336	1.0000

Further interpretation thru factor loading shows that PC1 represents the dimensions of safety and packaging structure, PC2 represents product identity and information readability/ clarity, while PC3 depicts the interaction between visual esthetics and ease of understanding (Table 9).

Table 9 Matrix Loading of PCA

Variabel	**PC1**	**PC2**	**PC3**
Well Organize	0.4521	0.3358	0.3458
Attractive font	-0.0877	0.5131	0.6008
Easy to understand	-0.3052	0.4509	-0.4929
Merk	-0.2282	0.6127	-0.1963
Safe	0.6096	0.1565	-0.0790
Plastic	0.5207	0.1444	-0.4814

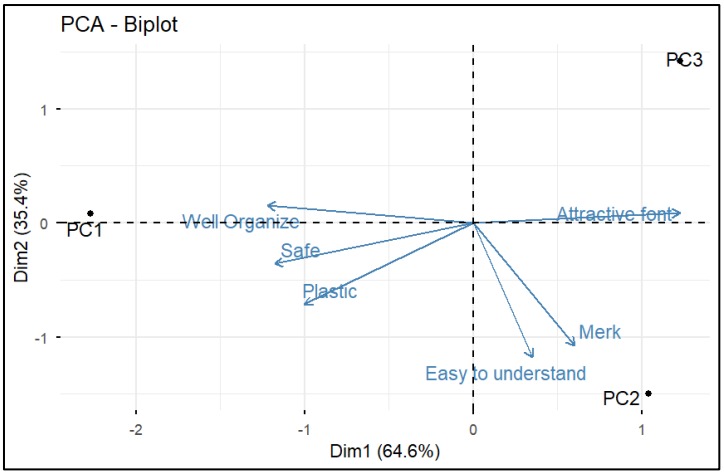

Figure 3 PCA Biplot of Kansei Attribute

The PCA biplot diagram shows the relationship between Kansei attributes and products in the two main dimensions, namely PC1 (64.6%) and PC2 (35.4%), which cumulatively explain almost all the data variation (Figure 3).

3.3. Packaging design

The analysis indicates that the creation of tempe packaging design has significant implications in three primary dimensions: structure and safety (PC1), clarity and readability (PC2), and product identity (PC3). According to the findings from Kansei and PCA, the proposed packaging design is presented on Figure 6.

Figure 4 Redesign tempeh packaging

3.4. Consumer Satisfaction Evaluation (CSAT) of Packaging Design

CSAT is calculated based on the average score of respondents' ratings on a Likert scale, then converted into a percentage by comparing it to the maximum scale value [32]. The results of the Customer Satisfaction Score (CSAT) calculation in Table 10.

Table 10 Consumer Satisfaction Evaluation (CSAT) of Packaging Design (old and new)

Result and Attribute Design	Safety	Well Organize	Easy to Understand	Merk	Attractive Font	Plastic
Old Design	39.33%	22.27%	22.27%	38.67%	20.00%	20.00%
New Design	86.67%	86.00%	84.67%	84.67%	84.67%	92.67%

The results of the Customer Satisfaction Score (CSAT) calculation in Table 7 show that the new packaging design has experienced a very significant improvement in all attributes compared to the old packaging.

4. Discussion

Based on the IFAS and EFAS analysis (Table 1 and Table 2), Tempe Production House "C" has its main strengths in product quality, affordable prices, and the freshness of tempeh, with an IFAS score of 2.82 indicating a strong internal condition. However, the main weaknesses lie in the less attractive packaging, lack of hygiene, and minimal information and brand identity. Externally, the EFAS score of 2.95 indicates a significant opportunity, especially from the increasing trend of consuming healthy and local products, although there are still negative perceptions regarding the durability of tempeh and its image as a cheap product. Therefore, the most appropriate strategy is to leverage opportunities by improving packaging weaknesses thru more attractive, hygienic innovations, and a strong brand identity, thereby enhancing competitiveness and consumer experience.

The standard deviation in PCA (Table 8) shows the contribution of each component in explaining data variation, with PC1 being the most dominant, followed by PC2 and PC3, where all three can explain 76.70% of the data variation. PC1 represents aspects of packaging structure and safety, PC2 clarity of information and identity, and PC3 strengthening product identity. The new packaging design shows improvements in all three aspects thru the use of hygienic transparent materials, clearer and more structured information presentation, and the reinforcement of a consistent visual identity. Overall, the new packaging is more balanced between functional, communicative, and visual aspects, which has significantly improved consumer satisfaction, as indicated by the increased CSAT value from the low range of the old packaging to above 84% on all attributes (Table 10).

5. Conclusion

Tempeh products from Tempeh Production House "C" excel in quality and price, but are weak in packaging, so improvements are needed to enhance competitiveness. Kansei Engineering and PCA identified the main factors as safety, clarity of information, and product identity. The redesign of the packaging has been proven to significantly increase consumer satisfaction.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors Oksilia, Gatot Priyanto, Daniel Saputra, Anny Yanuriati declare that have no conflict of interest to Tempeh Production House “C”.

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