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Bakery Packaging Improvement through Kansei Engineering: A Multi-Objective Analysis of Consumer Preferences

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Abstract. *This study investigates the packaging improvement process for plain bread at CV. X. Consumer complaints regarding the use of only tape for sealing and the subsequent negative impact on bread quality (shape, texture, shrinkage) prompted the bakery to explore packaging redesign. This research aims to redesign product packaging using Kansei Engineering, specifically Kansei Type 1, and multivariate analysis. The initial steps of Kansei Engineering Type 1 involve collecting 40 Kansei words, refining them to 30, and then creating a questionnaire for distribution to consumers. The collected questionnaire data will undergo multivariate analysis based on respondent feedback. Desired packaging criteria include bold product branding, multi-color packaging, featuring halal and food safety logos, a prominent company logo, a box-shaped package, made from Oriented Polypropylene (OPP) plastic, and sealed with clip closure.*

Keywords: *Redesign packaging, Kansei engineering, packaging improvement.*

I. INTRODUCTION

CV. X Bakery is a medium-scale bakery company operating in the bakery industry. CV. X has two types of production: the main company, CV. X headquarters, which produces cakes and brownies, and various outlets, including X Bakery outlets, scattered in several areas. One of these outlets is in North Cikarang Jababeka. CV. X Bakery, along with its outlets like X Bakery Cikarang Utara Jababeka, produces a variety of cakes, brownies, and bread. The bread products produced by X Bakery Cikarang Utara Jababeka include two types: sweet bread and plain bread. The issue faced by X Bakery Cikarang Utara outlet involves consumer complaints regarding the packaging of plain bread. The complaint pertains to the use of only tape or adhesive to seal the bread packaging. This concern has prompted the outlet to consider packaging improvements.

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In Figure 1, the product shows the condition of sliced bread on the first day after packaging. The bread retains its neat shape and has a favorable texture. The bread's condition inside the packaging remains satisfactory.

However, after 24 hours until the following day, the sliced bread undergoes physical changes. Upon visual inspection, these changes are evident in the aspect of bread shape irregularity (alteration in the shape of the sliced bread), a less appealing bread texture, and noticeable shrinkage. The potential causes of product damage inside the packaging stem from various factors, such as the entry of external air due to inadequate sealing of the packaging. This phenomenon may result in moisture transfer, causing a reduction in bread moisture content and subsequent physical damage. Alongside addressing the packaging closure issue, modifications to the packaging design have been made, incorporating additional product information to meet packaging standards.

A lot of research has been done on packaging redesign. Overall, the packaging redesign concept has been carried out for SMEs using the Kansei approach (Papantonopoulus et al., 2021; Suzianti & Aldianto, 2020; Ushada et al., 2020). Kansei engineering applications with data mining have also been developed (Jou et al., 2022), for example for eyewear design development. Apart from that, Kansei engineering with design thinking is also starting to be

Figure 1. Sliced bread after packaging.

Figure 2. A few laters after packaging.

Table 1. The Relationship between Kansei Engineering and Multivariate Analysis

Sequence	Method	Result
1	*Coeffisience Correlation Analysis*	The concept of desired consumer emotions is based on the Kansei words collected from the specimens.
2	*Principal Component Analysis*	
3	*Faktor Analysis*	
4	*Partial Least Square* (PLS)	Design requirements aligned with the target consumer emotions.

developed (Camargo & Henson, 2015; Gong et al., 2022; Hartono, 2021). However, this research uses Kansei engineering and multivariate analysis to redesign product packaging.

This study involves the design of packaging using Kansei Engineering methodology to discern consumer preferences through the emotions experienced by consumers. These emotions are then translated into several parameters using multivariate analysis.

Design is an activity involving the comprehensive development of features that influence the appearance and function of a specific product according to customer expectations (Liu et al., 2013). Product design is a strategic step in creating industrial products with the potential to achieve profitable commercial investment outcomes (rate of return on investment). In this context, the development of product concepts, whether for new products or modifications to existing ones, is essential through engineering design and industrial design. This aims to meet market demands (demand pull) or drive the utilization of technological innovations (Sari N.L.D.I.D., 2013).

Kansei Engineering is a technique that connects human feelings and emotions with engineering principles. In this method, consumer feelings and emotions can be translated into words, such as the function, attributes, and form of a product. Research in Kansei Engineering is rooted in emotions and requires all sensory inputs within the human body to represent consumer emotions or feelings (Gong et al., 2022). Kansei Engineering Type 1 is a method where the Kansei categories of a product are decomposed into a hierarchical structure to obtain detailed designs. The steps of Kansei Engineering Type 1 include collecting Kansei words, employing a scale to measure Kansei words, selecting benchmark samples, creating a questionnaire, evaluating data through statistical calculations, and interpreting the design (Suzianti & Aldianto, 2020).

Multivariate statistical analysis is utilized to simultaneously examine the relationships among multiple variables. When observations involve a set of correlated random variables, such analysis is essential for comprehending potential phenomena based on the measurement data (Setyawan Agus et al., 2015).

II. Research Method

This study used Kansei Engineering Type 1. The steps of Kansei Engineering Type 1 are as follows:

1. Specimen determination is carried out by taking bread packaging specimens from other products to determine respondent preferences for packaging design and as benchmarking.
2. Collecting Kansei words is done through interviews, journal articles, websites, and social media platforms like Instagram. Kansei words are collected by the concept for the bread packaging design.
3. Selecting Kansei words involves eliminating words with similar meanings. Before word selection, descriptions are created for the collected Kansei words to understand their explanations.
4. Creating a questionnaire with the Semantic Differential scale is conducted after the selection of Kansei words. The Semantic Differential Scale questionnaire involves respondents marking their preferences on a scale. The scale used in this study consists of 5 points. Subsequently, the questionnaire is distributed and targeted towards outlet customers.
5. Multivariate analysis is conducted to analyze the questionnaire results obtained from the respondents. Multivariate analysis is conducted to analyze the questionnaire results obtained from respondents, utilizing statistical analysis.
6. The reliability test employs Cronbach's alpha method. The reliability test assesses the indicator's correlation or relationship level with all variable scales. Instrument reliability is deemed satisfactory if Cronbach's Alpha value is > 0.60. Cronbach's alpha is a measure of internal consistency and scale reliability (Shrestha, 2021)

$$\alpha = \frac{n\bar{r}}{1 + \bar{r}(n-1)}$$

where, n represents the number of items, and $r\bar{r}$ is the mean correlation between the items. Cronbach's alpha ranges between 0 and 1
7. Coefficient Correlation Analysis (CCA) is employed to comprehend relationships among multiple variables. Many studies aim to identify relationships between two or more variables. Correlation measures the linear

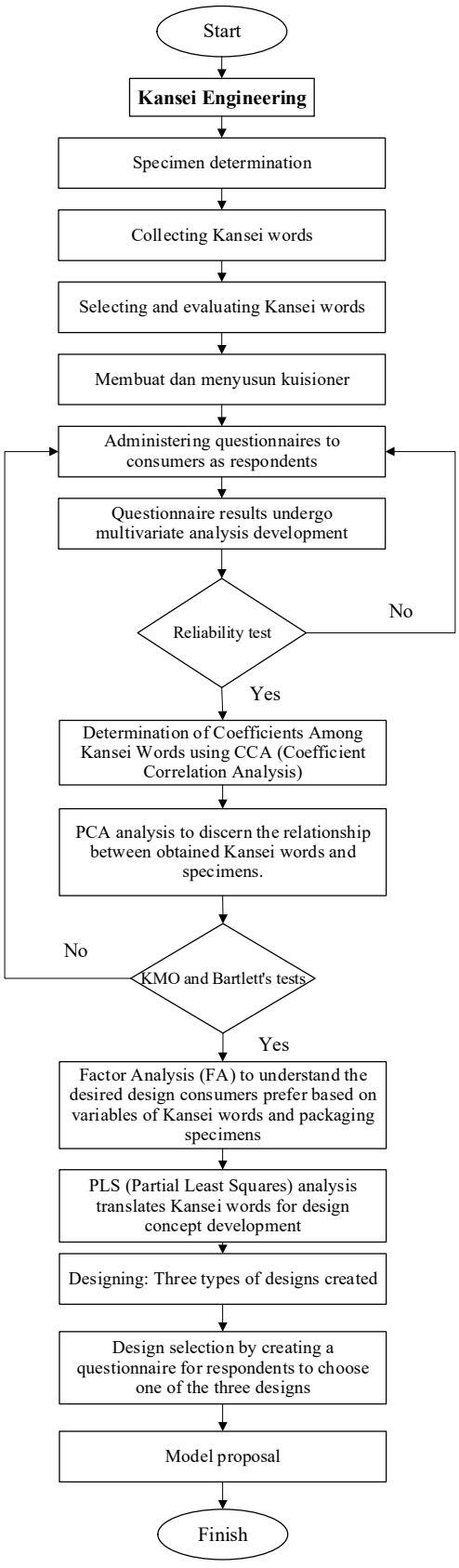

Figure 1. Research flowchart

relationship between these variables (relationship between variables X and Y).

8. Principal Component Analysis (PCA) is A simple, non-parametric method used in modern data analysis across diverse fields from neuroscience to computer graphics to extract relevant information from complex data sets (Shlens, 2014).
9. Barlett's Test of Sphericity helps determine if there is a significant correlation among variables by examining the significance level. If the obtained significance (sig) value is less than 0.05, the correlation between variables is considered high, and factor analysis can proceed. However, if the sig value is greater than 0.05, it indicates a low correlation between variables, and further factor analysis cannot be continued.
10. The Kaiser-Meyer-Olkin (KMO) test is a measure designed to determine the suitability of data for factor analysis. Essentially, it checks if the sample size is adequate. The test assesses the adequacy of the sample size for each variable in the model and for the entire model. The KMO measure is given by the formula (Shrestha, 2021):

$$KMO_j = \frac{\sum_{i \neq j} R_{ij}^2}{\sum_{i \neq j} R_{ij}^2 + \sum_{i \neq j} U_{ij}^2}$$

Where Rij is the correlation matrix and Uij is the partial covariance matrix. KMO value varies from 0 to 1. KMO values between 0.8 to 1.0 indicate adequate sampling.

11. The Measure of Sampling Adequacy (MSA) is used to assess the adequacy of samples for each variable. The MSA test is considered successful if the MSA value exceeds 0.5, indicating that the variable can be further predicted and analyzed. However, if the MSA value is less than 0.5, the variable cannot be adequately predicted or analyzed and may need to be excluded from the analysis.
12. FA (Factor Analysis) aims to identify relationships among several mutually independent variables, enabling the formation of one or several sets of variables that are fewer in number than the original variables. Factor analysis is a statistical method used to reduce the influencing factors of a variable into several sets of indicators without significant loss of information.
13. Partial Least Squares (PLS) is a statistical model used to explain the diversity structure within data. PLS can be seen as a related form to Principal Component Regression (PCR). The model generated through the PLS method optimizes the relationship between two groups of variables. PLS is used to estimate the relationship between variables Y and X, as well as predict specific values of variable Y using a specialized algorithm. The model determination process is carried out iteratively, considering the diversity of variables X and Y.
14. Designing is conducted after performing multivariate analysis. Designing involves creating a prototype of a new packaging design to clearly understand the desired packaging preferences of customers.
15. The selection of packaging design occurs when multiple design options are generated. The selection process involves distributing a questionnaire containing the design outcomes to respondents, allowing them to choose the preferred design.
16. The model proposal is presented by suggesting the chosen model to the company, as indicated by the respondents.

III. Results and Discussions

Specimen collection involves gathering similar products, namely bread packaging. In this study, 4 specimens were collected as seen in Table 2. Specimens are determined by variables: packaging text, packaging color, logo, packaging shape, packaging material, and packaging lid.

This specimen is used to create a matrix of specimen design elements. This matrix will be used for multivariate analysis to determine a design based on the preferred specimens by customers.

Collecting Kansei words is a type of Kansei Type I approach, where the development of product packaging using Kansei Engineering begins with the application of Kansei words. Kansei's words are collected through interviews,

Table 2. The specimen

Specimen Number	Packaging Reference	Brand	Description
A		Sari Roti	• Company logo is present • Company information is visible (address, pho number, composition) • Utilizes diverse colors • Packaging closure uses a clip (securely close • Product is partially visible (partly covered by packaging color) • Packaging image details are visible (circle sh explaining bread contents with colored design) • Shaped according to the product (box) • Halal logo is included
B		Bu Tri	• Company logo is present • No company information is available (no address, phone number, composition) • Utilizes only one color (plain) • Packaging closure uses a clip that can be opened and closed (securely closed) • Product is visible inside (transparent) • Shaped according to the product (circular)
C		Global Bakery	• Company logo is present • Halal logo is included • Company information is present (address, pho number, composition) • Packaging color is monotonous, not colorful • Product is visible inside (transparent) • Packaging is sealed using tape • Shaped according to the product (box) • Halal logo is included
D		Yamazaki	• Company logo is present • Company information is visible (address, pho number, composition) • Utilizes diverse colors • Packaging closure uses a clip (securely close • Product is partially visible (partly covered by packaging color) • Packaging image details are visible (Japanese Kanji characters as an identity from Japan) • Shaped according to the product (box) • Halal logo is included

Table 3. Matrix of specimen elements

Specimen Number	Packaging Text		Packaging Color		Logo		Packaging Shape		Packaging Material		Packagir Lid	
	Bold	Thin	1 Color	Colorfull	Big	Small	Box	Cylinder	PP	OPP	Sealed Clip	T
A	✓			✓	✓		✓			✓	✓	
B		✓	✓			✓		✓	✓		✓	
C	✓			✓	✓		✓			✓		
D	✓			✓	✓		✓			✓	✓	

Table 1. The collection of Kansei words

No	Kansei	No	Kansei	No	Kansei	No	Kansei
1	Safe	11	Simple	21	Trend	31	Natural
2	Strong	12	Elegant	22	Light	32	Clear writing
3	Modern	13	Beautiful	23	Aesthetic	33	Minimalist
4	Durable	14	Creative	24	Foodgrade material	34	Protected produ
5	Colored	15	Simple	25	Dynamic	35	Halal logo is cle
6	Economical	16	The packaging is closed	26	Recycle	36	Product name is
7	Thick writing	17	Interesting	27	Shaped	37	Flexible packagi
8	Unique	18	Neat	28	Character	38	Plastic bearing t
9	Manipulation	19	Transparent	29	Details	39	Expired writing
10	Higenis	20	Informative packaging	30	Harmonious	40	Innovative

journal surveys, and social media. From the research results, 40 Kansei words were obtained as seen in Table 4.

The selection of Kansei words starts by determining descriptions and meanings of the collected Kansei words. Selecting Kansei words is a crucial step in Kansei engineering, which aims to design products based on user emotions and sensory perceptions. Once the Kansei list is completed, then eliminate redundant words, ensure clarity, and avoid ambiguity. The selected Kansei words can be seen in Table 5.

After Kansei word selection, a questionnaire is developed using a Semantic Differential scale. The questionnaire employs a 5-point scale. After determining the scale of the questionnaire, the questionnaire is created. The obtained respondents are a total of 106 participants. Table 6 shows the questionnaire results.

Table 5. The Selected Kansei Words Result

No	Kansei Words	No	Kansei Words
1	Safe	16	Modern packaging design
2	Strong	17	Color packaging design
3	Durable	18	Unique design packaging
4	Higenis	19	Creative packaging design
5	Tightly closed	20	Simple packaging design
6	Neat	21	Interesting packaging model
7	Informative	22	Product transparent visible
8	Made of light	23	Design according to the trend
9	Foodgrade standard	24	Aesthetic packaging design
10	Fit shape	25	Character packaging design
11	Large Halal Logo	26	Detailed packaging design
12	Large company logo	27	Product image harmonious
13	Flexible packaging	28	Natural packaging image
14	Large big food logo	29	Writing product name is clear
15	Big expired writing	30	Innovative packaging design

Table 6. Questionnaire average results

No	Kansei Words	Specimen A	Specimen B	Specimen C	Specimen D
1	Safe	-1,56	-1,6	-1,68	-1,2
2	Strong	-1,28	-1,32	-1,36	-1,2
3	Durable	-1,2	-1,44	-1,36	-0,36
4	Higenis	-1,68	-1,68	-1,72	-1,12
5	Tightly closed	-1,56	-1,6	-1,4	-1,16
6	Neat	-1,84	-1,44	-1,52	-1,28
7	Informative	-1,52	-1,76	-1,68	-1,2
8	Made of light	-1,52	-1,36	-1,48	-1,08
9	Foodgrade standard	-1,4	-1,56	-1,72	-1,24
10	Fit shape	-1,12	-1,16	-1,2	-0,92
11	Large Halal Logo	-0,52	-0,88	-0,68	-0,08
12	Large company logo	-0,72	-0,56	-0,8	0
13	Flexible packaging	-1,56	-1,44	-1,64	-1,12
14	Large big food logo	-0,76	-0,92	-0,72	-0,44
15	Big expired writing	-0,92	-1,44	-0,88	-0,08
16	Modern packaging design	-1	-1,44	-1,12	-1,04
17	Color packaging design	-0,92	-1,2	-0,88	-1,12
18	Unique design packaging	-1,52	-1,56	-1,2	-0,8
19	Creative packaging design	-1,36	-1,64	-1,52	-0,76
20	Simple packaging design	-1,64	-1,56	-1,48	-1,2
21	Interesting packaging model	-1,72	-1,44	-1,28	-1
22	Product transparent visible	-1	-1,16	-1,36	-0,88
23	Design according to the tren	-1,32	-1,32	-1,16	-0,92
24	Aesthetic packaging design	-1,48	-1,44	-1,28	-1,04
25	Character packaging design	-1,44	-1,48	-1,48	-1,12
26	Detailed packaging design	-1,32	-1,52	-1,2	-1
27	Product image harmonious	-1,52	-1,56	-1,4	-1
28	Natural packaging image	-1,24	-1,16	-1,24	-1,16
29	Writing product name is clea	-1,6	-1,64	-1,56	-1,32
30	Innovative packaging design	-1,56	-1,48	-1,44	-0,96

Cronbach's Alpha calculation was performed on the obtained questionnaire results. The questionnaire yielded a Cronbach's Alpha value of 0.952, which is greater than 0.6. This indicates that the 30 questionnaire items (30 Kansei words) are considered reliable or consistent for use in this study.

Figure 4 presents the results of PCA in the form of Principal Components (PC). It can be observed that PC1, PC2, PC3, PC4, and PC5 have eigenvalues exceeding 1, which satisfies the criterion for being significant factors representing the variance of the variables. Eigenvalues are used to determine factors that have a greater influence on the variables, indicated by principal component values greater than 1.

Table 7. Results of correlation component analysis (CCA)

Correlations					
	P.1	P.2	P.3	P.4	…
P.1	1	.454**	.439**	.729**	…
P.2	.454**	1	.428**	.442**	…
P.3	.439**	.428**	1	.445**	…
P.4	.729**	.442**	.445**	1	…

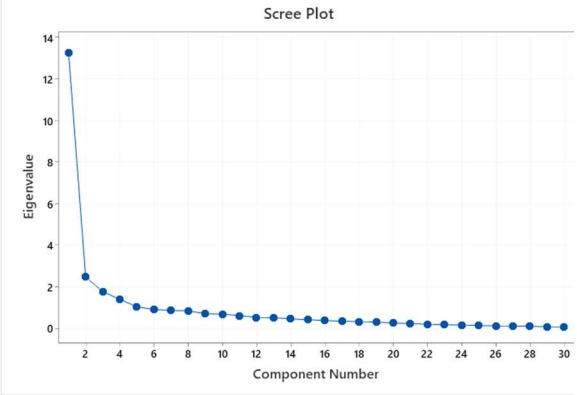

Figure 2. Scree Plot Principal Component Analysis (PCA)

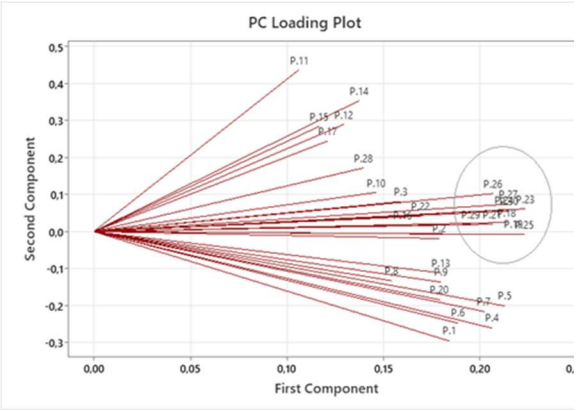

Figure 3. PC Loading Plot

In the scree plot of the overall PCA results from all respondents, it can be observed that 30 variables (30 questionnaire items) can be reduced to 5 factors: PC1, PC2, PC3, PC4, and PC5, which will be referred to as F1, F2, F3, F4, and F5. This naming convention is used due to the decreasing slope of the graph's line, indicating that the relationship between variables and factors becomes weaker.

The results of PC loading can be observed in Figure 6, which depicts the PC loading graph to determine the positioning of the word 'Kansei.' The positioning of the word 'Kansei' on the PC loading plot is positive as it clusters in the region of the x-axis (as seen within the circle). The words associated with 'Kansei' include detailed packaging design (P.26), harmonious production images (P.27), trend-aligned design (P.23), innovative packaging design (P.30), clear product name writing (P.29), attractive packaging model (P.21), unique packaging design (P.18), creative packaging design (P.19), and character-based packaging design (P.25).

In Figure 10, the PC scores among specimens are evident. The arrangement of specimens is based on the results from PC loading and is adjusted according to the design element matrix of the specimens. Figure 4.5 illustrates that there are 3 specimens on the positive x-axis, namely specimens A, C, and D, and 1 specimen on the negative x-axis, which is specimen B. The PC score outcomes indicate that specimens A, C, and D are categorized as dominant and favored by respondents because they fall within the positive x-axis region. On the other hand, specimen B, situated on the negative x-axis, is assumed to be less favored by respondents.

PC vectors are utilized to assess the extent of emotional influence on the packaging product specimen, while also determining the Kansei domain in proposing the design concept for bread packaging products. In Figure 4.6, the

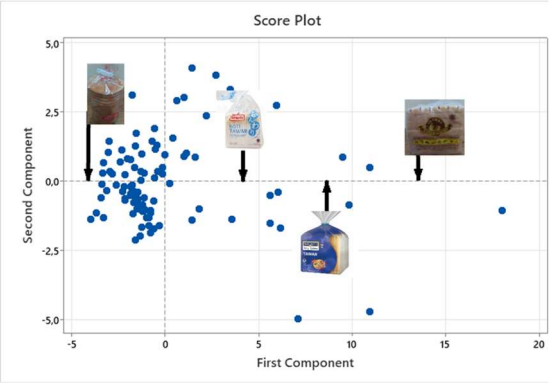

Figure 4. PC Score of specimens

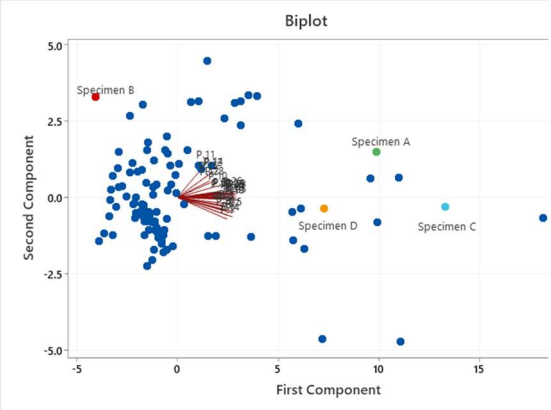

Figure 5. PC vector of specimen

Table 8. Result of KMO and Barlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,905
Bartlett's Test of Sphericity	Approx. Chi-Square	2365,808
	df	435
	Sig.	0,000

Table 9. Result of Factor Analysis

Initial Eigenvalues			
Component	Total	% of Variance	Cumulative
1	13,238	44,128	44,128
2	2,519	8,397	52,525
3	1,759	5,862	58,387
4	1,483	4,943	63,330
5	1,085	3,617	66,947

distribution of Kansei words along the red line indicates the user's emotional distribution towards the specimen. These Kansei words comprise detailed packaging design (P.26), harmonious production images (P.27), trend-aligned design (P.23), innovative packaging design (P.30), clear product name writing (P.29), attractive packaging model (P.21), unique packaging design (P.18), creative packaging design (P.19), and character-based packaging design (P.25).

Factor Analysis (FA) is employed to examine the concept of 'Kansei' words by identifying significant factors related to these words, aiming to determine new stimulus concepts for bread packaging products. The outcomes of FA are utilized to refine the results of the PCA analysis, using the data source derived from the average questionnaire responses of all respondents.

Based on Table 8, the results of Bartlett's Test of Sphericity, which has a sigma value (Sig.) smaller than 0.05, the correlation between variables is high, and the process of factor analysis can proceed. Meanwhile, the Kaiser-Meyer-Olkin (KMO) result yields a value of 0.905, which is greater than 0.5, indicating that the factor analysis is suitable to be conducted [10].

In the PCA results, 5 factors are obtained, which will serve as the foundation for designing the packaging for each respective variable, i.e., the Kansei words. In Table 9, the outcomes of the factor analysis (FA) show 5 factors, confirming that the results from PCA and FA are consistent with no changes.

Table 9 presents the component matrix of the factor analysis. The component matrix in factor analysis indicates whether the formed factors are correlated or not.

To observe the relationships between variables assigned to each factor, a rotated component matrix is necessary. This matrix further highlights the variables associated with each factor. In the rotated component matrix (Table 10), only the numerical values of variables connected to a specific factor are displayed. If there is no relationship, the numerical values for those variables will be eliminated.

After determining the placement of Kansei words within the 5 factors, the next step is to establish the design concept based on the obtained factors (Table 11).

Table 10. Component Matrix of Factor Analysis (FA)

Kansei		Component Matrix[a] Factor Analysis				
		1	2	3	4	5
P.1	Safe	0,670	-0,468	0,217	-0,124	0,021
P.2	Strong	0,651	-0,029	-0,004	-0,216	0,463
P.3	Durable	0,578	0,128	0,370	-0,168	0,094
P.4	Higenis	0,751	-0,413	0,143	-0,068	-0,165
P.5	Tightly closed	0,774	-0,318	0,036	-0,037	-0,078
P.6	Neat	0,686	-0,392	0,261	-0,018	0,033
P.7	Informative	0,735	-0,342	0,146	-0,161	-0,091
P.8	Made of light	0,561	-0,210	0,321	0,357	0,179
P.9	Foodgrade standard	0,654	-0,216	0,033	-0,054	-0,047
P.10	Fit shape	0,531	0,167	0,261	0,434	-0,040
P.11	Large Halal Logo	0,387	0,693	0,177	-0,159	-0,070
P.12	Large company logo	0,471	0,458	0,465	0,157	-0,219
P.13	Flexible packaging	0,655	-0,177	0,399	-0,137	-0,109
P.14	Large big food logo	0,500	0,561	0,168	-0,101	0,112
P.15	Big expired writing	0,424	0,450	0,224	-0,403	-0,416
P.16	Modern packaging design	0,582	0,027	0,039	0,075	-0,012
P.17	Color packaging design	0,440	0,387	0,111	-0,226	0,505
P.18	Unique design packaging	0,778	0,039	-0,275	-0,214	-0,113
P.19	Creative packaging design	0,791	-0,012	-0,282	-0,170	-0,049
P.20	Simple packaging design	0,651	-0,292	0,111	-0,057	-0,074
P.21	Interesting packaging model	0,751	0,032	-0,318	-0,037	0,010
P.22	Product transparent visible	0,616	0,066	0,179	0,359	0,350
P.23	Design according to the trend	0,813	0,097	-0,250	0,091	0,040
P.24	Aesthetic packaging design	0,773	0,093	-0,343	0,166	-0,137
P.25	Character packaging design	0,811	-0,013	-0,245	0,031	-0,030
P.26	Detailed packaging design	0,752	0,162	-0,238	-0,135	-0,144
P.27	Product image harmonious	0,781	0,118	-0,252	-0,201	0,253
P.28	Natural packaging image	0,507	0,272	-0,013	0,532	-0,160
P.29	Writing product name is clear	0,711	0,031	-0,187	0,348	-0,042
P.30	Innovative packaging design	0,783	0,089	-0,310	0,189	-0,014

Table 11. Result of Analysis Factor for Design

Faktor	Aspek
F1	Gambar dan desain
F2	Aspek kemasan dan keterangan
F3	Logo dan informasi tambahan
F4	Bahan kemasan
F5	Tambahan

Table 12. Dummy Of Specimen

Variable	Bold	Thin	1 Color	Colorfull	Big	Small	Box	Cylinder	PP	OPP	Sealed Clip	Tape
A	1	0	0	1	1	0	1	0	0	1	1	0
B	0	1	1	0	0	1	0	1	1	0	1	0
C	1	0	0	1	1	0	1	0	0	1	0	1
D	1	0	0	1	1	0	1	0	0	1	1	0

The factors to be used are renamed as criteria that serve to determine the design based on the established criteria: C1, C2, C3, C4, and C5.

Partial Least Squares (PLS) is conducted by analyzing the results of Principal Component Analysis (PCA) and Factor Analysis (FA) to identify design elements that significantly influence the respondents. The outcomes of this analysis serve as a reference for designing bread packaging products in alignment with respondent emotions. The data employed in the PLS analysis in this study consists of three elements: Variable Y (dependent), represents the average results of the semantic differential scale questionnaire. Variable X (Independent), representing design elements translated into dummy variables, with checked boxes assigned a value of 1 and empty columns assigned a value of 0. The design elements collected originate from four packaging product specimens.

Table 12 represents the dummy variables obtained from the design element matrix table, where check marks assumed to indicate design criteria are replaced with a value of 1, while empty columns without check marks, assuming no design criteria, are assigned a value of 0. The PLS calculations were conducted using XL Stat 16.

Table 13 illustrates the translation of the emotional concept relationship between the average respondent questionnaire scores and dummy specimens, aiming to ascertain the extent of the influence of variable values (design element concepts) on participant concepts.

The design resulting from the collection of Kansei words and multivariate analysis indicates that consumers desire packaging to have bold product labeling, multiple colors, a prominent halal logo, food, and company logos that are large, a box packaging shape that corresponds to the square shape and size of the bread, packaging material made from Oriented Polypropylene (OPP) plastic, and a sealed clip

Table 13. Results of partial least square (pls) regression

Criteria	Variable	Coefficient
Packaging Desing	Bold	0,11
	Thin	0,05
Packaging Color	1 Color	0,05
	Colorfull	0,11
Logo	Big	0,11
	Small	0,05
Packaging Shape	Box	0,11
	Cylinder	0,05
Packaging Material	PP	0,05
	OPP	0,11
Packaging Closuer	Sealed Clip	0,51
	Tape	0,23

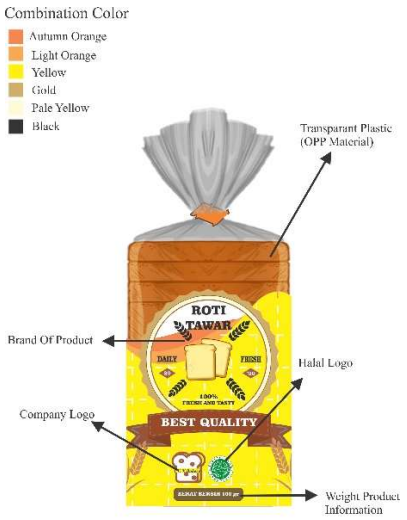

Figure 6. Design Type 1

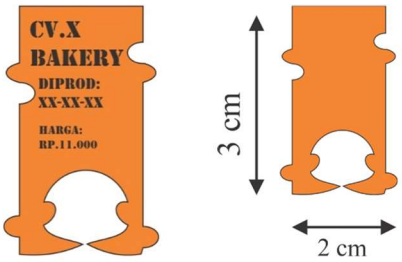

Figure 7. Sealed clip of design type 1

closure. Three design proposals were obtained.

Design Type 1 (Figure 9) for bread packaging features a box shape with the bread positioned vertically. The base color utilized is yellow, serving as the company's identity color. The packaging design includes a detailed image of wheat, symbolizing that the bread is made from high-quality wheat flour. The bread packaging is made from Oriented Polypropylene (OPP) plastic, known for its smooth and transparent surface, reflecting its good quality. The top part of the packaging is transparent, allowing the contents to be visible. The packaging is appropriately sized to accommodate the bread. The text on the packaging is bold and black, with the halal logo and company logo displayed on the front, while the food-grade plastic logo is prominently featured on the back. The expiration date is printed on the back of the packaging.

For the sealed clip of the box-shaped and orange-colored packaging. On the sealed clip (Figure 10), there is the company's logo, production date, and the price of the 'roti tawar' product.

Design type 2 takes the form of a box, but the position of the bread product is vertical. The detailed illustration on the packaging features a wheat image, symbolizing that the bread is made from high-quality wheat flour. The bread packaging is made from OPP (Oriented Polypropylene) plastic, known for its smooth and transparent surface due to its excellent quality. Transparent packaging on the right and left sides

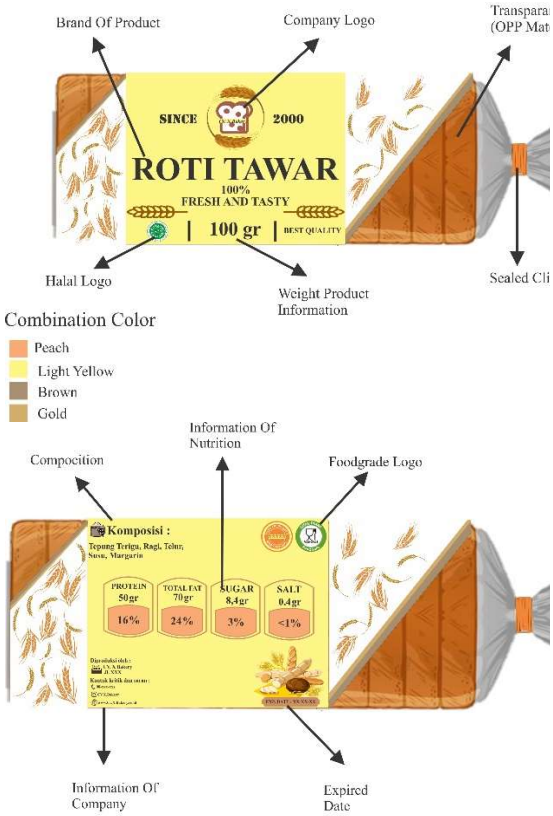

Figure 11. Design Type 2

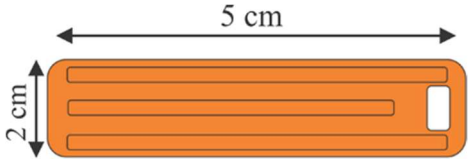

Figure 12. Sealed Clip Of Design Type 2

allows the product to be visible. The design type 2 packaging is also appropriately sized for the bread it contains. The text on the packaging is bold and in black, with the halal logo and company logo prominently displayed on the front. Meanwhile, the food-grade plastic logo is located on the back. The expiration date is indicated on the back of the packaging.

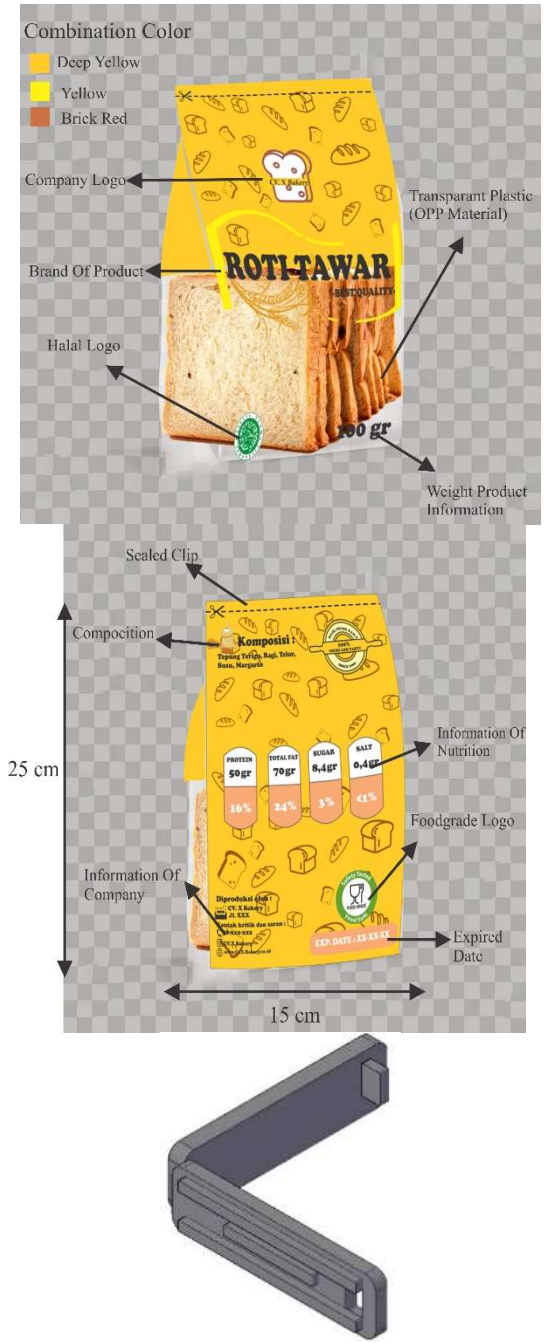

Figure 13. Design Type 3 and the sealed

For the sealed clip of type 2 packaging (Figure 12), a thin but secure clamp-shaped clip is used, which tightly seals the packaging due to its locking mechanism.

Design type 3 features a box-shaped packaging design with the bread positioned horizontally. The box shape of design type 3 resembles a pouch, but it is larger in size to accommodate the bread product. The text on the packaging is bold and in black. The company logo and halal logo are located on the front, while the food-grade plastic logo is placed on the back of the packaging. The expiration date is indicated on the back of the packaging. The bread packaging is made from OPP (Oriented PolyPropylene) plastic, known for its smooth and transparent surface due to its excellent quality. Transparent packaging on the right and left sides allows the product to be visible.

For the type 3 packaging, the sealed clip uses a ziplock mechanism, ensuring a tight and airtight seal.

In this study, three different designs were obtained, and these three design concepts were presented in a questionnaire for consumers to choose their preferred and desired packaging for the bread product. The questionnaire was completed by 35 respondents. Below are the results of the selection of the three packaging

Figure 14. Ziplock of design type 3

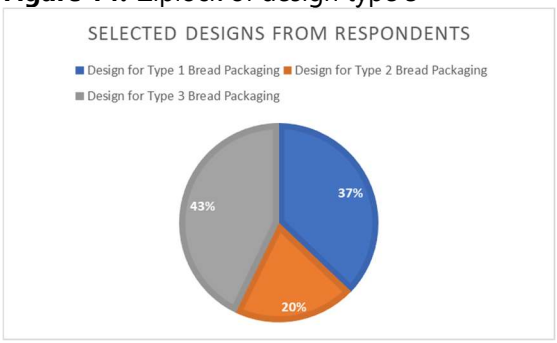

Figure 85. Selected design from respondents

designs as chosen by the respondents.

From the questionnaire distributed to 35 respondents for the Type 1 design, it was found that there is interest from 37% of the respondents, which is 13 individuals. For the design type, there is an interest from 20% of the respondents, which amounts to 7 individuals. Meanwhile, for the Type 3 design, there is an interest from 43% of the respondents, which is 15 individuals. It can be assumed that respondents prefer the Type 3 design.

IV. CONCLUSION

In the product packaging design using Kansei Engineering method for Type 1, a total of 40 Kansei words were collected. These words were then narrowed down to 30 through selection.

A questionnaire was distributed using a semantic differential scale with 5 levels: 2, 1, 0, -1, and -2. Respondents were consumers or customers of Outlet X Bakery in Cikarang Utara Jababeka. The collected data included responses from 106 participants.

The results were calculated using multivariate analysis. The outcome of the analysis, based on the collection of Kansei words and multivariate analysis, indicated that consumers desire packaging with bold product labeling, multiple colors, large halal, food-grade, and company logos. The preferred packaging shape is a box that corresponds to the square shape of the bread, made from OPP (Oriented Polypropylene) plastic material, and sealed with a clip.

Three distinct design options were identified for the bread packaging design, to be determined by the outlet based on the results of the multivariate analysis

REFERENCES

Camargo, F. R., & Henson, B. (2015). Beyond usability: designing for consumers' product experience using the Rasch model. *Journal of Engineering Design, 26* (4–6), 121–139. https://doi.org/10.1080/09544828.2015.1034254

Gong, X., Guo, Z., & Xie, Z. (2022). Using Kansei Engineering for the Design Thinking Framework: Bamboo Pen Holder Product Design. *Sustainability (Switzerland), 14* (17), 1–17. https://doi.org/10.3390/su141710556

Hartono, M. (2021). Kansei Engineering and Design Thinking Methodology for Product/Service Design. Kansei Engineering and Design Thinking Methodology for Product/Service Design, 14–16.

Jou, Y. T., Sukwadi, R., Silitonga, R. M., & Roselly. (2022). Application of Kansei Engineering and Data Mining for the Eyewear Industry in Jakarta. *Jordan Journal of Mechanical and Industrial Engineering, 16* (2), 175–183.

Liu, S. Q., Zheng, X. J. S., Liu, G. M., Jian, J., & Peng, K. P. (2013). Beautiful, usable, and popular: Good experience of interactive products for Chinese users. *Science China Information Sciences, 56* (5), 1–14. https://doi.org/10.1007/s11432-013-4835-4

Papantonopoulus, 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

Sari N.L.D.I.D. (2013). Elemen Visual Kemasan Sebagai Strategi Komunikasi Produk. *Profetik, 6* (1), 43–52.

Setyawan Agus, A., Isa, M., Wajdi, W. F. M., Syamsudin, & Nugroho Permono, S. (2015). An Assessment of SME Competitiveness in Indonesia. *Journal of Competitiveness, 7* (2), 60–74. https://doi.org/10.7441/joc.2015.02.04

Shlens, J. (2014). *A Tutorial on Principal Component Analysis*. http://arxiv.org/abs/1404.1100

Shrestha, N. (2021). Factor Analysis as a Tool for Survey Analysis. *American Journal of Applied Mathematics and Statistics, 9* (1), 4–11. https://doi.org/10.12691/ajams-9-1-2

Suzianti, A., & Aldianto, A. (2020). Redesign of Product Packaging with Kansei Engineering: Empirical Study on Small-medium Enterprises in Indonesia. *Makara Journal of Technology, 24* (2), 65. https://doi.org/10.7454/mst.v24i2.2990