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Planning and Conceptualizing Crispy Tofu Packaging Design Using Kansei Engineering Method

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Abstrak

Masyarakat Indonesia telah lama menjadikan tahu sebagai lauk pauk atau makanan ringan. Permasalahan krusial yang ditemukan pada kemasan Tahu Crispy yaitu kemasan berbahan kertas Duplex tidak Food Grade yang menyerap minyak berlebih, tidak terdapat identitas produk, dan desain kemasan tidak menarik. Oleh sebab itu, penelitian ini bertujuan menentukan konsep desain kemasan untuk produk Tahu Crispy. Metode Kansei Engineering digunakan karena memiliki kemampuan untuk menginterpretasikan kesan, emosional, dan keinginan konsumen. Kansei Word dikelompokkan dengan menggunakan Principal Component Analysis (PCA). Sebanyak 31 Kansei Word diperoleh melalui penyebaran kuesioner dengan video stimulus. Selanjutnya, software R digunakan untuk mengolah data yang menghasilkan konsep desain melalui input data (PCA).

***Kata Kunci**: Kansei Engineering, Kemasan, Pengembangan, Principal Component Analysis (PCA), Tahu Crispy*

Abstract

Indonesian society has long consumed tofu as a side dish or snack. A crucial issue identified in the packaging of Tahu Crispy is the use of non-food-grade duplex paper, which absorbs excessive oil, lacks product identity, and has an unattractive design. Therefore, this study aims to determine a suitable packaging design concept for Tahu Crispy. The Kansei Engineering method is employed due to its ability to interpret consumer impressions, emotions, and desires. The Kansei words were grouped using Principal Component Analysis (PCA). A total of 31 Kansei words were obtained through a questionnaire distributed with video stimuli. The data was then processed using R software, generating a design concept based on PCA input.

***Keywords**: Development, Kansei Engineering, Packaging, Principal Component Analysis (PCA), Tahu Crispy*

1. Introduction

Tofu is a popular food in Indonesia due to its pleasant taste and affordability (Arsita et al., 2023). Indonesians have long been accustomed to consuming tofu as a side dish or snack. According to Shidiqy (2016), product popularity influences consumers' emotional evaluations of packaging design. Consumers' emotional responses can be enhanced through the visualization of packaging design. Purchasing decisions are strongly influenced by the sensations and emotions evoked by the product (Saeed & Nagashima, 2013), as well as by the image, shape, and color of the packaging (Sinaga, 2022).

Packaging development for Crispy Tofu is essential. According to survey results, 61.7% of respondents agreed that packaging development for Crispy Tofu is important due to several existing issues. These include the use of non-food-grade duplex paper, the tendency for the packaging to become greasy, and the absence of product identity information. These issues can reduce customer trust, as packaging plays a critical role in maintaining product quality and safety, and in ensuring transparent product information (Herudiansyah, 2019).

Currently, Crispy Tofu is packaged using materials that may pose health risks. According to research led by Dr. Lisman Suryanegara from LIPI, duplex paper is made from recycled materials that may contain hazardous substances such as printing ink, formaldehyde, and heavy metals. Crispy Tofu is typically packaged using folding cartons made from non-food-grade duplex paper. Using food-grade packaging is essential to ensure that packaging materials are safe and environmentally friendly (Mutmainah et al., 2022).

The durability of the Crispy Tofu packaging is also insufficient. Duplex paper does not provide adequate protection, as it is vulnerable to tearing and oil penetration. According to Mukhtar & Nurif (2015), packaging functions to protect products from sunlight, weather conditions, mechanical shocks, and microbial contamination, all of which can affect product quality. Paper- or cardboard-based packaging generally has weak

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barrier properties and is permeable to gases, water vapor, and liquids (Deshwal et al., 2019). Therefore, selecting the right packaging material is essential for ensuring food safety and quality (Kim et al., 2014).

Another significant issue is the lack of proper product identity on the Crispy Tofu packaging. According to the Directorate General of Processing and Marketing of Agricultural Products, Ministry of Agriculture of the Republic of Indonesia, packaging should serve as a product identifier and communicate brand information to consumers. Product identity influences purchasing interest, and repurchase intention is positively correlated with a clear and strong product identity (Zullaihah & Setyawati, 2021). Packaging without product identity reduces customer appeal and limits sales potential (Widiati, 2019).

Emotional needs of consumers are increasingly recognized as crucial in product and service experiences (Mu'alim & Hidayat, 2014). As noted by Colwill et al. (p. 38), while products are manufactured in factories, brands are created in the minds of consumers—and design is what bridges the two. A successful product contributes to business growth when it is well-designed and meets both functional and emotional needs. Customer satisfaction forms the basis of loyalty, which is rooted in emotional and attitudinal connections, rather than merely behavioral patterns (Ronasih & Widhiastuti, 2021). This connection is reinforced by findings from Amanah & Harahap (2019), who showed that emotional value positively influences customer loyalty.

Kansei Engineering is a method that translates consumers' emotions and ideas into design elements (Colwill et al., p. 1). According to Nagamachi & Lokman (2015), Kansei refers to the emotional response felt by individuals under specific stimuli and circumstances. Kansei is a sensory-emotional system that involves all five senses: sight, hearing, taste, touch, and smell. Auditory experiences, for instance, are processed based on personal life experiences and can evoke deep Kansei responses, such as those associated with music (Nagamachi & Lokman, 2015). Among all senses, visual stimuli have the most dominant influence on Kansei responses.

Kansei Engineering is proven to enhance customer satisfaction and align product quality with consumer desires (Mu'alim & Hidayat, 2014). It has been widely applied in packaging development studies, such as the redesign of Tike Chips packaging (Arini et al., 2023), which utilized the Kano method and Kansei words to capture consumer emotional impressions. The study concluded that the most preferred packaging was both creative and informative. Another study applied Kansei Engineering to redesign Takoyakiku food packaging (Faisal et al., 2021), using Kansei and conjoint analysis to identify consumer preferences. Consumers preferred ivory paper packaging that included a logo, product images, and product information. Similarly, the development of packaging concepts for Lealoe products using a Kansei Engineering approach (Delfitriani et al., 2023) resulted in a new packaging design concept derived from PCA-ranked variables. Packaging that meets customer expectations can influence purchasing decisions, enhance competitiveness, and improve product reputation. In another study, Suzianti & Aldianto (2020) found that redesigned packaging based on Kansei Engineering should reflect four key attributes: attractiveness, durability, practicality and eco-friendliness, and lightness. Their final designs successfully met these criteria for SME products.

Despite Crispy Tofu's popularity and market potential, there is currently no packaging that fulfills food safety standards, offers sufficient durability, and presents a clear product identity. Moreover, previous Kansei Engineering research has primarily focused on other food products—such as chips, takoyaki, and herbal drinks—without specific application to Crispy Tofu.

Therefore, this study applies the Kansei Engineering method to plan and develop a packaging design concept for Crispy Tofu that aligns with customer desires based on survey responses. This approach is expected to address existing packaging problems and create improved packaging that enhances trust and increases product sales (Segita et al., 2024).

The objective of this study is to develop packaging that meets food safety standards, offers strong durability, features clear product identity, and fulfills the emotional expectations of consumers. Additionally, this study aims to contribute an innovative packaging design concept that reflects both regulatory requirements and consumer preferences while expanding the application of the Kansei Engineering method in the development of traditional food product packaging in Indonesia.

2. Research Methods

The Kansei Engineering method and Principal Component Analysis (PCA) were employed in this study to plan and determine the packaging design concept for Tahu Crispy. Kansei Engineering aims to explore consumers' emotional responses related to packaging needs (Arini et al., 2023). This method enables the translation of consumers' selected descriptive words into expected design criteria (Arini et al., 2023). Figure 1 presents a flowchart illustrating the research methodology applied from the initial to the final stages.

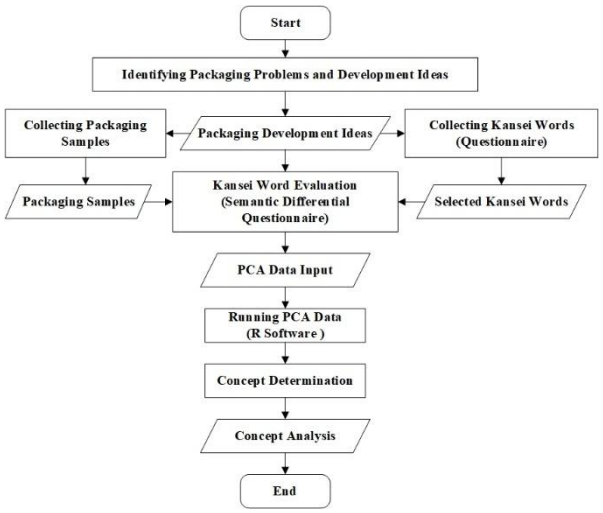

Figure 1: Flowchart of Methodology

2.1. Idea Generation and Problem Identification

Problem identification was conducted through observations of Crispy Tofu packaging, which revealed several weaknesses, including the use of non-food-grade materials, susceptibility to grease, and the absence of product identity. To validate these issues and explore ideas for packaging development, the researchers distributed open-ended questionnaires to consumers. The responses were analyzed to identify critical problems, which then served as the foundation for designing a descriptive questionnaire incorporating video stimuli of packaging samples. This questionnaire enabled the translation of consumer expectations and design ideas into Kansei words, which were subsequently categorized into emotional domains and design characteristics to serve as the basis for determining the packaging concept.

2.2. Collecting Packaging Samples

The packaging samples collected were selected based on their ability to address the identified issues. According to Sari (2019), a minimum of twenty to twenty-five different samples should be gathered. These samples were sourced from the internet and represented packaging designs applicable to the product in question. The selection process involved filtering the samples based on their shape, size, material, and features.

2.3. Collecting Kansei Words

The initial step involved distributing a descriptive questionnaire focused on consumer expectations, impressions, and perceived issues related to the Tahu Crispy product. The questionnaire aimed to collect Kansei words by displaying packaging samples via Google Forms, allowing respondents to express their emotions while describing expectations and product-related problems. Respondents were selected using purposive sampling, in which the characteristics of participants were defined according to the research objectives (Andrade, 2021). The questionnaire results were translated into Kansei words. According to Sari (2019), Kansei words are a collection of terms derived from translating customer emotions and serve as descriptors of the design domain.

The collected Kansei words were then refined by eliminating duplicates or synonyms (Pratiwi et al., 2023). They were categorized into emotional adjectives and descriptive terms related to packaging design characteristics such as material, structure, and design. The Kansei words were then organized and matched with their antonyms. The number of Kansei words collected generally ranges from 50 to 600 words (Nagamachi & Lokman, 2015). A total of 30 respondents who frequently consumed Tahu Crispy participated in this stage (Sari, 2019).

2.4. Evaluation of Kansei Words

The selected Kansei words were incorporated into a Semantic Differential questionnaire and assessed using a 7-point scale (-3, -2, -1, 0, 1, 2, 3) (Fathimahhayati et al., 2019). The 7-point Semantic Differential scale allows respondents to express their attitudes with greater specificity and nuance (Sari, 2019).

2.5. Concept Determination

According to Nasution (2020), Principal Component Analysis (PCA) is used to identify patterns within the data collected from the Semantic Differential questionnaire. The results were transferred into Excel, then saved in Notepad format and processed using R software to determine the design concept. R is a statistical software based on the S programming language and is used for data and graphical analysis (Asdi, 2017). After processing, the output includes graphical results such as the Scree Plot, Standard Deviation Method, Cumulative Proportion, and Kaiser Method (Arini et al., 2023). The Kansei words were then extracted into clusters or groups. PCA facilitates the accurate extraction of design concepts (Kobayashi & Kinumura, 2017). The clustered results were interpreted by an expert panel. According to Sari (2019), to ensure the accuracy of identifying critical packaging components that influence consumer preferences, input from experienced panelists is essential. An expert panelist should consist of 5–15 individuals, each with at least 10 years of experience in the relevant field.

3. Results and Discussion

The Kansei Engineering method was used to conduct this research. The process consisted of collecting selected packaging samples, identifying Kansei words, inputting data using R software, and determining the selected design concept.

3.1. Problem Identification and Idea Generation

In the initial stage, a questionnaire was distributed to assess packaging that requires development, along with respondents' objective evaluations of existing packaging issues. Based on observations from 79 respondents, 45.6% agreed that the packaging of Tahu Crispy needs improvement and further development.

3.2. Packaging Samples

Packaging samples were collected by sourcing reference images from the internet, resulting in a variety of design options. The samples used to determine Kansei words were selected prior to the Kansei word collection process. According to Soikun & Ibrahim (2020), the sample collection was conducted with diverse variations, requiring a minimum of 20 to 25 samples. Initially, 60 packaging samples were collected. These samples were then filtered based on similar component elements such as material, shape and size, label design style, and additional features. Samples with distinctive characteristics were retained (Sari, 2019). After the elimination process, 56 unique samples remained and were used in this study, as shown in Table 1 below:

Table 1: Packaging Samples

No.	Sample Name	Sample Picture	No.	Sample Name	Sample Picture	No.	Sample Name	Sample Picture	No.	Sample Name	Sample Picture
1	A		15	O		29	AC		43	AQ	
2	B		16	P		30	AD		44	AR	
3	C		17	Q		31	AE		45	AS	
4	D		18	R		32	AF		46	AT	
5	E		19	S		33	AG		47	AU	
6	F		20	T		34	AH		48	AV	
7	G		21	U		35	AI		49	AW	
8	H		22	V		36	AJ		50	AX	
9	I		23	W		37	AK		51	AY	
10	J		24	X		38	AL		52	AZ	
11	K		25	Y		39	AM		53	BA	

No.	Sample Name	Sample Picture	No.	Sample Name	Sample Picture	No.	Sample Name	Sample Picture	No.	Sample Name	Sample Picture
12	L		26	Z		40	AN		54	BB	
13	M		27	AA		41	AO		55	BC	
14	N		28	AB		42	AP		56	BD	

3.3. Kansei Word (KW)

The collection of Kansei words was conducted through online interviews and the distribution of descriptive questionnaires via Google Forms (Pratiwi et al., 2023). According to Sari (2019), the questionnaire was accompanied by a video stimulus to help respondents more easily express their opinions. Kansei words were obtained from 36 respondents who frequently consume Crispy Tofu products, which meets the minimum data requirement of 30 respondents (Sari, 2019). The initial number of collected Kansei words was 336. These words were then refined by eliminating terms with similar meanings (Pratiwi et al., 2023), resulting in a final list of 31 Kansei words along with their antonyms, as shown in Table 2. The selected Kansei words were further categorized into two main groups: emotional adjectives and words describing design characteristics, which include material, structure, and design aspects. Examples of design-related Kansei words include: Kraft Paper, Ivory Paper, Art Carton, Lamination, and Brand Identity, which serve as valuable inputs in determining the appropriate packaging design.

Table 2: Kansei Words with Their Antonyms

No	Kansei Word	Kansei Word Antonym	No	Kansei Word	Kansei Word Antonym
1	Aman dari migrasi (Safe from migration)	Tidak aman dari migrasi (Not safe from migration)	17	Ergonomis (Ergonomic)	Tidak ergonomis (Not Ergonomic)
2	Memberikan informasi (Provides information)	Tidak memberikan informasi (Not providing information)	18	Desain estetis (Aesthetic design)	Desain tidak estetis (Unaesthetic Design)
3	Praktis (Practical)	Tidak praktis (Not practical)	19	Tahan minyak (Oil resistant)	Tidak tahan minyak (Not Oil Resistant)
4	Higienis (Hygienic)	Tidak higienis (Not hygienic)	20	Desain kemasan mendeskripsikan produk tersebut beraroma (The packaging design describes the product as flavorful)	Desain kemasan tidak mendeskripsikan produk tersebut beraroma (The packaging design does not describe the product as flavorful)
5	Kemasan terdapat sirkulasi udara (Breathable packaging)	Kemasan tidak terdapat sirkulasi udara (Unbreathable packaging)	21	Desain kemasan mendeskripsikan produk tersebut asin (The packaging design describes the product as salty)	Desain kemasan tidak mendeskripsikan produk tersebut asin (The packaging design does not describe the product as salty)
6	Mudah disimpan (Storable)	Tidak mudah disimpan (Unstorable)	22	Desain kemasan mendeskripsikan produk tersebut gurih (The packaging design describes the product as savoury)	Desain kemasan tidak mendeskripsikan produk tersebut gurih (The packaging design does not describe the product as savoury)
7	Desain sederhana (Simple design)	Desain tidak sederhana (Not simple design)	23	Desain kemasan mendeskripsikan produk tersebut krispi (The packaging design describes the product as Crispy)	Desain kemasan tidak mendeskripsikan produk tersebut krispi (The packaging design does not describe the product as Crispy)
8	Desain trendi (Trendy design)	Desain tidak trendi (Not trendy design)	24	Desain kemasan mendeskripsikan produk tersebut keras (The packaging design describes the product as hard)	Desain kemasan tidak mendeskripsikan produk tersebut keras (The packaging design does not describe the product as hard)
9	Desain minimalis (Minimalist design)	Desain tidak minimalis (Not minimalist design)	25	Desain kemasan mendeskripsikan produk tersebut renyah (The packaging design describes the product as crunchy)	Desain kemasan tidak mendeskripsikan produk tersebut renyah (The packaging design does not describe the product as crunchy)

No	Kansei Word	Kansei Word Antonym	No	Kansei Word	Kansei Word Antonym
10	Nyaman (Convenient)	Tidak nyaman (Not convenient)	26	Desain kemasan mendeskripsikan produk tersebut lembut (The packaging design describes the product as soft)	Desain kemasan tidak mendeskripsikan produk tersebut lembut (The packaging design does not describe the product as soft)
11	Bahan kemasan tebal (Thick material)	Bahan kemasan tipis (Thin material)	27	Desain kemasan mendeskripsikan produk tersebut pedas (The packaging design describes the product as spicy)	Desain kemasan tidak mendeskripsikan produk tersebut pedas (The packaging design does not describe the product as spicy)
12	Desain menarik (Attractive design)	Desain tidak menarik (Not attractive design)	28	Kemasan mudah dibuka dan ditutup (Packaging is easy to open and close)	Kemasan tidak mudah dibuka dan ditutup (Packaging is not easy to open and close)
13	Kemasan ramah pengguna (User friendly)	Kemasan tidak ramah pengguna (Not user friendly)	29	Desain kemasan berwarna-warni (Colorful packaging design)	Desain kemasan tidak berwarna-warni (Non-colorful packaging design)
14	Aman untuk penggunaan makanan (Food Grade)	Tidak aman untuk penggunaan makanan (Not Food Grade)	30	Desain kemasan menggambarkan produk olahan kedelai (The packaging design describes processed soy products)	Desain kemasan tidak menggambarkan produk olahan kedelai (Packaging design does not depict processed soy products)
15	Kokoh (Sturdy)	Tidak kokoh (Not sturdy)	31	Desain kemasan menggambarkan produk sebagai produk yang lezat (The packaging design describes the product as delicious)	Desain kemasan tidak menggambarkan produk sebagai produk yang lezat (The packaging design does not describe the product as delicious)
16	Desain unik (Unique design)	Desain tidak unik (Not unique design)			

3.4. Evaluation of Kansei Words with Packaging Samples

The next stage, after obtaining 31 pairs of Kansei words, was to evaluate how relevant these words were to the 56 selected packaging samples. This evaluation was carried out using a Semantic Differential questionnaire, in which 30 respondents assessed each packaging sample using a 7-point scale ranging from -3, -2, -1, 0, 1, 2, to 3 (Sari, 2019), as illustrated in Figure 2.

Figure 2: Semantic Differential Questionnaire

3.5. Extraction of Kansei Words Using Principal Component Analysis (PCA)

The input data for the design concept analysis were obtained from the results of the Semantic Differential questionnaire. These data were processed using the Principal Component Analysis (PCA) method with the help of R software. The analysis revealed that two principal components—PC1 and PC2—should be retained for further interpretation. Subsequently, the results from the PCA method were analyzed in more detail. The following describes the results generated by various methods available in R software:

a. Kaiser Method

According to Coghlan (2014), components with a variance (eigenvalue) greater than 1 should be retained. In the PCA output, two principal components met this criterion: PC1 with a variance of 50.65898 and PC2 with a variance of 1.187273. These results indicate that both components are significant and should be considered for further analysis. The PCA results based on the Kaiser method are shown in Figure 3.

```
> (datakanseipca.pca$sdev)^2
 [1] 5.065898e+01 1.187273e+00 6.236769e-01 5.107308e-01 4.620726e-01
 [6] 2.847503e-01 2.292480e-01 2.133440e-01 1.794035e-01 1.663977e-01
[11] 1.513518e-01 1.355802e-01 1.125764e-01 1.021662e-01 9.825562e-02
[16] 8.948317e-02 7.556049e-02 7.193239e-02 6.141790e-02 6.094767e-02
[21] 5.443073e-02 4.572553e-02 4.279209e-02 3.839938e-02 3.393487e-02
[26] 3.231657e-02 3.060746e-02 2.556186e-02 2.439227e-02 2.172478e-02
[31] 2.098401e-02 1.860255e-02 1.705499e-02 1.611770e-02 1.480833e-02
[36] 1.440372e-02 1.229116e-02 9.218905e-03 8.477380e-03 6.520674e-03
[41] 5.805374e-03 5.433958e-03 4.505461e-03 3.817909e-03 3.428551e-03
[46] 2.667698e-03 2.501932e-03 2.010387e-03 1.770199e-03 1.453119e-03
[51] 9.929615e-04 8.216922e-04 6.443978e-04 3.679274e-04 1.639579e-04
[56] 1.005922e-04
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Figure 3: PCA Data of Kaiser Methods

b. Plot Screen Graphic

According to Delfitriani et al. (2022), the scree plot provides a graphical representation of the variance explained by each principal component. The flatter the gradient between the plotted points, the smaller the incremental variance explained. As shown in Figure 4, selecting the first two principal components (PCs) can be considered sufficient, as they demonstrate a significant increase in cumulative variance explained.

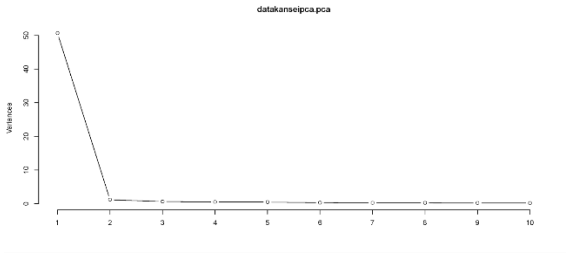

Figure 4: PCA Data of Plot Screen Methods

c. Standard Deviation Methods

According to R. D. Putri (2020), the greater the standard deviation value, the better the component's explanatory power. In the PCA results, two principal components exhibited the highest standard deviation values: PC1 (7.1175) and PC2 (1.0896). These results are presented in Figure 5, which shows the PCA output based on the Standard Deviation method.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Standard deviation	7.1175	1.0896	0.78973	0.71465	0.67976	0.53362	0.47880
Proportion of Variance	0.9046	0.0212	0.01114	0.00912	0.00825	0.00508	0.00409
Cumulative Proportion	0.9046	0.9258	0.93696	0.94608	0.95433	0.95942	0.96351
	PC8	PC9	PC10	PC11	PC12	PC13	PC14
Standard deviation	0.46189	0.4236	0.40792	0.3890	0.36821	0.33552	0.31963
Proportion of Variance	0.00381	0.0032	0.00297	0.0027	0.00242	0.00201	0.00182
Cumulative Proportion	0.96732	0.9705	0.97350	0.9762	0.97862	0.98063	0.98246
	PC15	PC16	PC17	PC18	PC19	PC20	PC21
Standard deviation	0.31346	0.2991	0.27488	0.26820	0.2478	0.24688	0.23330

Figure 5: PCA Data of Standard Deviation Methods

d. Cumulative Proportion Method

Based on the PCA output, the cumulative variance percentage that explains the total data variation is considered acceptable if it ranges between 70% and 80% (Delfitriani et al., 2022). In this study, the cumulative proportion reached 92.58%, which indicates that the selected components adequately represent the information contained in the data. The PCA output using the Cumulative Proportion method is illustrated in the following figure.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Standard deviation	7.1175	1.0896	0.78973	0.71465	0.67976	0.53362	0.47880
Proportion of Variance	0.9046	0.0212	0.01114	0.00912	0.00825	0.00508	0.00409
Cumulative Proportion	0.9046	0.9258	0.93696	0.94608	0.95433	0.95942	0.96351
	PC8	PC9	PC10	PC11	PC12	PC13	PC14
Standard deviation	0.46189	0.4236	0.40792	0.3890	0.36821	0.33552	0.31963
Proportion of Variance	0.00381	0.0032	0.00297	0.0027	0.00242	0.00201	0.00182
Cumulative Proportion	0.96732	0.9705	0.97350	0.9762	0.97862	0.98063	0.98246
	PC15	PC16	PC17	PC18	PC19	PC20	PC21
Standard deviation	0.31346	0.2991	0.27488	0.26820	0.2478	0.24688	0.23330

Figure 6: Data PCA of Cummulative Proportion Method

3.6. Design Concept Results

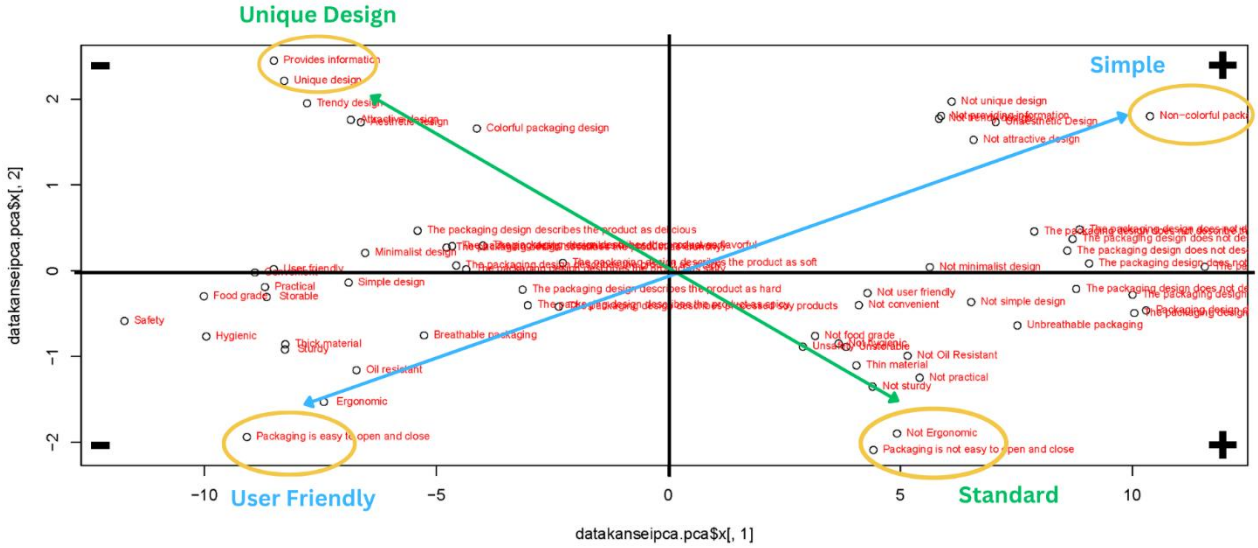

Figure 7: Representation of PCA Analysis Results

Based on Figure 7, it can be concluded that the elements with the highest negative loading on PC1 include Provides information and Unique design. After verification by expert panelists, the corresponding packaging concept was identified as Unique Design. Meanwhile, elements with the highest positive loadings on PC 1, such as Not ergonomic and Packaging is not easy to open and close, led to the formulation of the Standard packaging concept.

The Unique Design concept reflects the desire of certain consumers for visually appealing packaging that differentiates the product in the market. Conversely, the emergence of the Standard concept highlights a segment of consumers who prefer simple, non-flashy packaging that is more universally accepted.

In PC 2, the element with the highest negative loading was Packaging is easy to open and close, which contributed to the formation of the User Friendly concept. On the positive side of PC 2, the dominant element was Non-colorful packaging, resulting in the Simple packaging concept.

The User Friendly concept emphasizes the consumer's need for packaging that is practical and easy to use, while the Simple concept indicates a preference for minimalistic packaging designs. These align with the

characteristics of Crispy Tofu consumers who value functionality and affordability.

When compared to the study by Arini et al. (2023) on tike chips, which produced a creative-informative concept, the findings of this study suggest that although consumers appreciate attractive packaging, practicality and simplicity are more dominant preferences for Crispy Tofu. A similar trend is seen in the research by Faisal et al. (2021) on takoyaki packaging, which emphasized the importance of brand identity through logos and clear information. However, for Crispy Tofu, ease of use takes precedence over complex or visually crowded designs. This highlights a difference in consumer priorities, influenced by product characteristics and consumption habits.

Based on the PCA analysis, two pairs of packaging concepts were identified for Crispy Tofu: Unique Design–Standard and User Friendly–Simple. These PCA results were validated through discussions with three expert panelists. The expert panelists provided design recommendations that reinforced the analytical findings, including:

1. Using food-grade materials such as ivory paper to prevent oil leakage;
2. Including clear product logos and information to strengthen product identity; and
3. Implementing a simple yet visually appealing design to ensure the packaging is practical, cost-effective, and aligned with consumer preferences.

These recommendations are consistent with the extracted PCA concepts (User Friendly–Simple and Unique Design) and underscore the importance of aligning consumers' emotional preferences with the functional attributes of the packaging.

4. Conclusion

Based on the findings of this study using the Kansei Engineering method, 56 packaging samples and 31 pairs of Kansei Words were analyzed to develop packaging design concepts. The concepts derived from Principal Component 1 (PC1) were Unique Design and Standard, while those from Principal Component 2 (PC2) were User Friendly and Simple. These concepts reflect consumers' emotional responses and perceptions toward packaging. However, further research is recommended to identify the specific design elements that correspond to these conceptual categories.

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