BOTTLE DESIGN OF ONION CHILI SAUCE USING KANSEI ENGINEERING FOR SMEs IN INDONESIA

Weldellin Tanawi[1], Syafina Aisha Fitori[2], Rida Zuraida[3*]

Industrial Engineering Department, Faculty of Engineering Bina Nusantara University, 11480, Jakarta, Indonesia[123]

welldelin.tanawi@binus.ac.id[1], syafina.fitori@binus.ac.id[2], rzuraida@binus.ac.id[3*]

ABSTRACT

Onion chili sauce is one of popular food product in Indonesia, and currently it available at many e-commerce platforms. The problem that is faced by the producer is generic bottle packaging which may not meet consumer expectations. This study aims to design the product packaging for onion chili using Kansei Engineering (KE) to increase its value. This research was conducted in two stages, the first stage was to assess customer satisfaction and collect Kansei words that related to packaged onion chili. The satisfaction level was measured based on color, packaging durability, and packaging style. In the second stage, a questionnaire consisting of a packaged design checklist and Kansei words was developed, then, those were reduced using Principal Component Analysis (PCA) that resulting 3 main factors (convenience, durability, and hygiene & attractiveness). The result was then followed by determining the elements of the new design based on Partial Least Square Regression (PLSR) and followed by design requirement analysis. The CSI index has pinpointed the area for enhancement: improving font color on the information label to make it more readable. Evaluation using KE in design requirements has uncovered three essential factors important for revamping the packaging of product bottles: convenience, durability, hygiene, and appeal. Three proposed bottle designs were developed based on those 3 main factors as an alternative design for SMEs who sell this kind of product.
Keywords: Bottle Design, Kansei Engineering (KE), Onion Chili, Sauce, Convenience, Durability.

1. Introduction

Indonesia is famous for its richness of spices, various foods and culinary delights. Food processing and packaging technology continues to develop, encouraging the small and medium-sized enterprises (SMEs) to become at the forefront of innovation, driving the growth and diversification of the nation's food industry. Sales channels, including online media, increase market opportunities. During last pandemic, e-commerce transaction in Indonesia was increasing rapidly. The transaction value reached 145.17 trillion rupiah (2019), 204.91 trillion rupiahs (2020), 305.44 trillion rupiahs (2021), and post-pandemic about 476 trillion rupiah in 2022, 474 trillion throughout 2023. The value of e-commerce transactions is predicted to grow 2.8% to IDR 487 trillion in 2024 and 3.3% to IDR 503 trillion in 2025 (Haryati, 2021; Ahdiat, 2022; Nurhayati-Wolff, 2024). Those transactions are believed to be dominated by SMEs sectors. In 2021, the number of SMEs was about 65.47 million units, and it absorbed almost 97% workforce and has a significant contribution to Product Domestic Bruto (60.3%), and to national export (14.4%) with average annual revenue 3.6 billion in 2020 (the highest average revenue was 10.25 billion in West Sulawesi, and the lowest was 325 million rupiahs in North Kalimantan (Rizaty, 2022; Hermawan, 2022).

The growth of sales channels including e-commerce drives the need for food packaging. Based on data from the Indonesian Packaging Federation (IPF), in 2021 the growth of the packaging industry in Indonesia only increased by 3-4% with a packaging production value of around IDR 102-105 trillion. This was influenced by pandemic restrictions and rising raw material prices. Meanwhile, in 2022, local packaging production is estimated to grow by 5% with a production value of IDR 107.1-110.2 trillion, and increase by 6% in 2023, the packaging production value will reach IDR 116.8 trillion (Fitriani, 2023).

Even though SMEs have great potential, the SMEs faced several obstacles in their business. The obstacles include marketing difficulties, limited human resources (HR), raw material limitations, limited innovation and technology, and difficulty accessing financing

sources (Kindström et al., 2024). Digitalization in marketing through e-commerce channels and other platforms has become one of the ways to reach out to more customers (Abdul-Azeez et al., 2024). In supporting marketing, how the food is packaged becomes more important. However, SMEs often struggle with designing the right package for their product, as well as the high costs associated with quality packaging materials and design.

Currently, some of the packaging of food products is considered dull, provides incomplete information, has no distinguishing signature, and is generic(Chitturi et al., 2019). Packaging plays a major role in marketing a product, such as attracting consumer attention, describing product features, and making an impression on consumers. Packaging with good aesthetics and functional values is believed to be able to satisfy consumer needs (Kotler, 2012). Packaging represents the product's external point of view that is useful for increasing buyer expectations of the product. This includes information about product composition, appearance, branding, packaging materials, and product price. This aspect will be considered as important to consumers and will affect consumer's emotions toward products (Gunaratne, et al., 2019). A study of traditional Indonesian instant food brand packaging found that most of the packaging was functional but not unique. To make the product look more eye-catching and emotional, three elements can be applied to the packaging design: first, leave a unique impression with unusual colors and shapes, second, a traditional image rather than a modern one, and third visual and verbal icons referring to the origin of the traditional dish that are still popular to create a familiar image (Hartanti & Nurviana, 2020).The rapid growth of e-commerce in Indonesia has created new market opportunities for SMEs, yet these businesses face significant challenges with packaging design and materials, often resorting to generic solutions that fail to differentiate their products.

One Indonesian product that is quite popular and has potential sales is sambal bawang (onion chili sauce). This kind of product reaches 1.000 sales monthly and there are more than 10.000 brands of onion chili that can be found on the e-commerce platform. The sambal bawang in a package is quite popular because it is practical and easy to serve, so this chili sauce is a very promising business opportunity. This product usually has similar bottles or plastic packaging, and the customer has difficulties distinguishing them from each other. On the other hand, consumers also have several problems before and after opening the packaging, such as how to open and store it, the hygienist, how long it spoiled after it opens, and so on. These considerations are not affected by whether purchases are made through digital channels or direct purchases to stores (Agus et al., 2021). A critical issue lies in the packaging of products like sambal bawang (onion chili sauce), where generic and uninspired packaging fails to attract consumers and differentiate products in a crowded market. This inadequacy not only hampers consumer satisfaction but also limits the competitive edge of SMEs. Despite the potential of innovative methodologies like Kansei engineering to enhance packaging design by aligning it with consumer emotions and preferences, there is a notable gap in research applying these techniques to the food packaging sector in Indonesia. Addressing this gap could significantly improve product appeal and market success for SMEs, making this research both timely and essential

Selection of food packaging could play an important role in standing out from the crowd. One such product, the onion chili, has been the subject of increasing interest and scrutiny(Taneo et al., 2019). The onion chili product faces several obstacles in its quest to differentiate itself from similar offerings, and the importance of bottle design and packaging cannot be overstated (Alawamleh et al., 2022). The SMEs may prefer to use generic packaging for their product to minimize the cost, so they choose to use the packaging that is available in the market. The consumers also have no other choice or voice.

For chili-based products like sambal bawang, inadequate packaging not only hampers consumer satisfaction due to practical concerns but also lacks the emotional appeal needed to attract and retain customers. Addressing this gap can help SMEs create distinctive, consumer-friendly packaging that enhances functionality and market appeal, thereby boosting their competitiveness in the digital marketplace. In this research, the application of Kansei engineering as a methodology, aims to translate customer emotional responses into product design elements, as a means of enhancing the packaging design of chili-based food products for

SMEs. Kansei engineering has been widely adopted in various product development contexts, from designing sling bags to enhancing the packaging of peppermint hard candies(Fajri Hasibuan, 2020; Effendi et al., 2020). Through the integration of Kansei engineering and the Kano model, a framework for classifying products based on customer satisfaction, this study seeks to identify the key Kansei words that influence consumer perception and satisfaction with the packaging of chili-based food products(Djatna & Kurniati, 2015; Effendi et al., 2020; Ginting & Ali, 2019; Prastawa et al., 2021). This research aims to explore the application of Kansei engineering to enhance the packaging design of chili-based food products, thereby improving consumer satisfaction and competitive advantage for SMEs.

2. Literature Review

The reviewed literature highlights the effectiveness of Kansei engineering in capturing the emotional and perceptual responses of customers to product design elements (Fatchurrohman et al., 2022; Fitriani, 2023; Ginting & Ali, 2019; Prastawa et al., 2021). SMEs can develop more effective and appealing packaging designs that cater to the target market's preferences and needs, and on understanding the emotional and psychological factors that drive consumer perception and purchase decisions (Rodrigues et al., 2021). Kansei engineering, an affective engineering methodology, offers a compelling approach to translating consumers' feelings and emotions into tangible design elements(Papantonopoulos et al., 2021).

Existing research has demonstrated the efficacy of Kansei engineering in various product domains, from gloves (Ginting & Ali, 2019) to briefing presentations for the elderly(Chen & Huang, 2014). Kansei engineering provides a framework for connecting user perceptions and emotional desires to specific product attributes, allowing designers to better align their creations with consumer preferences. The integration of Kansei engineering principles with product design and development will enable the creation of a chili sauce bottle that not only satisfies functional needs but also captivates consumers on an emotional level, ultimately enhancing their overall experience (Ariyanti & Chan, 2020; Tama et al., 2015).

A combination of Kansei words, principal component analysis, and partial least square regression to identify the key design elements that resonate with consumers (Fatchurrohman et al., 2022; Tama et al., 2015). By uncovering the underlying Kansei words associated with the desired product characteristics, such as "fresh," "spicy," and "convenient,". The study discusses about the that not only meets functional requirements but also evokes a positive emotional response from users' development (Ariyanti & Chan, 2020; Tama et al., 2015; Wang & Ju, 2013). Design should incorporate smooth lines and a sleek, modern shape to appeal to the visual senses. In terms of color, a vibrant and fresh green or red hue can create an immediate connection to the product's key ingredients—onion and chili—while also conveying a sense of freshness and passion. Additionally, the materials used should be not only durable but also easy to clean and maintain for optimal hygiene. Similar work that was done by Nurudin (2022) suggested that for packaging design, the label should include expiry information, the lid uses a seal, and the color of the lid is adjusted to the product variant. See Table 1 for comprehensive review:

Table 1 - Literature review.

Topics	Author(s)	Similarity	Difference
Kansei Engineering in Product Design	(Fajri Hasibuan, 2020; Ginting & Ali, 2019; Prastawa et al., 2021; Rahayu et al., 2021)	Utilize Kansei Engineering to enhance product design, focusing on emotional and functional aspects to improve user satisfaction	While most papers focus on food packaging, Hasibuan applies Kansei Engineering to a non-food product (sling bag), and Yang & Jia provide a broader study on Kansei Engineering applications, and Ginting et al., and Ariyanti et al. proposed the integration Kansei Engineering with QFD, and Prastawa et al. integrated the process with Kano Model
Packaging Design and	(Gunaratne et al., 2019; Hartanti & Nurviana,	Both papers focus on how packaging design	Hartanti & Nurviana (2020) focus on traditional Indonesian food,

Topics	Author(s)	Similarity	Difference
Consumer Behavior	2020)	influences consumer behavior and preferences.	while Gunaratne et al. (2019) study chocolate packaging.
Packaging and Satisfaction	(Fithri et al., 2022; Hadi et al., 2021; Hartono et al., 2017)	Packaging design on customer satisfaction	Fitri et.al and Hadi et al (2021) focus on relationship between packaging design and customer satisfaction, and Hartono et al., 2017 focus on focuses on service improvement in logistics

3. Research Methods

To aim the objective of this study, an assessing the current opinion of the customer to the product was conducted. The collected data was driven in two stages, in both stages, a questionnaire was used as a tool. In the first stage, a questionnaire was used to collect a customer satisfaction index for the union chili product in general and collect words that have an important relation to onion chill packaging. Those words become an input to the second stage as Kansei words as part of Kansei Engineering (KE) method. Kansei Engineering (KE) is commonly used to translate consumer perception toward product into design element (Dewi et al., 2017). In the second stage, the participants were asked to rate those words as input to develop the product along with the product specification (specimen) checklist. To be clear, in this research the methodology and research flow developed by authors and describe in Figure 1 below:
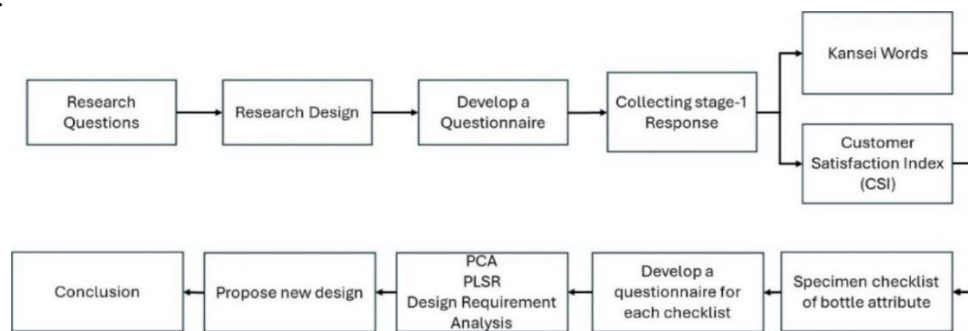

Fig. 1. Research Methodology

In this study, 121 responses were collected, however, only 108 responses were processed and analyzed further, as they claimed as a consumer of packaged onion sauce products. The questionnaire distributed online through email and messenger application. The questionnaire of satisfaction index measured some variables: color, packaging durability, and packaging style. The color variable was chosen because it has a very large influence on a product and how consumer views to the product, and color can make the atmosphere of a text livelier (Hadi et al., 2021; Khattak et al., 2021). The packaging durability variable was chosen because it has influences to the choice of material to be used for a product (Hadi et al., 2021). The packaging style is related to the size of the packaged product which also influences the consumer's perception of the volume or weight, and the consumer's psychological attractiveness to the design of the package. The questions are as follows in Table 2:

Table 2 - Attribute, Question, and Variable

No	Attribute	Question	Variable
1	W1	The package color is attractive	
2	W2	Conformity of the color of the packaging label with the onion sauce product	Color
3	W3	Font color in the information label is easy to read	
4	KK1	Packaging is not easily damaged or leaks	
5	KK2	The ability of the packaging to maintain the quality of its contents before and after opening the package	Packaging Durability

6	KK3	Reusable packaging	
7	BK1	Onion sauce packaging design is easy to carry and use (easy to handle)	
8	BK2	The onion sauce packaging design is easy to open and close	Packaging Style
9	BK3	The onion chili packaging design is easy to store/organize	

The specific variables and questions included in the questionnaire were selected based on a comprehensive literature review. The questionnaire was subjected to a validation process to ensure its reliability and validity, including the content validity to ensure that the questionnaire comprehensively covers the research topic, the construct validity to confirm that the questions accurately measure the intended constructs, and last phase was reliability testing to assess he consistency of the responses through measures such as Cronbach's alpha.

The questionnaire was applied to measure the Customers Satisfaction Index (CSI) of the Onion Chili packaging in general. Along with the measurement, the Kansei Engineering (KE) methodology was also utilized in the first stage. Kansei Engineering (KE) is a technique that translates human emotion and psychology into a new product. The process begins by collecting sensory-related functions such as feelings, emotions, and intuition, through the five human senses (Nagamachi & Lokman, 2016). Customers who are emotionally satisfied with the services they receive will have strong memories and create loyalty emotion to the product or services. Several stages in Kansei Engineering were applied in this study, which were(Hartono et al., 2017):

1. Specimen is synthesized by looking at existing sample products that have a visually distinct for a particular domain. The next procedure is to investigate the design elements of each sample with the number of design elements according to the level of detail. The design elements obtained will be classified into items and categories. Items are physical attributes that exist in each specimen, while the category is a specification of each item. Finally, a valid specimen for Kansei measurement was created based on all initial samples.
2. Creating the Kansei checklist by: (a) building Kansei words, (b) choosing a specific domain for Kansei words (c) building a checklist.
3. Kansei calculation and requirements analysis with experts or consumers of the product. The results are used to determine design requirements in product development stage
4. Kansei product prototype at level tests the validity of the design requirements

The stage of this research describes as follows:
1. *Distribution of Questionnaire 1*. The study continued by distributing questionnaires about customer satisfaction with chili sauce packaging in general and asking about hopes or expectations that can be expressed on chili sauce packaging in the form of Kansei words. The purpose of the questionnaire was to measure the level of customer satisfaction with chili sauce in general and to obtain Kansei Words for the next stage of research.
2. *Selection of Kansei Words*. The results of collecting Kansei Words in the first questionnaire will be summarized and selected for Kansei Words for the next stage of data processing.
3. *Distribution of Questionnaire 2*. Distribution of the second questionnaire containing the value of Kansei words against the selected product specimens. Respondents will assess each Kansei word contained in each specimen with a Semantic Differential (SD) scale. The purpose of distributing the questionnaire is to determine the relationship between each Kansei Word that has been obtained and as material for analyzing design needs for chili sauce packaging products.
4. *Principal Component Analysis and Design Needs Analysis*. The results of the questionnaire using the SD scale can be used for principal component analysis, namely the relationship between the Kansei Words that have been obtained. The purpose of the principal component analysis is to reduce the number of Kansei words obtained and used as the basis for the new packaging design. The results of the questionnaire were also analyzed for design needs based on the specimens used with Partial Least Square Regression (PLSR). The goal is to

determine the appropriate packaging elements so that they can meet the expectations or feelings that are right for customers.

5. *New Kansei Product Design*. The results of the factor analysis and design needs can be used as material for designing new chili sauce packaging that suits customer feelings.

4. Results and Discussions

Customer Satisfaction Index

In the first stage, a questionnaire was distributed to find satisfaction and interest values, about 121 respondents filled a questionnaire online however only 108 respondents had ever been consuming onion chili in packaging. Cronbach's alpha of the instrument for variables importance was 0.8786 dan performance was 0. 9153. The results of the validity test for the satisfaction value show that all attributes of satisfaction value are valid, and the data can be used for the next stage, the data processing for the customer satisfaction index and gap analysis. The result of CSI score is described as follows (Table 3).

Table 3 - Questionnaire results.

Attribute	Performance (x)	Importance (y)	x̄	ȳ	Weight Factors (WF)	Weighted Score (WS)	CSI
W1	400	403	3.70	3.73	10.09%	0.37	
W2	406	403	3.76	3.73	10.09%	0.38	
W3	424	444	3.93	4.11	11.12%	0.44	
KK1	448	482	4.15	4.46	12.07%	0.50	
KK2	454	486	4.20	4.50	12.17%	0.51	79.2%
KK3	408	417	3.78	3.86	10.44%	0.39	
BK1	435	451	4.03	4.18	11.29%	0.45	
BK2	441	464	4.08	4.30	11.62%	0.47	
BK3	436	443	4.04	4.10	11.09%	0.45	
		Total	35.67	3.97	100%	3.96	
		Average	3.96	4.11			

Performance (x) and Importance (y) results obtained from the total score for each attribute, and the weighted factors calculated by changing the average value (ȳ) into a percentage of the total average importance level of all the attributes tested. Weighted score calculated by mean average performance score (x̄) multiplied by the Weighted Factor (WF). While CSI score determined by total WS divided by highest score of Likert scale of questionnaire or 3.96/5 = 79.2% (table 2). which shows that the current packaging of onion chili products is perceived as good, however it still needs some improvement on several attributes (see Figure 2 below):
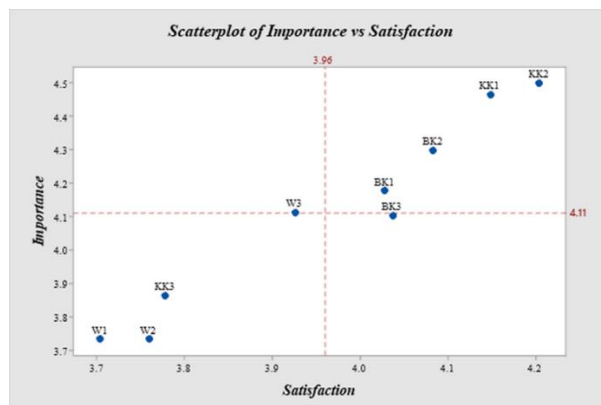

Fig. 2. Result of Satisfaction Index in Scatterplot

The results for the scatterplot of satisfaction and importance of each attribute show that the W3 attribute (Font color in the information label is easy to read) should become a priority to help SMEs in increasing product satisfaction. Gap analysis in customer satisfaction is also used to find out all dimensions for improvement and to serve as a comparison for choosing Kansei words. The results of the gap analysis for each dimension are presented in the table below (Table 4):

Table 4 – Gap Analysis.

Variable	Attribute	GAP	Gap Variable

Color	W1	-0.03	-0.061728
	W2	0.03	
	W3	-0.19	
Packaging Durability	KK1	-0.31	-0.231481
	KK2	-0.30	
	KK3	-0.08	
Packaging Style	BK1	-0.15	-0.141975
	BK2	-0.21	
	BK3	-0.06	

Kansei Words Selection

   The Kansei Words is carried out based on the results of the open questions about consumer wishes that often appear as last question of the questionnaire. There were 24 Kansei Words that often appeared and were grouped and reduced using the variable of customer satisfaction. The Kansei Words obtained can be seen in the following Table 5:

Table 5 - Kansei Word Selection Result.

Symbol	Variable/Survey Kansei Word	Symbol	Variable/Survey Kansei Word
X1	Sealed and Secure	X10	Solid
X2	Not easily leak	X11	Reusable
X3	Clean	X12	Easy to carry
X4	Practical	X13	Simple
X7	Transparent	X14	Attractive pattern design
X8	Easy to open	X15	Light
X9	Eco- friendly	X16	Attractive Label Design

Creating a Checklist of Specimen

   The next step after determining Kansai Engineering words is to create a list of specimens. This checklist is then utilized as input for the differential semantic scale questionnaire and can also be used for design requirement analysis at a later stage. The process involves categorizing existing specimen items to distinctly differentiate them from one another. The Kansei Engineering analysis can be conducted through a combination of Principal Component Analysis (PCA) and Partial Least Square (PLS) regression.

   Each specimen's item category is determined based on the corresponding element. When making the checklist, each specimen can only be assigned to 1 category for each item and every item must be filled in. Once formed, if there are multiple specimens with the same category for each item, all but one will be removed, resulting in 10 valid specimens after checklist formation.

   The Kansei words and the checklists of specimens become an input for the second questionnaire. This questionnaire asked respondents to rate the Kansei words available for each specimen. The number of specimens in the questionnaire is 10, while the Kansei words are 18, so the respondents need to fill 180 questions in total.

   Based on the questionnaire, the obtained of number of Kansei words then reduce using Principal Component Analysis (PCA). PCA results show that the Kansei words obtained can be divided into several main components with the help of the XLSTAT 2018 application, and here is the result as can be seen in the following Table 6:

Table 6 - Kansei Words Selection Results.

	F1	F2	F3	F4	F5
Eigenvalue	10.71	3.98	1.42	0.74	0.65
Variability (%)	59.48	22.13	7.90	4.13	3.60
Cumulative %	59.48	81.61	89.51	93.64	97.24

   PCA results showed that Kansei words can be divided into 3 factors: F1, F2, and F3, where the cumulative percentage value is 89.51%. The cumulative value is large enough to represent the initial data. The analysis is continued with the factor loading results of each main factor as described in the following Table 7:

Table 7 - Kansei Words Loading Factors.

	F1	F2	F3		F1	F2	F3
Sealed & secure			0.954	Easy to open	0.830		
Clean			0.802	Reusable		0.968	

Durable		0.922	Easy to carry	0.931	
Eco-friendly		0.827	Simple	0.759	
Solid		0.926	Light	0.839	
Not easily leaked		0.585	Easy to hold	0.882	
Practical	0.924		Attractive pattern design		0.805
Convenient to store	0.870		Unique label design		0.802
Transparent		0.789	Simple pattern design		0.674

As can be seen in Table 7, the loading factor of F1 is made from 7 Kansei words: practical, convenient to store, easy to open, easy to carry, simple, light, and easy to hold, with the largest loading factor value being easy to carry (0.931). The F1 factor was defined as Convenient based on the characteristics of those 7 Kansei words. The loading factor of F2 consists of 7 Kansei words: durable, eco-friendly, solid, not leaked easily, transparent, reusable, and simple pattern design, with the largest loading factor value being reusable (0.968). The F2 was defined as Durable based on the characteristics of the Kansei words in F2. The loading factor of F3 consists of 4 Kansei words: sealed & secure, clean, attractive pattern design, and attractive label design, with the largest loading factor, sealed & secure (0.954). This factor defines as the Hygiene & attractiveness.

Partial Least Square Regression (PLSR)

The next step was to determine the design requirement using Partial Least Square Regression (PLSR) based on the PLS coefficient. The PLS coefficient states the prediction of the influence of each design element on the existing Kansei words. A positive coefficient means that the design element has a positive influence on the Kansei word and vice versa. These coefficients show the importance and become the reference in the selection of design elements for Kansei words. In the PLS, Kansei's words with the largest factor loading value were used to represent the factors: easy to carry for convenience, reusable for durability, and securely & sealed for hygiene & attractive (Table 8).

Table 8 - Coefficient PLS.

Design Element	Convenient	Durable	Hygiene & Attractive	Design Element	Convenient	Durable	Hygiene & Attractive
Intercept	3.850	3.237	4.123	Intercept	3.850	3.237	4.123
T1	0.069	0.045	0.045	SK1	0.035	0.137	0.038
T2	0.013	0.062	-0.031	SK2	0.044	-0.002	0.014
T3	0.054	-0.060	0.054	SK3	-0.083	0.062	-0.081
T4	-0.151	-0.099	-0.069	SK4	-0.051	-0.247	-0.027
P1	0.095	-0.203	-0.007	WL1	0.024	0.066	-0.037
P2	0.041	0.106	0.008	WL2	-0.091	-0.079	0.001
P3	-0.031	0.093	-0.012	WL3	-0.041	0.091	0.000
P4	-0.073	-0.167	0.007	WL4	0.076	-0.075	0.036
L1	0.084	-0.148	0.026	JTL1	0.025	0.095	-0.002
L2	-0.027	0.016	-0.007	JTL2	0.024	0.096	0.043
L3	-0.031	0.093	-0.012	JTL3	-0.185	-0.237	-0.041
BT1	-0.073	-0.167	0.007	JTL4	0.035	-0.043	0.001
BT2	0.095	-0.203	-0.007	GPL1	0.021	-0.111	-0.018
BT3	-0.031	0.084	-0.025	GPL2	-0.021	0.111	0.018
BT4	0.033	0.126	0.014	UL1	-0.111	-0.032	-0.018
Tr1	-0.084	0.148	-0.026	UL2	0.013	0.062	-0.031
Tr2	0.084	-0.148	0.026	UL3	0.037	0.097	0.022
DT1	-0.045	-0.164	-0.028	UL4	0.084	-0.148	0.026

Design Element	Convenient	Durable	Hygiene & Attractive	Design Element	Convenient	Durable	Hygiene & Attractive
DT2	0.039	0.121	-0.002	WT1	0.025	0.095	-0.002
DT3	0.010	0.101	0.081	WT2	-0.185	-0.237	-0.041
TT1	-0.041	0.091	0.000	WT3	-0.083	0.062	-0.081
TT2	0.061	0.104	0.019	WT4	0.030	0.103	0.045
TT3	-0.051	-0.247	-0.027	WT5	0.084	-0.148	0.026

Design element: Ti=Packaging height, Pi=Long, Li= Width, BTi=Bottle Style; Tri=Transparent; DTi=Diameter; TTi= Cap height; Ski=Packaging secure; WLi=Label Color; JTi=Font style; GPi=Picture; ULi=Size, WTi=Weight

Design Requirement Analysis

In this step, the effect value of the design elements was calculated by subtracting the largest value of the PLS coefficient from the smallest of each item. The item effect value is a range value that is used as a reference to determine which items need to be prioritized in designing a new packaging design. Higher value means that the item of elements design has greater influences to the Kansei words (Table 9).

Table 9 - Result Value.

Item	Convenient	Item	Durable	Item	Hygiene & Attractive
Cap Color	0.269	Packaging Seal	0.385	Cap Color	0.127
Label's font style	0.220	Cap Height	0.351	Height	0.123
Height	0.220	Cap Color	0.340	Packaging Seal	0.119
Label dimension	0.194	Label's font style	0.333	Cap diameter	0.109
Length	0.168	Bottle Style	0.329	Label's font style	0.084
Bottle style	0.168	Length	0.308	Label's Color	0.073
Transparent	0.168	Transparent	0.295	Label dimension	0.058
Label's color	0.167	Cap diameter	0.285	Transparent	0.053
Packaging seal	0.127	Label Dimension	0.244	Cap height	0.046
Width	0.115	Width	0.241	Bottle style	0.038
Cap height	0.112	Label's Picture	0.222	Width	0.038
Cap diameter	0.084	Label's Color	0.170	Label's picture	0.036
Label's picture	0.042	Height	0.161	Length	0.020
Average	0,158	Average	0.282	Average	0.071

The next stage involves examining the selected design elements to fulfill consumers' Kansei requirements. Based on the results of PCA, all Kansei words can be grouped into three primary factors, which will inform the development of three new designs applying these components. The choice of design elements for each item will depend on the highest PLS coefficient. The following proposed design was developed based on 3 factors, as shown in Figure 3, below:

Design based on Convenient   Design based on Durable   Design based on Hygiene &
Factor   Factor   Attractive

Fig. 3. Proposed New Kansei Packaging Onion Chili

The design in Figure 3, was developed based on high-element designs for each Kansei word factor. For example, in the convenient factor, T1 with the largest PLS coefficient value of 0.069, then it translates to the height product and is convenient to store < 10cm. The selected elements obtained from PLSR as results of Kansei words.

Discussion

The findings of this study highlight the design that result from Kansei Engineering (KE) in enhancing the packaging design of onion chili sauce as a popular food product in Indonesia. By focusing on consumer satisfaction and emotional responses, the study able to identify key factors that influence consumer preferences and perceptions based on collecting Kansei words related to packaged onion chili sauce. Those three proposed packaging design especially the first design will satisfy convenience aspect to support easy to open, handle, and store as expected by customers (Purwaningsih et al., 2020). To enhance user experience and its attractiveness a suggestion related to larger font sizes and clear styles significantly improve readability, which can be applied to food product labels (Song et al., 2021). The approach aligns with previous studies that emphasize the importance of sensory attributes in packaging design (Papantonopoulos et al., 2021). The application of PCA in reducing the questionnaire data to three main factors—convenience, durability, hygiene & attractiveness, demonstrates the effectiveness of this statistical method in simplifying complex data sets. These factors are consistent with findings from other studies in the field of food packaging, which also highlight the importance of these attributes in consumer decision-making(Adiyanto et al., 2019; Bisma et al., 2024). Although the designs are not entirely 100% new, and have some similarity to the bottles available, the designs in this study have advantages compared to the current bottles used by onion chili sauce. The convenience, colors, size, and materials in the designs give some options to SMEs in marketing their products in new package.

5. Conclusion

The application of Kansei engineering in this study resulting in four essential factors important for revamping the packaging of product bottles: convenience, durability, hygiene, and appeal, to enhance the packaging design of chili-based food products. The CSI index has pinpointed a notable area for enhancement: improving font color on the information label to make it more readable. There are three designs proposed to align with consumer expectations based on critical factors as the CSI Index result: color, packaging durability, and packaging style. For further research, the design also should consider ergonomic aspects such as hands anthropometry and the range of hand strange in opening bottle. The ergonomics aspect can help to ensure the bottle design is user-friendly for a wide range of consumers, including those with limited hand strength. This could also include testing different bottle shapes and sizes on different populations.

References

Adiyanto, O., Jatmiko, H. A., & Erni. (2019). Development of food packaging design with kansei engineering approach. *International Journal of Scientific and Technology Research*, *8*(12), 1778–1780.

Agus, A. A., Yudoko, G., Mulyono, N., & Imaniya, T. (2021). E-Commerce Performance, Digital Marketing Capability and Supply Chain Capability within E-Commerce Platform: Longitudinal Study Before and After COVID-19. *International Journal of Technology*, *12*(2), 360. https://doi.org/10.14716/ijtech.v12i2.4122

Ahdiat, A. 2022, November 10th. *https://databos.katadata.co.id/*. Retrieved 11 2023, from katadata: https://databoks.katadata.co.id/datapublish/2022/10/11/indonesia-punya-umkm-terbanyak-di-asean-bagaimana-daya-saingnya

Alawamleh, M., Al-Hussaini, M., & Bani Ismail, L. (2022). Open innovation in the food industry: trends and barriers — a case of the Jordanian food industry. *Journal of Global*

Entrepreneurship Research, *12*(1), 279–290. https://doi.org/10.1007/s40497-022-00312-6

Ariyanti, F. D., & Chan, S. (2020). Kansei engineering, MANOVA and quality function deployment to design bottle packaging and seasoning quality. *IOP Conference Series: Earth and Environmental Science*, *426*(1), 12113. https://doi.org/10.1088/1755-1315/426/1/012113

Bisma, A., Pranowo, D., & Hendrawan, Y. (2024). Aplikasi kansei engineering untuk desain kemasan kopi excelsa Wonosalam. *Agrointek:Jurnal Teknologi Industri Pertanian*, *18*(1), 221–231. https://doi.org/10.21107/agrointek.v18i1.10804

Chen, P. H., & Huang, S. R. (2014). Applying Kansei Engineering to Design an Affective Briefing Presentation for the Elders. In *2014 International Symposium on Computer, Consumer and Control* (pp. 211–214). IEEE. https://doi.org/10.1109/is3c.2014.65

Chitturi, R., Carlos Londono, J., & Alberto Amezquita, C. (2019). The Influence of Color and Shape of Package Design on Consumer Preference: The Case of Orange Juice. *International Journal Of Innovation And Economic Development*, *5*(2), 42–56. https://doi.org/10.18775/ijied.1849-7551-7020.2015.52.2003

Dewi, D. S., Irfoni, A. R., & Rahman, A. (2017). Kansei Engineering Approach for Designing a Self-monitoring Blood Glucose Application. *International Journal of Technology*, *8*(2), 272. https://doi.org/10.14716/ijtech.v8i2.6144

Djatna, T., & Kurniati, W. D. (2015). A System Analysis and Design for Packaging Design of Powder Shaped Fresheners Based on Kansei Engineering. *Procedia Manufacturing*, *4*, 115–123. https://doi.org/10.1016/j.promfg.2015.11.021

Effendi, M., Anggraeni, D., & Astuti, R. (2020). Peppermint hard candy packaging design with Kansei engineering. *IOP Conference Series: Earth and Environmental Science*, *475*(1), 12061. https://doi.org/10.1088/1755-1315/475/1/012061

Fajri Hasibuan, C. (2020). Design Sling Bag Using Kansei Engineering Method. *IOP Conference Series: Materials Science and Engineering*, *1003*(1), 12003. https://doi.org/10.1088/1757-899x/1003/1/012003

Fatchurrohman, N., Yetrina, M., Muhida, R., & Hidayat, A. (2022). Product Development using Kansei Engineering to Re-design New Food Packaging. *Jurnal Teknologi*. https://doi.org/10.35134/jitekin.v12i1.60

Fithri, P., Zadry, H. R., & Turrahmi, U. N. (2022). Kansei-Based Design For An Indonesian Traditional Food Packaging. *ASEAN Engineering Journal*, *12*(1), 63–68. https://doi.org/10.11113/aej.v12.16715

Fitriani, E. 2023, October 29th. Laju Industri Kemasan Salip Pertumbuhan Ekonomi Nasional .Retrieved from https://investor.id: https://investor.id/business/334397/laju-industri-kemasan-salip-pertumbuhan-ekonomi-nasional/all

Ginting, R., & Ali, A. Y. (2019). Improved Kansei Engineering with Quality Function Deployment Integration: A Comparative Case Study. *IOP Conference Series: Materials Science and Engineering*, *505*(1), 12092. https://doi.org/10.1088/1757-899x/505/1/012092

Gunaratne, N. M., Fuentes, S., Gunaratne, T. M., Torrico, D. D., Francis, C., Ashman, H., Gonzalez Viejo, C., & Dunshea, F. R. (2019). Effects of packaging design on sensory liking and willingness to purchase: A study using novel chocolate packaging. *Heliyon*, *5*(6), e01696–e01696. https://doi.org/10.1016/j.heliyon.2019.e01696

Hadi, A. P., Suryani, S., & Wibowo, M. C. (2021). Pengaruh Desain Kemasan Terhadap Kepuasan Pelanggan Umkn Sakukata.Co Salatiga. *Pixel :Jurnal Ilmiah Komputer Grafis*, *14*(1), 95–108. https://doi.org/10.51903/pixel.v14i1.461

Hartanti, M., & Nurviana, N. (2020). Functional and Emotional Features Studies on Traditional Indonesian Instant Food Packaging. *Journal of Visual Art and Design*, *12*(1), 25. https://doi.org/10.5614/j.vad.2020.12.1.2

Hartono, M., Santoso, A., & Prayogo, D. N. (2017). How Kansei Engineering, Kano And QFD can Improve Logistics Services. *International Journal of Technology*, *8*(6), 1070. https://doi.org/10.14716/ijtech.v8i6.689

Hasibuan, C. F. (2020). Design Sling Bag Using Kansei Engineering Method. *2nd International Conference on Industrial and Manufacturing Engineering (ICI&ME 2020). 1003(1)*, pp.

012003-012003. Medan: IOP Publishing. doi:https://doi.org/10.1088/1757-899x/1003/1/012003

Hermawan, D. 2022, August 22. *Challenge of Culture-based SMEs Digitalisation.* Retrieved 11 10, 2022, from https://www.bi.go.id: https://www.bi.go.id/en/bi-institute/BI-Epsilon/Pages/Tantangan-Digitalisasi-UMKM-Berbasis-Budaya.aspx

Khattak, D. S. R., Ali, H., Khan, Y., & Shah, M. (2021). Color Psychology in Marketing. *Journal of Business & Tourism*, *4*(1), 183–190. https://doi.org/10.34260/jbt.v4i1.99

Kindström, D., Carlborg, P., & Nord, T. (2024). Challenges for growing SMEs: A managerial perspective. *Journal of Small Business Management*, *62*(2), 700–723. https://doi.org/10.1080/00472778.2022.2082456

Kotler, P., & Keller, K. 2012. *Marketing Management* (14th ed.). New Jersey: Pretince Hall.

Nagamachi, M., & Lokman, A. M. (2016). *Innovations of Kansei Engineering*. CRC Press. https://doi.org/10.1201/ebk1439818664

Nurhayati-Wolff, H. 2024, May 23rd. Aggregate value of e-money transactions in Indonesia from 2014 to 2023. Retrieved November 10, 2024, from Statista: https://www.statista.com/statistics/958171/indonesia-online-transaction-value/

Nurudin, A. 2022. Pengembangan Desain Kemasan Produk Sambal Kemasan dengan Penerapan Metode Quality Function Deployment (Studi Kasus Pada Sambal Kemasan Resep Kuno, Surabaya). *undergraduate thesis, Universitas Wijaya Kusuma Surabaya*. Retrieved from https://erepository.uwks.ac.id/11661/1/ABSTRAK.pdf

Oliwatosin Abdul-Azeez, Alexsandra Ogadimma Ihechere, & Courage Idemudia. (2024). SMEs as catalysts for economic development: Navigating challenges and seizing opportunities in emerging markets. *GSC Advanced Research and Reviews*, *19*(3), 325–335. https://doi.org/10.30574/gscarr.2024.19.3.0230

Papantonopoulos, S., Bortziou, M., & Karasavova, M. (2021). A Kansei Engineering Study of Saffron Packaging Design. *International Journal of Affective Engineering*, *20*(4), 237–245. https://doi.org/10.5057/ijae.ijae-d-21-00006

Prastawa, H., Mahachandra, M., & Donida, D. A. H. (2021). Kansei engineering application in redesigning carica packaging to support local-small industry in Central Java. *IOP Conference Series: Materials Science and Engineering*, *1072*(1), 12060. https://doi.org/10.1088/1757-899x/1072/1/012060

Purwaningsih, I., Surachman, S., Pratikto, P., & Santoso, I. (2020). Integration of packaging design in food kansei model: Conceptual model development. *Journal of Hygienic Engineering and Design*, *30*, 26–32.

Rahayu, F., Barkah, C., Chan, A., & Tresna, P. W. (2021). Analisis Kepuasan Konsumen Terhadap Produk Sambal Kemasan Untuk Formulasi Perbaikan Strategi Produk. *BISMA: Jurnal Bisnis Dan Manajemen*, *15*(1), 47. https://doi.org/10.19184/bisma.v15i1.21960

Rizaty, M. (2022). Rata-Rata Pendapatan Usaha Makan Minum di 10 Provinsi Ini Tertinggi Nasional. Retrieved November 10, 2022, from https://databoks.katadata.co.id/datapublish/2022/06/16/rata-rata-pendapatan-usaha-makan-minum-di-10-provinsi-ini-tertinggi-nasional

Rodrigues, R. I., Lopes, P., & Varela, M. (2021). Factors Affecting Impulse Buying Behavior of Consumers. *Frontiers in Psychology*, *12*, 697080. https://doi.org/10.3389/fpsyg.2021.697080

Song, J., Brown, M. K., Tan, M., MacGregor, G. A., Webster, J., Campbell, N. R. C., Trieu, K., Ni Mhurchu, C., Cobb, L. K., & He, F. J. (2021). Impact of color-coded and warning nutrition labelling schemes: A systematic review and network meta-analysis. *PLoS Medicine*, *18*(10), 1–28. https://doi.org/10.1371/journal.pmed.1003765

Tama, I. P., Azlia, W., & Hardiningtyas, D. (2015). Development of Customer Oriented Product Design using Kansei Engineering and Kano Model: Case Study of Ceramic Souvenir. *Procedia Manufacturing*, *4*, 328–335. https://doi.org/10.1016/j.promfg.2015.11.048

Taneo, S. Y. M., Noya, S., Setiyati, E. A., & . M. (2019). Disruptive Innovation-Based Model of Sustainable Competitiveness Development in Small and Medium Food Industries. *Matrik: Jurnal Manajemen, Strategi Bisnis Dan Kewirausahaan*, 153. https://doi.org/10.24843/matrik:jmbk.2019.v13.i02.p03

Wang, K.-C., & Ju, F.-R. (2013). An Innovative Design Methodology KKBDCA for Affective Product Development. *Mathematical Problems in Engineering*, *2013*, 1–10. https://doi.org/10.1155/2013/629708