Product Development using Kansei Engineering to Re-design New Food Packaging

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Abstract

In the era of high market competition, product development must implement excellent innovation and responsiveness toward customer needs. One of the tools that had been successfully applied to support this objective is Kansei Engineering. Kansei is a Japanese word that refers to perception, impression, and feeling. Kansei Engineering is the process to collect product information based on the psychological emotions and feelings of customers. These represent customers’ general impressions and emotions towards certain products or services which are then translated into characteristic designs. In this research, the researcher uses the Kansei engineering is applied to design a new packaging for West Sumatra Sanjai Chips produced by a local small-medium enterprise (SME). In processing the data, the researcher carried out a sampling technique, determining the number of respondents with the number of respondents being 100 in the first stage and 15 respondents in the second stage. From the first stage, eight Kansei words were collected. Followed by the second stage which was able to classify the most significant Kansei words based on the customer opinions. It was demonstrated from the investigation that new packaging was designed. With the new design it is expected that customers will become more aware and attracted to purchase the product.

Keywords: Product Development, Kansei Engineering, Kansei Words, Small Medium Enterprise, New Packaging Design, West Sumatra Sanjai Chips.

1. Introduction

In the era of global competition, product development must implement excellent innovation and responsiveness toward customer needs, moreover, these are key factors for the success of a product [1,2]. Product development must also focus on the customer needs are constantly evolving and increasingly demanding a lot of customization [3].

Product development is a series that starts from an analysis of market perceptions and opportunities and then ends with the production stage of sales and product delivery to customers [4,5]. In the form of finished products, semi-finished products, components, assembling, sub-assembly or product raw materials.

Product development can be referred to as a stage of activity that starts by analysing the perception, sales, and delivery of the product [6,7]. Six phases in the generic development process in general, namely planning, concept development, product system-level design, detailed design, testing and evaluation, and production ramp-up [8].

Kansei engineering technique in developing customer experience via design. This style of engineering is utilized to generate product aesthetic and ergonomic features that explain consumer emotional experiences [9].

A product development investigation performed by Chiu [10] applied Kansei Engineering and text mining. The investigation used road bikes as the case study. The design determinants are classified into six significant features. The framework was used to reduce the time and cost of product design through automation.

Another work which applied KE was done by Gan [11]. KE is combined with a deep convolutional generative adversarial network (DCGAN) to perform product development for social robot design. Evaluation of aesthetic and emotional appearance preferences is first adopted by the KE method. The goal is to identify key characteristics, which are divided into two categories. The first is physical properties and colour for aesthetic sense. The second category is emotional features.

KE and deep learning were applied to product development, especially on concept generation which covers data set gathering, pre-processing, emotional preference detection, conceptual image generation models, and product-style transfer networks. The case study selected was hand drill design and bicycle helmet design [12].

A product development study by Quan [13] applied KE and deep learning. The combined method was able to execute a plotting model amongst product properties and styles. Furthermore, it could reconstruct and merge colour and pattern features of the style image, which are
then migrated to the target product. According to KE analysis, the semantics of the new product has been extended based on the target product, which allows the design of the new product to better meet the needs of the user. The application of this proposed method is through a case study of women's coat design.

Kansei Engineering (KE) and the analytic hierarchy process (AHP) were used to conduct a product evaluation system by constructing a comprehensive product evaluation system [14]. The case study is to classify some modern chair evaluation indexes. The KE and AHP methods proposed in this study are reliable and effective and can be used for product evaluation to determine product popularity and improve product competitiveness.

Packaging design has many effects on customer perception of a product. Work done in [15] suggested that packaging development allows designers to add transparent elements and consumers can see them directly before buying a product. This work investigated the impact on food images and packaging design with transparent elements. It is suggested that guidelines for designers and brands are also provided on how to take advantage of the viewing effects of these foods.

The review done in [16] stated that packaging is not just a convenient way to get a product to the store/consumer intact. It is mentioned the recognition that product packaging is a powerful marketing tool and therefore requires the same attention and techniques as other areas of marketing to maximize business success. Therefore, the impact of packaging design should be very important to designers, marketers and brand managers. It is estimated that more than three-quarters of food/beverage purchase decisions are made at the point of sale. Consumers need to find, rate and compare the products they want from a variety of products in the store.

The paper completed by [17] mentioned that many packaging design options and parameters must be considered to ensure that the packaging conveys the most effective message, and captures the attention of consumers in-store. It can realise its full potential as a tool to enhance product knowledge. The outlook of food triggers a variety of neural and physiological responses, including increased hunger, more favourable taste ratings, and activation of reward networks.

Festila and Chrysochou in [18] studied the packaging design elements used by food companies for their healthy food products. They have used content analysis of the packaging design of 12 types of food products in two countries which are Denmark and the United States.

The results informed that; implicit design elements of packaging (colour, image, material and shape) differ between healthy and conventionally manufactured products. Other results indicated that these differences are specific to a product category rather than common. It is expected that the results contribute to the knowledge of the use of packaging design as a health communication tool.

The concept of packaging sustainability has evolved with the increasing integration of sustainability principles. Difficulties such as the complexity of the value chain due to the economic, social and environmental demands of sustainable behaviour and the undesirable attitudes of consumers can prevent companies from applying more sustainable packaging. Therefore, the market for enhanced shelf life packages is never exhausted. However, next-generation sustainable solutions can be facilitated by efforts to encourage consumers' positive attitudes towards sustainable packaging [19].

The method of designing merchandise with the usage of KE encompasses: (1) accumulating Kansei records from customers in a particular product area the usage of psychological measurements; (2) analysing Kansei records to make clear the Kansei structure; (3) decoding the analysed records and moving the records to the brand new product area; and (4) designing a brand new Kansei product [20]. To acquire a Kansei product innovatively, collaboration among product designers and Kansei engineers. The collaboration can achieve a fantastic product which is the end result of the analysis of the Kansei data, as depicted in Figure 1.

Kansei Engineering (KE) changed into first delivered with the aid of using Mitsuo Nagamachi as a brand new ergonomic generation in product layout. The KE approach interprets consumers’ emotions into layout specifications [20]. It is indicated that the foremost implementation of KE entails many steps that permit the utilisation of techniques derived from diverse fields of study, along with marketing, psychology, and statistics [21,22].

In this study, West Sumatra Sanjai Chips is presented as the case study. This product is very popular in this region and is commonly known as local cuisine. This cuisine is produced by a local Small Medium Enterprise (SME) namely Sanjai Nina. The current packaging of this food is not so marketable and quite dull. The objective of this study is to re-design the packaging so customers will find it attractive, and eye-catching and hence they will be more eager to purchase.
2. Research Method

KE initial data collection was carried out by interviewing the owner of SME Sanjai Nina. The next process of collecting Kansei words was carried out by distributing questionnaires to 100 visitors and respondents from Sanjai Nina customers. In the process of collecting Kansei design words, the respondents gave their opinions about the current packaging design and their recommendations to improve the packaging.

The method of the study used the Kansei Engineering approach as shown in the flowchart (Figure 2).

From the first phase, significant Kansei words grouping was derived. These words became the foundation for the second phase of KE which was to perform a semantic differential questionnaire. The questionnaire was given to respondents who already knew well the packaging.

The purpose of the questionnaire was to determine the ranking or the respondent’s assessment to the stimulus that was paired with the Kansei words. The questionnaire was distributed to 15 respondents who are regular customers of Sanjai Nina.

3. Result and Discussion

The product packaging in Figure 3 is an image of the packaging that has not been redesigned. The materials used are plastic which contains hazardous materials, the packaging colours are too plain and unattractive, and the labels are not clear. Further improvement is required at this point. At the KE initial stage, the current packaging design was used to collect information to form the Kansei words.

Discussion is the basic explanation, relationship and generalization shown by the results. The description
answers the research questions. If there are dubious results, then show them objectively.

Figure 3. Current Packaging Design

Through the first phase, Kansei words were collected. The grouping of Kansei words that contain the same meaning will be reduced in the number of variables to make it easier to carry out the analysis. Kansei word grouping is done by combining Kansei words that have the same meaning. The grouping of Kansei words that have the same meaning can be seen in Table 1.

| No. | Kansei Words | Grouping of Kansei Words |
|-----|--------------|--------------------------|
| 1.  | Logo is easy to remember | Information on the packaging (informativeness) |
| 2.  | Halal Description | Practicality |
| 3.  | Composition | |
| 4.  | There is a Home Industry Product Permit | | |
| 5.  | There is a production address | | |
| 6.  | Expiration statement | | |
| 7.  | Clear writing | | |
| 8.  | Can be opened and closed (Zip lock) | | |
| 9.  | Easy to store | | |
| 10. | Simple | | |
| 11. | The packaging material is harmless | | |
| 12. | Airtight | Safety |
| 13. | Waterproof | | |
| 14. | Not easy to tear | | |
| 15. | Character | | |
| 16. | Unique Design | | |
| 17. | Logo is not superfluous | | |
| 18. | Different from the others | | |
| 19. | Good use of colour | | |
| 20. | Colour variations | | |
| 21. | Lack of colour | | |
| 22. | Bright colour | | |
| 23. | Flashy colours | | |
| 24. | Plain | | |
| 25. | Modern design | | |
| 26. | Easy to remember | | |
| 27. | Many design attributes | | |
| 28. | Lots of pictures | | |
| 29. | Easily decomposed materials | | |
| 30. | Durable material | | |
| 31. | Disposable | | |
| 32. | Reusable | | |
| 33. | Neat packing | Neatness |
The result of the semantic differential questionnaire is presented in Table 2. It is indicated that the grouping can be categorized into main packaging features, namely; packaging material, packaging material, packaging colour, label type, label colour, logo style, and information on the packaging. Respectively on each main feature, the specific features were determined. The highest specific feature with the greatest number of respondents is highlighted in bold. The new design of the packaging was developed using these features.

Table 2. KE words collected through the second interview phase

| No. | Main packaging features | Specific features | Number of respondents |
|-----|-------------------------|------------------|----------------------|
| 1   | Packaging material      | Plastic packaging material | 11                  |
|     |                         | Aluminum foil    | 2                    |
|     |                         | Plastic and aluminum foil | 2            |
|     |                         | Paper board      | 0                    |
| 2   | Packaging colour        | Gradation        | 1                    |
|     |                         | packaging colour |                      |
|     |                         | Combination of 2 colours | 13               |
|     |                         | 3 colours mix     | 1                    |
|     |                         | Mix of many colours | 1                   |
|     | Packaging print         |                  | 14                   |
| 3   | Label type              | Card Paper       | 1                    |
| 4   | Label colour            | Black and white  | 1                    |
|     |                         | 2 bright colours | 2                    |
|     |                         | 3 bright colours | 11                   |
|     |                         | More than 3 bright colours | 1        |
| 5   | Logo style              | Logo with motif  | 14                   |
|     |                         | Plain            | 1                    |
| 6   | Information on the packaging | Halal label | 4                    |
|     |                         | Legalization label | 0                |
|     |                         | Composition      | 4                    |
|     |                         | Expired date     | 3                    |
|     |                         | Company Logo     | 2                    |
|     |                         | Production place | 2                    |

At this stage, the packaging design obtained from the previous stage will be carried out by collecting the Kansei word stage. Packaging designs made by researchers have been conceptualized from the results of the Kansei word stages. The most significant Kansei words based on the respondent's answers are; packaging material using plastic, the colour of packaging using a combination of two colours, type of label using print labelling, the colour of a label using a combination of three bright colours, design with logo, description of packaging including halal label and composition. The new packaging design for the Sanjai Nina chips can be seen in Figure 4.

![Figure 4. Redesign of Nina's Sanjai Chips Packaging](image-url)
Besides the significant features based on the Kansei words, additional features were added including food safety with a zip opening if food still has leftovers it can be stored again without damaging the texture of the food and also the new packaging design has complete information such as halal labels, food composition, place of production and expiration date that makes it easier for consumers to find the correct information.

4. Conclusion

The purpose of this research is to produce a new design for food packaging which is the West Sumatra Sanjai Chips. Based on the first survey at the initial phase six most significant Kansei words describing the packaging were obtained. From the second phase using the personal interview, the Kansei words were more specified. The most significant Kansei words based on the respondents’ answers are: packaging material using plastic, the colour of packaging using a combination of two colours, type of label using print labelling, the colour of a label using a combination of three bright colours, design with logo, description of packaging including halal label and composition. Hence the new packaging was designed based on the Kansei words as mentioned. With the new design, it is expected that customers will become more aware and attracted to purchase the product. For future work, it is recommended to verify the new design using a validation method, which can confirm that the new design can have a good impact on the sales volume.

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