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Design of Ready-to-Drink Coffee Product Packaging Using Kansei Engineering Method and Eye Tracking

Aprilia Tri Purwandari[1*], Moza Aisyah Yasmin[1], Budi Aribowo[1]

[1]Industrial Engineering, Faculty of Science and Technology, Universitas Al-Azhar Indonesia, Sisingamangaraja Street, Jakarta, Indonesia.

Corresponding author/E-mail: aprilia@uai.ac.id

Abstract – **Packaging plays an important role in enhancing a product's competitiveness. Therefore, the aim of this research is to design attractive packaging for ready-to-drink coffee that will boost the company's competitiveness in selling such products, especially for Micro, Small, and Medium Enterprises (MSME), which face tough competition from both local and international companies. The objective of this research is to design ready-to-drink coffee packaging that caters to consumer preferences using Kansei Engineering and Eye Tracking. Based on the analysis using Kansei Engineering and Eye Tracking methods, two packaging recommendations for ready-to-drink coffee were obtained. If the company wants to focus on environmentally friendly packaging design, use bulb-shaped packaging made of glass, with a medium size of 300-350 ml, a monochrome label that provides detailed information and attached with pictures, based on the results of the Kansei Engineering analysis. On the other hand, if the focus is on aesthetics, the company should use bulb-shaped packaging made of plastic, with a medium size of 300-350 ml, a monochrome label that provides detailed information and attached with pictures, based on the results of the Eye-tracking analysis.**

Keywords *- Conjoint Analysis, Eye Tracking, Kansei Engineering, Packaging, Ready-to-Drink Coffee.*

INTRODUCTION

Products need protective packaging to protect the contents of the product. However, not only that, packaging also has a function as an indirect promotion [1]. The more attractive the design concept on the packaging, the higher customer interest will be to buy them. Moreover, not only the aesthetics of the design, the packaging also needs to be adjusted to the target market of the product. Some products even carry the concept of environmentally friendly packaging to enhance the product's brand image.

Coffee is one of the agricultural products in Indonesia that has great business potential, both at domestically and internationally [2]. Based on data from the Central Bureau of Statistics, Indonesia's total coffee exports to various countries in the world in 2021 were 384,510.6 tons, while the amount of coffee consumption in the world in 2021 was 10,032,000 tons, an increase from the previous year, with world consumption of 9,977,800 tons [3]. Based on data from the International Coffee Organization (ICO), the amount of coffee consumption in Indonesia in 2021 is 300,000 tons. This shows an increase from the previous year of 288,360 tons [4]. This shows that both the coffee industry in the world and in Indonesia continues to grow and develop.

One of the processed products from coffee is ready-to-drink coffee. Ready-to-drink coffee is a liquid coffee product that is stored in bottles that can be drunk anytime and anywhere. Ready-to-drink coffee products are not only produced by large companies, but also by micro, small and medium enterprises. The existence of tough competition in the ready-to-drink coffee industry requires companies to be able to compete with other competitors, especially for micro, small and medium enterprises. To face such situation, the company needs to pay attention to the packaging of the products being sold, because product packaging design can significantly influence buyer's decision to buy a product [5]. Based on observations made on the internet, it has been found

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that there are several micro, small, and medium enterprises that do not pay attention to the packaging design of the products they sold. This study was conducted to determine the design of ready-to-drink coffee packaging according to customer preferences to increase competitiveness of selling ready-to-drink coffee products.

METHOD

In this study, two methods were used, Kansei Engineering and Eye Tracking. Kansei Engineering is a method used to find out the feelings or emotional responses of customers to the needs of the desired product or service and can be used to identify items and categories of products that are in accordance with customer desires [6].

Eye-tracking is the process of recording the gaze and eye movement of a person using optical method-based equipment to track eye movements [7], by detecting the parts seen, the duration or length of gaze, and the path seen by the eyes. This method is one of the non-verbal methods used to measure user attention and design evaluation. Due to software limitations, there were only a total of 20 participants in the eye tracking study. For studies with strong experimental control and well-defined variables, smaller sample sizes (10-20) can be adequate [8]. The experiment only performed aesthetic or visual assessments of packaging. The manufacture and transportation costs for the packaging are not taken into account in this experiment.

The stage begins with making a pre-questionnaire consisting of 1 question to collect kansei word. The collection of Kansei words was carried out using a pre-questionnaire to 50 respondents. It will be used to get to know about customer's feelings or emotional responses to the packaging of the existing ready-to-drink coffee products. The kansei word that have been collected will be structurized. Structuring is done by grouping words that have the same meaning and then creating kansei word that can represent words that have been grouped before.

After structuring the kansei word, the kansei word is paired with the opposite of the structured kansei word. Then the paired kansei words will be the input to the first questionnaire, Semantic Differential I questionnaire. Respondents will evaluate the kansei word in which the pair of kansei words will be given a scale of 1-4. Then data validity and reliability testing is conducted.

The next stage is to determine the items and attributes that can represent the respondent's preferences. Determination of items is based on pre-questionnaires data that have been obtained previously, literature studies and online observation. Items and categories that have been obtained are combined using the help of statistical software, the output is stimuli from a combination of items and categories of ready-to-drink coffee packaging. Stimuli will be used as input for The Semantic Differential II questionnaire and the Eye Tracking experiment.

The next stage is to collect data for Semantic Differential II and Eye Tracking. For The Semantic Differential II, questionnaire is used to obtain the data. Input for the questionnaire is valid and reliable kansei words and image stimuli which are a combination of items and categories that have been obtained previously. For Eye-Tracking, RealEye software is used to obtain heat maps data and fixation time duration. Input for the Eye-Tracking is image stimuli, same as The Semantic Differential II. The output for both methods are recommendation for ready-to-drink coffee packaging.

RESULTS AND DISCUSSIONS

Gathering Kansei Words

In the pre-questionnaire, respondents were given open-ended questions to find out how respondents felt about ready-to-drink coffee packaging. Respondents for the pre-questionnaire were limited to people who have purchased coffee before. The number of kansei words obtained was 40. The kansei words that have been collected then were structured.

Structuring Kansei Words

Kansei word structuring is done by grouping kansei words that have the same meaning

Table 1. Results of Structuring Ready-to-Drink Coffee Packaging Design

No	Kansei Word Results from Pre-Questionnaire	Structurize Kansei Words
1	Clear packaging	Product Visible
2	Display product content	
3	Transparent bottle	
4	Environmentally friendly	Environmentally friendly
5	Recyclable	
6	Reusable	
7	*Eco-Friendly*	
8	Non-Plastic	
9	Not slippery when held	Safe

No	Kansei Word Results from Pre-Questionnaire	Structurize Kansei Words
10	Safety (not easy to leak)	
11	Have good material	Good Quality
12	Good quality of bottle material	
13	Using materials that are not easily broken	
14	Unique shapes	Unique
15	Easy to carry anywhere	Ergonomic
16	Easy to hold	
17	Easy to grip	
18	Not burdensome if carried everywhere	Practical
19	Flexible and easy to put in the bag	
20	Easy to use	

Based on the structuring that has been done in table 1. There are 7 kansei words that can represent consumer feelings and desires for physical packaging design of ready-to-drink coffee, namely product visible, environmentally friendly, safe, good quality, unique, ergonomic and practical.

Table 2. Results of Structuring Ready-to-Drink Coffee Packaging Design

No	Kansei Word Results from Pre-Questionnaire	Structurized Kansei Words
1	There is a taste exploration	Informative
2	There is an expiration date and a date of manufacture	
3	Logo Halal	
4	Ada brand then logo	
5	Types of drinks	
6	Product information available	
7	There are ingredients and compositions of coffee	
8	Informative	
9	Elegant design	Elegant
10	Simple design	Minimalist
11	Not too much color	
12	Minimalist Design	
13	Attractive design	Eye-Catching
14	Labels or writing have an attractive aesthetic	
15	*Catchy* design	
16	Attract	
17	Brands are easy to remember and recognize	Has Distinctive Characteristics
18	Has distinctive features	
19	Contemporary	Up-to-date

Based on the structuring that has been done in table 2. There are 6 kansei words that can represent consumer feelings and desires for packaging label design of ready-to-drink coffee, namely informative, elegant, minimalist, eye-catching, has distinctive characteristics and up-to-date.

Word Pair for Kansei Words

Kansei words that have been structured are given opposite pairs of each kansei word. The pairing of kansei words is used as input for developing the Semantic Differential I questionnaire. The Kansei engineering method uses semantic differential as a technique used to obtain adjectives that have the potential to be used as a scale in assessing customer feelings towards a product, by placing opposite words on the line. straight on each side which is given an antonym scale at each pole [9].

Table 3. Kansei Word Pairing for Physical Packaging Design

Physical Packaging Design		
No	***Kansei* Word (Left – Right)**	
1	Not Environmentally Friendly	Environmentally Friendly
2	Non-Ergonomic	Ergonomic
3	Product Invisible	Product Visible
4	Not Safe	Safe
5	Impractical	Practical
6	Common	Unique
7	Poor Quality	Good Quality

Table 4. Kansei Word Pairing for Packaging Label Design

Packaging Label Design		
No	***Kansei* Word (Left – Right)**	
1	Lack of Information	Informative
2	Lacks Distinctive Features	Has Distinctive Characteristics
3	Excessive	Elegant
4	Not Eye-Catching	Eye-Catching
5	Complex	Minimalist
6	Outdated	Up-to-date

Table 3 and 4 are show the results of pairing kansei words with opposites which are then used as input for The Semantic Differential I questionnaire. Right kansei words are the result of structuring kansei words obtained from collecting kansei words, while left kansei words are opposites of right kansei words. The purpose of distributing The Semantic Differential I questionnaire is to evaluate Kansei words.

Semantic Differential I Results

After distributing the Semantic Differential I questionnaire, an assessment was obtained for each kansei word and data on the influence of packaging on the decision to purchase ready-to-drink coffee.

Respondents obtained from the Semantic Differential I questionnaire, were 100 people. It is known that 67% of respondents answered "Yes", 21% of respondents answered "Maybe", and 12% of respondents answered "No". It can be concluded that packaging can influence customer decisions in purchasing ready-to-drink coffee. These results are also supported by research, in which the product packaging design significantly influences the purchasing decision of Cleo's drinking water in the city of Banda Aceh [10]. The results of the assessment of kansei words from the Semantic Differential I questionnaire will be tested for the validity and reliability of the data.

Validity and Reliability Test

Spearman Rank is used for validity test, Spearman Rank test is used because the type of data in the questionnaire is ordinal. Then the reliability test was carried out on the results of The Semantic Differential I. To test the reliability, Cronbach's Alpha test was used. Cronbach's Alpha is a test used to see whether the variable is reliable or not. Variables are declared reliable if the value of r alpha > r table.

The results obtained from the reliability test for Cronbach's Alpha value are 0.766. It can be said that the instrument variable data is reliable, with a high level of reliability because the Cronbach's Alpha value is between 0.7 - 0.9 [11].

Factor Analysis

Factor analysis is a multivariate statistical technique used to reduce the amount of data. Factor analysis was performed using KMO and Bartlett tests. This analysis is used to determine whether the variables can be further analyzed or not. The value of Bartlett's Test of Sphericity has a value of Sig. < from Alpha 5% which is 0.000 < 0.05, it can be seen that the correlation between variables is significant. Based on the MSA results obtained, the MSA value > 0.5 (0.767 > 0.5), it can be concluded that the sample is considered adequate for further factor analysis.

For the MSA results for all kansei words are more than 0.5 (MSA results for Kansei words > 0.5). It can be seen that all kansei words as a whole can be analyzed further and can be processed into further questionnaires, it can also be concluded that all kansei words can influence consumers in choosing ready-to-drink coffee product packaging.

Determination of Items and Categories

At this stage, the item design and product design categories are determined. The function of determining items and categories from product design is to design attributes to meet ready-to-drink coffee packaging preferences. Determination of items is based on kansei words that have been obtained previously, the specified items can be seen in table 5.

Table 5. Item Determination Based on Kansei Words

Kansei Words	Item
Ergonomic	Bottle Shape
Practical	
Unique	
Practical	Bottle Size
Ergonomic	
Environmentally friendly	Bottle Material
Product Visible	
Safe	
Good Quality	
Eye-Catching	Design Colors and Labels
Minimalist	
Elegant	
Has Distinctive Characteristics	
Informative	Information on Labels
Eye-Catching	Design on Labels
Up-to-date	
Minimalist	
Elegant	
Has Distinctive Characteristics	

Based on the kansei words, 6 items were obtained. The category of each item is determined based on the results of the literature study and its availability in the market. Items and categories that have been created will be used to form a combination of designs or prototypes that will be used as stimuli in the Semantic Differential II questionnaire on Kansei words and Eye Tracking experiments.

Table 6. Ready-to-Drink Coffee Packaging Items and Categories

Item	No	Category
Bottle Shape	1	Sprawl
	2	Round
	3	Bulb
Bottle Size	1	Medium (300 - 350 ml)
	2	Small (200 - 280 ml)
Bottle Material	1	Glass
	2	Plastic
Design Colors and Labels	1	Monochrome
	2	Colorful
Information On Labels	1	Detail
	2	Enough Information
Design On Labels	1	There are pictures
	2	No images

After conducting a literature study and searching on the internet, a total of 6 items and 13 categories were grouped for the design of ready-to-drink coffee packaging stimuli which can be seen in table 6.

Determine Stimuli Products

The next stage is to make product stimuli. The input of making product stimuli are items and categories that have been created in the previous stage. To make product stimuli, the first step is to calculate the minimum number of stimuli. The following is the calculation to determine the minimum number of stimuli (1):

Minimum number of stimuli items = (Total number of categories – Total number of items) + 1 (1)

Minimum number of stimuli items= (13 – 6) + 1 = 8

The calculation shows that the minimum number of stimuli that must be made is 8. To determine the combination of stimuli for ready-to-drink coffee packaging from previously created items and categories, the orthogonal array method was used with the help of SPSS 25 software. The orthogonal array method is used to reduce the workload of the respondents which can affect the accuracy of the research evaluation results [12]. The results of the combinations that have been made and 16 combinations were obtained which will then proceed to the design stage that will be used in the Semantic Differential II questionnaire and Eye-Tracking experiments.

Conjoint Analysis Results

Conjoint analysis is used to analyse the relationship between kansei words with each item and design category. The conjoint analysis used in this study is the traditional conjoint analysis with the full-profile presentation method. Full-profile conjoint analysis is used because this method can compare all attributes (the assessment is not partial) [13].

Table 7. Conjoint Analysis Results

		Utilities		
Category	Importance Values (%)	Item	Utility Estimate	Std. Error
Shape	32.78	Sprawl	0.013	0.043
		Round	-0.092	0.05
		Bulb	0.078	0.05
Size	6.52	Keep	0.013	0.032
		Small	-0.013	0.032
Material	29.67	Glass	0.005	0.032
		Plastic	-0.005	0.032
Color	9.08	Monochrome	0.012	0.032
		Colorful	-0.012	0.032
Information	12.04	Detail	0.043	0.032
		Enough Information	-0.043	0.032
Design	9.91	There are Pictures	0.024	0.032
		No Images	-0.024	0.032

Based on the results of SPSS 25 output listed in table 7. it can be seen that the form category gets the highest importance value of 32.78%. The results of the importance values show that the greater the value, the more important the attribute is to all kansei words, it can be seen that the form of packaging is the packaging attribute that most influences customers in buying ready-to-drink coffee products.

Glass

Figure 1. Selected Packaging Design on Conjoin Analysis

Based on figure 1, The packaging design selected in the conjoint analysis with attributes, namely the packaging in the form of a bulb, medium size with glass material and having a mono chrome coloured label with detailed information and accompanied by a picture.

Eye Tracking Experiments and Analysis

Eye tracking is used to detect how long an object is seen so that it can help researchers to understand visual attention [14]. Eye tracking experiments were carried out using Realeye software. In this study, an online eye tracking experiment was conducted to determine the preferences of ready-to-drink coffee packaging through the visualization of heat maps and duration of fixation with a total of 20 people because of the software's limitations. As a result, the respondents' visual or aesthetic judgments are the only ones considered in this investigation. Fixation duration is the amount of time spent viewing a predetermined Area of Interest (AOI).

The duration of time given to respondents to see the stimuli of ready-to-drink coffee packaging is 20 seconds. The duration up to 20 seconds long, ideal for focused interaction with the design elements [15]. AOI can help researchers to get the data needed

according to the object area to be analysed. After the eye tracking experiment was completed, it is necessary to check the quality of participant data from the eye tracking experiments that have been carried out. From the results obtained, the quality obtained for all respondents are Perfect, Very Good, and Good. There are 3 respondents with Perfect data quality, 12 respondents with Very Good data quality, and 5 respondents with Good data quality. Then all respondent data can be analysed further.

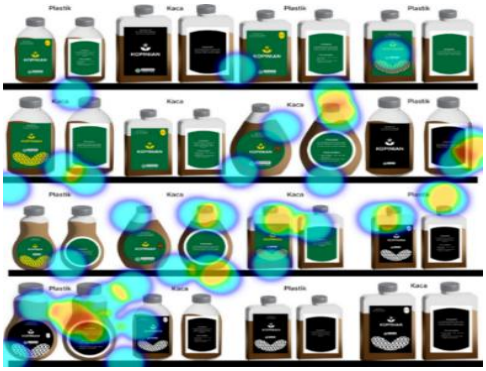

Figure 2. Heat Maps Results on ready-to-drink Coffee Packaging Stimuli

From the results of eye tracking experiment, it can be seen on figure 2 that the area of the stimulus design object is dominated by regional heat maps. The red color shows that the object area is getting hotter due to the length of the respondent's gaze. It can also be interpreted that the redder the area of the object is, the more interested respondents are in the packaging. This can also be validated by the duration of the fixation time on the object area. The results of the stimuli with the longest duration of eye fixation in the eye tracking study is stimuli 13 became the selected packaging with 5 respondents having the longest viewing time duration. In eye tracking research, the duration of time respondents look at the Area of Interest can be interpreted that there is greater interest and involvement with something [16]. The selected stimulus, namely stimulus 13, can be seen in figure 3.

Figure 3 is the result of the selected packaging design based on the eye tracking experiment, namely the packaging in the form of a bulb, medium size (300 – 350 ml) with plastic material, and has a monochrome-colored label with detailed information and is equipped with pictures.

Figure 3. Selected packaging designs on eye tracking experiments

Comparison of Conjoint Analysis Results and Eye Tracking

From the two methods that have been used for processing, namely Kansei Engineering and Eye Tracking analysis, it can be seen that for the shape attribute different results are obtained. Both methods showed that the chosen shape is a bulb, but with different material. The result obtained for Kansei Engineering is a bulb with glass material, while for eye tracking it is a bulb with plastic material.

It can be concluded that there are 2 packaging recommendations, if the company wants to focus on the subjective assessment of customers, it can use recommendations based on Kansei Engineering, which is packaging in the form of a bulb, medium size with glass material, and having a monochrome coloured label with detailed information and equipped with pictures. The advantage is that it is environmentally friendly because the packaging material is made of glass, suitable for companies that have a vision to protect the environment. Meanwhile, if the company wants to focus more on objective assessments from customers, it can use eye tracking recommendations, which is packaging in the form of a bulb, medium size with plastic material, and having a monochrome label with detailed information and accompanied by pictures.

CONCLUSIONS

Based on the analysis that has been done in this study it can be concluded that, the selected Kansei words are divided into 2 categories, namely physical packaging design and packaging label design. For physical packaging design the Kansei words obtained are environmentally friendly, ergonomic, product contents are visible, safe, practical, unique, good quality. For packaging label design Kansei's words are informative, distinctive, elegant, eye-catching, minimalist and up-to-date. For ready-to-drink coffee packaging attributes that are designed

are shape, size, material, label design color, information and image design. For shape attributes, there are flat, round, and bulb shapes. The size types are medium and small. The material types are glass and plastic. The colors are either monochrome or colorful. As for information, there are either detailed information or sufficient information. At last, the image design is either there are images or no images.

We come up with two packaging recommendations. If the company wants to focus on the subjective assessment of customers, it can use recommendations based on Kansei Engineering, namely packaging in the form of a bulb, medium size with glass material, and having a monochrome label with detailed information and equipped with pictures. The advantages of this design are environmentally friendly, suitable for companies that have a vision to protect the environment. Meanwhile, if the company wants to focus more on objective assessments from customers, it can use eye tracking recommendations, namely packaging in the form of a bulb, medium size with plastic material, and having a monochrome color label with detailed information and equipped with images.

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