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Article

Application of Kansei Engineering to Capture Consumer Demand for Cooking Oil Product Packaging

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Abstract

Plastic food packaging has become a part of human daily life. The management of plastic waste is a matter of concern due to its potential which is difficult to decompose. This condition causes all producers to have a responsibility not only during the manufacturing process but until the end of the life of their products. This expanded responsibility is called EPR (Extended Producer Responsibility). Therefore the resulting packaging design becomes a breakthrough in this matter. This research attempts to apply the Kansei Engineering method to capture customers' emotional needs from consumers in compiling plastic packaging design parameters. The research method in this paper uses the Kansei Engineering method, namely by collecting Kansei words from respondents at random, then the Kansei words are reduced. The reduced Kansei word will be synthesized to produce quality attributes that are able to meet the customer's emotional needs. The Kansei words obtained from the survey results are 55 words. Packaging quality attributes that have met the customer's emotional needs include protection, refillable, recyclable, biodegradable, food safety, additional function, attractiveness, conformity, ergonomic, user friendly, and content declaration (on the packaging label).

Keywords: cooking oil, extended producer responsibility, kansei engineering, plastic packaging.

1. Introduction

The packaging industry has developed according to human needs. Keeping food products in containers so that they are safe from animals and contaminants has started to encourage entrepreneurs to find several solutions, one of which is plastic packaging. Plastic food packaging has become a part of human daily life.

Plastic has many advantages that make it easy for consumers. However, plastic has a weakness in its use as food packaging, as certain types of plastic (e.g. PE, PP, PVC) are not heat resistant, potentially releasing hazardous chemicals. Cooking oil products use more plastic materials and plastic is a material that is difficult to biodegrade so it can pollute the environment (Santhi, 2016). So that the management of plastic

waste is a threat to the ecosystem if it is not managed properly.

The use of plastic in cooking oil packaging makes many companies an expanded responsibility as an effort to deal with the waste they produce. So far, manufacturers only think that the starting point of product packaging is at the time of production and the end point of product packaging is when the product has been sold. Manufacturers never think about the continuation of the product packaging (Williams, et al., 2020), not only when the manufacturing process is running but until the end of life of their product, in other words extended producer responsibility is better known as EPR (Extended Producer Responsibility).

This study uses the Kansei Engineering method. The Kansei Engineering method is preferred over the voice of customer method because using Kansei Engineering can cover more general products than when using the voice of customer method. For example, in applying the voice of customer method, product specifications must be explained, such as size (1 liter, 2 liters or 5 liters) and the form of packaging (bottle or pouch). In the Kansei Engineering method, product specifications do not have to be explained because consumers will speak their impressions and feelings to describe the product. So that when consumers are asked what kind of packaging they want, consumers will say what comes to mind and designers will translate it into design parameters that apply universally (regardless of packaging size and type of packaging).

Kansei Engineering is a proactive product development methodology that translates customer impressions, feelings and demands of existing products or concepts into design solutions and concrete design parameters. This method was developed by Professor Misuto Nagamachi in the early 1970s in Japan and has been used in many Japanese companies. In the mid-1990s, this method spread to the US and Europe. During its 30 years of existence, Kansei Engineering has developed substantially (Schutte, et al., 2004).

Researchers used the Kansei Engineering method in forming a research questionnaire. The questionnaire was made to find out what kansei words emerged from the respondents. Furthermore, the resulting kansei word is reduced to be used as a quality attribute of a package that is able to meet the wants and needs of consumers.

2. Material and Method

2.1. Life Cycle Management (LCM): Life Cycle Engineering (LCE)

Symbiosis-based life cycle management (LCM) is a way to achieve sustainable resource flows, which are circular flows with high environmental efficiency and less environmental impact. In the LCM framework, there are 5 sections, namely Life Cycle Assessment (LCA), Life Cycle Costing (LCC), Life Cycle Engineering (LCE), technical support (TS), and product data management (PDM) as shown in Figure 1. This study uses one one part of the LCM framework, namely Life Cycle Engineering (LCE) or often referred to as Design-for-X or Design-for excellence (Baptista, et al., 2018).

The application of the DfX approach has developed and has considered analyzes of various aspects or "X" domains such as: design for manufacturing (DfM), design for assembly, (DfA), design for variety (DfV), design for quality (DfQ), design for reliability (DfR), design for disassembly (DfD) and design for maintainability (DfMa).

In implementing LCE for the process of redesigning packaging for palm cooking oil products, the author uses the Kansei Engineering method as the basis for establishing design parameters that are oriented to customer's emotional needs.

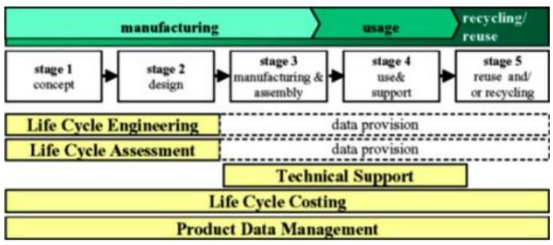

Fig. 1. Application of LCM methodologies

2.2. Kansei Engineering

A successful product design is always the result of a perfectly matched integration between the designer and the user's perception. User-oriented design is increasingly recognized, and well-designed products can attract more attention than products that do not meet the psychological needs of users (Guo, et al., 2020).

The procedure described by Schütte (2002), starts with the definition of the domain and

target group. Two parallel actions are performed. The first act is the definition of a semantic space (e.g. a set of Kansei words). These words are terms used by customers or users to discuss a product and describe how the customer or user feels about the product. In line with these efforts, the team responsible for the application of the method conducts analysis and defines the properties or characteristics of the product. After these two steps are executed in parallel, a synthesis is performed to establish relationships with algorithms and clustering techniques and between words and properties. Synthesis allows the team to identify properties or designs that adapt the product to customer needs. The client's impression, which is the target of a product, is represented in words (Kansei words) and related to the configuration of the product using a numerical scale. Kansei Engineering is the subjective impression of a consumer's respect for artifacts, environments, or situations becauthe senses, such as sight, hearing, touch, and taste can perceive them. (Zabotto, et al., 2019).

The Kansei Engineering method is preferred over the voice of customer method because using Kansei Engineering can cover more general products than when using the voice of customer method. For example, in applying the voice of customer method, product specifications such as the size (1 liter, 2 liters, or 5 liters) and the form of the packaging (bottle or pouch) must be explained. In the Kansei Engineering method, product specifications do not have to be explained because consumers will speak their impressions and feelings to describe the product. So that when consumers are asked what kind of packaging they want, consumers will say what comes to mind and designers will translate it into design parameters that apply universally (regardless of packaging size and type of packaging).

Figure 2 is a flowchart of the research methodology. They are starting from determining the product domain, namely the packaging of palm cooking oil products. Next, Kansei words were collected from respondents through a questionnaire and reduced Kansei words based on similarity in meaning. At the same time, attributes of good packaging quality were compiled according to several journals. Next, the synthesis between Kansei words and quality attributes is carried out. The synthesis process is carried out using affinity diagrams.

The affinity diagram, also known as the K-J method, was first introduced by a Japanese anthropologist named Jiro Kawakita in the 1960s. Affinity Charts are one of the 7 Management and Planning Tools.

Through the affinity diagram, Kansei words that have been reduced based on the similarity of meaning will be used as the second level of Kansei words, while quality attributes are used as the first level of Kansei words. The final step is to collect quality attributes that have been validated with Kansei's words. This quality attribute will be used in developing a palm cooking oil packaging design that is able to satisfy the customer's emotional needs.

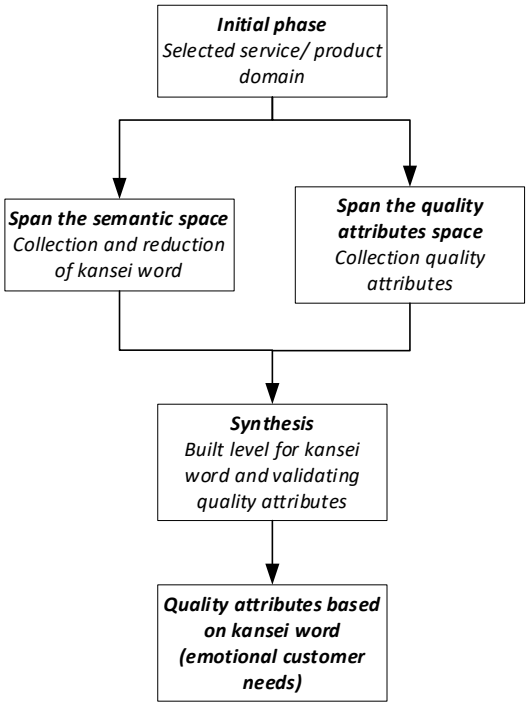

Fig. 2. Research methodology flowchart

2.3. Formation and processing of research questionnaire results with the Kansei Engineering method

The initial stage carried out by the author was to collect Kansei words from several respondents at random. The questionnaire which was formed using the Kansei Engineering method consisted of only one question, namely "Please write down at least 3 characteristics of good palm cooking oil packaging in your opinion". Respondents' answers that will be processed further are only answers that contain Kansei words. Answers from respondents (Kansei word) will then be reduced in 2 stages. The first reduction stage is carried out by

collecting Kansei words that have the same meaning into one group, while the second reduction stage is to form levels of Kansei words using affinity diagrams. There are 2 levels of Kansei words, the first level (quality attribute) is Kansei words which are formed from second-level Kansei words, while the second level of Kansei words is Kansei words which have been reduced based on similarities in meaning. In addition to the aim of reducing Kansei words, the formation of levels of Kansei words also has the aim of validating the quality attributes of packaging that have previously been prepared based on literature studies. Validation is carried out to ensure that the quality attributes that were previously formed from literature studies have fulfilled the customer's emotional needs.

3. Results and Discussion

Based on the results of a survey conducted on 404 respondents, respondents obtained answers regarding the characteristics of good packaging according to respondents. Not all of the respondents' answers are included in the Kansei word, only feelings that are answered will be included in the Kansei word. For example, the respondent's answer "no leak" is not included in the Kansei word because the definition of non-leakage already has clear parameters, namely no oil coming out of the packaging, while the respondent's answer "low cost" is included in the Kansei word because the definition of low cost does not yet have clear parameters (lowcost according to one person with another will be different).

Table 1 is the result of Kansei word reduction stage 1 which is based on the similarity of meaning. Kansei word reduction based on similarity in meaning is carried out using the KBBI dictionary so that respondents can find out answers that have the same meaning. The Kansei word in Table 1 will be reduced again using an affinity diagram in the Kansei word synthesis stage.

Table 1. Kansei word reduction results from 404 respondents

First stage of kansei word reduction	
Clear	The size is just right
Thick	Pouch can be used without a bottle (stands up)
Durable	3R applicable
Easy to store	Sleek packaging
Transparent container	Not easily broken
Used repeatedly	No holes
Easy to unravel	Physical and biological odor pollution
Big packaging	Heavy
Light	sturdy
Resilient	Can detect the quality of palm oil (smart packaging)
Product color/clarity	Not easy stale
Easy to open	Low cost
Practical. The packaging is taken everywhere	Not greasy
There is a lid to store the remaining oil	Save storage space
Keep the oil durable	Tasty
Easy to hold	Cheap
Oil doesn't melt easily	Doesn't spoil the taste
Not easy to spill	No plastic smell
Strong	Not harmful
Not sharp	Maintain content quality
Easy to use/hold texture	Fine
Guaranteed quality	Not easy to tear
Not slippery	Immaculate
The plastic type is the same as the product type	Practical
Not exaggerated dimensions	Not easy to break
Not harmful	Less reduceable
Weather resistant	

Table 2 is a table that lists the quality attributes of product packaging based on the results of a literature study. Quality attributes are distinguished from one semantic product to another. Product semantics is used to separate the attributes of packaging quality and packaging labels. Quality attributes for packaging consist of quality attributes of protection, refillable, recyclable, biodegradability, food safety, additional function, attractive, conformity, ergonomic, and user friendly. Quality attributes for packaging labels include certain brand communicates, communicates family product category, main information, content declaration, instruction, opening, symbol, and eco-label.

Table 2. Attributes of product packaging quality

Semantic Products	Quality Attributes
Packaging	Protection
	Refillable
	recycleable

Semantic Products	Quality Attributes
Packaging Labels	Biodegradability Food safety Additional functions Attractive conformity Ergonomics Userfriendly Communicates certain brands Communicates family product category Main information Content declaration Instructions Open-dating Symbols Ecolabels

Table 3 is a table that contains the Kansei word mapping in Table 1 to the quality attributes in Table 2 using the affinity diagram method. The first level of Kansei word is a quality attribute that has been built in Table 2 based on the results of a literature study, while the second level of Kansei word is the Kansei word in Table 1 which is grouped based on its relationship to the first level of Kansei word. The first level of Kansei word for protection has 14 related Kansei words; for refillable has 3 related Kansei words; for recyclable has 2 related Kansei words; for biodegradability has 1 related Kansei word; for food safety, it has 6 related Kansei words; for the additional function has 2 related Kansei words; for attractive it has 6 related Kansei words; for conformity it has 4 related Kansei words; for ergonomics has 4 related Kansei words; for user friendly has 11 related Kansei words; for content declaration has 1 related Kansei word.

Table 3. Formation of levels of kansei word with affinity diagrams

First level of kansei word	Second level of kansei word
Protection	Thick, durable, resilient, keeps the oil durable, oil doesn't melt easily, doesn't spill easily, strong, doesn't break easily, weather resistant, doesn't break easily, doesn't have holes, doesn't spoil easily, maintains the quality of the contents, doesn't tear easily
Refillable	Used repeatedly, has a lid, has a seal
recycleable	Reduceable, 3R applicable
Biodegradability	Easy to unravel
Food safety	Guaranteed quality, plastic type is the same as product type, harmless, does not pollute physical and biological odors, does not spoil taste, does not smell plastic
Additional functions	Pouches can be used without bottles, can detect the quality of palm oil (smart packaging)
Attractive	Clear, transparent container, can see the color/clarity of the product, sturdy, waterproof, not stained
conformity	Big packaging, not exaggerated in dimensions, just the right size, heavy
Ergonomics	Easy to store, easy to hold, slim packaging, save storage space
Userfriendly	Light, easy to open, practical, packaging can be carried everywhere, not sharp, easy to use, not slippery , low cost , not greasy, cheap, smooth
Communicates certain brands	-
Communicates family product category	-
Main information	-
Content declaration	Clear content
Instructions	-
Open-dating	-
symbols	-
Ecolabels	-

From Table 3, the quality attributes were validated with kansei words from respondents to find out whether these quality attributes met the emotional needs of consumers. The results obtained from Table 3 are that the quality attribute of protection has the highest number of kansei words than the other attributes. This indicates that the quality attribute of protection has a very close relationship with the customer's emotional needs. Then the attributes communicate certain brands, communicates family product categories, main information, instructions, open dating, symbols, and ecolabelling do not yet have a related kansei word. This indicates that these quality attributes

still do not have a relationship with the customer's emotional needs.

The absence of kansei words related to quality attributes communicates certain brands, communicates family product category, main information, instructions, open dating, symbols, and eco-labelling proves that consumers actually do not pay much attention to what is written on a product label. Even though product labels are made with the aim of communicating important information from producers to consumers. As a producer who will implement EPR, increasing consumer interest to pay more attention to a product label is a task that must be carried out immediately. Manufacturers can redesign their packaging labels to make them more attractive, so consumers will pay more attention to product packaging labels.

4. Conclusions

This research aims to find ways to capture the emotional customer needs of consumers of palm cooking oil in terms of packaging. One of the right methods to use is Kansei Engineering. The Kansei Engineering method can translate emotional customer needs into design parameters (quality attributes) of palm cooking oil product packaging. From the results of a survey of 404 respondents, there were 55 Kansei words obtained. The quality attributes of the packaging for palm cooking oil products that can meet emotional customer needs include protection, refillable, recyclable, biodegradability, food safety, additional function, attractive, conformity, ergonomic, user friendly, and content declaration (on the packaging label).

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