Determining Kansei Words in Chocolate Product Development Model Design Based on Social Media Trend by Using Key Element Extraction (KEE) Algorithm

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Abstract. This research applies Key Element Extraction (KEE) algorithm to identify customer requirement and preference about chocolate product design based on social media trend. The aim of this paper are to determine Kansei words based on customer feeling and emotion that reflected from comments on social media. Kansei words are determined through data acquisition processes, identification of Kansei words, and determination of key element. Data acquisition is done by copying all comments from every social media account of chocolate products. Kansei words are identified manually from the comments that have been copied from social media. Each Kansei words will be analyzed to determine the key element by using Key Element Extraction (KEE) algorithm. The result shows that there are 25 key element or Kansei words as the results of Key Element Extraction (KEE) algorithm that show customer requirement, preference, feeling, and emotion about chocolate product.

1. Introduction

Chocolate is a type of food which is processed from cocoa beans (Theobroma cacao) that contain flavonoids and antioxidants. Thus, chocolate has many health benefits, such as reducing the risk of chronic diseases such as heart disease, cancer, and other age-related diseases. Chocolate is currently popular in society, which is often active in social media.

Nowadays, the use of social media is very rapid and change the way of communication in the society. Many comments in social media, such as Instagram, Facebook, etc, that reflect people feeling and emotion about posts or contents in chocolate product account. These can be a big opportunity for chocolate factory or producer to know customer requirement and preference based on their feeling and emotion that reflected on social media. Thus, social media provide a huge data that can be used to design chocolate product development model.
Kansei Engineering (KE) is known as a methodology that has been used to fulfill subjective needs and preference of customers in product design and development that aims to translate human psychology, such as feelings and emotions, into appropriate product designs attributes, such as size, shape, color, and other characteristics[1]. The functions that are the basis for Kansei are the human senses, such as eyesight, hearing, taste, touch, and smell. These senses will be memorized, decided, or judged by human as perception that results in Kansei. Thus, Kansei itself can be defined as the term that expresses the feeling, emotion, and perception about a situation that faced by human. Kansei can be represented in various forms and shapes, such as words, brain waves, eye, facial expression, and action or behavior. Kansei Engineering has been widely used in the design and development of various types of products, such as car seats, office chairs, chocolates, aircraft interior designs and other products[2].

Key Element Extraction (KEE) is an algorithm for finding key participant and key terms of a discussion by scoring each participant and terms in the context of their significance in discussions. Higher scored participants are the key participants having innovative and creative ideas or potential for producing them. Higher scored terms are key terms indicating or leading to innovative and creative ideas. KEE is based on the idea of mutually reinforcing relationship between participant and terms. Significant participants are the participants using many significant terms, and conversely, significant terms are the terms used by many significant participants. KEE algorithm is simultaneously finding key terms and key participants in network-based discussions that held for enhancing innovation and creativity toward product development, based on participants posting and replying messages (comments on social media), on online message boards or chat rooms[3].

This research proposes the application of Key Element Extraction (KEE) algorithm in order to identify customer preference and requirements in chocolate product development based on social media trend. These customer preferences are known by analyzing customer feeling and emotion about chocolate product, which is done by identifying Kansei words from comments in chocolate product accounts on social media. Since the number of Kansei words that identified are really huge, KEE algorithm is used to determine which Kansei words that become the key elements or key terms in order to determine the Kansei words effectively.

Some challenges that faced by this research are as follows. First, there are various ways and characteristic of comments from customer in social media. Second, there are various Kansei words that identified from comments in social media many complexity of chocolate. According to those problems and challenges, the objectives of this paper are to identify Kansei words based on customer feeling and emotion through social media trend and determine the Kansei words that become the key elements or key terms to be used in chocolate product development.

The rest of this paper are as follows. The research methodology of this paper is detailed in Section 2. The result and discussion are given in Section 3. Finally, the conclusion and recommendation for future works are described in Section 4.

2. Methodology
This research develops a Kansei Engineering approach based on the framework proposed by Nagamachi[4] and data mining. The procedure of this research is explained as follows.

2.1. Step 1 - Data Acquisition
Data acquisition is the process of collecting all of the comments on social media in the chocolate product accounts. Instagram and Facebook are the media social that chosen to be used in this research. This step is done by searching chocolate accounts and copying the comments to Microsoft Word. There are 10 products which were chosen from 4 chocolate social media account. They are Silverqueen, Toblerone Fruit & Nut, Toblerone Dark Chocolate, Toblerone
Plain, Toblerone White Chocolate, Toblerone Crunchy Almond, Kitkat, Kitkat Ruby, Kitkat Wafer, and Delfi Premium Bar.

2.2. Step 2 - Identification of Kansei Words
Customer feelings and emotions must be captured accurately when a product is developed or created by using Kansei[2]. Therefore, Identification of Kansei words from comments on social media was conducted to collect data about customer’s emotion, feeling, perception, and preferences about chocolate product. Identification of Kansei words consist of two steps, they are Manual Language Processing and Text Preprocessing.

Manual Language Processing is a process to identify Kansei words manually on social media as well as the accompanying design elements. While preprocessing the text is the process to translate sentences or comments that have been collected from the Manual Language Processing stage into transcripts containing the original words of the customer. Each word is separated from other words by spacebar to facilitate the identification process and be standardized according to the dictionary so that it becomes a raw word previously filtered to remove words that are irrelevant to the word Kansei on the design of chocolate products.

2.3. Step 4 - Key Element Extraction (KEE)
According to Oshawa[5], one of the biggest advantages in using network-based communication is the many ideas, opinions, and interests of diverse people that can be easily collected. The reading of all logs of communication is an impractical process so that the extraction of key elements of communication is an important component of discourse analysis.

KEE (Key Element Extraction) is an algorithm to find the key participant or key terms from a discussion by calculating the scores for each participants and each terms based on their significance in the discussion. Participants with higher scores are the key participant with innovative and creative ideas. Meanwhile, Terms with higher scores is a key terms that leads to innovative and creative ideas. The basic idea of KEE is to strengthen the relationship between participants and terms. Participants are significant participants that use many significant terms, and conversely, significant terms are the terms that used by many significant participants.

This step is conducted by calculating the terminology score for each Kansei words and choose the words with score above 0.1. The KEE algorithm obtains the participant score and terminology score simultaneously by means of iterative calculations. The participant score is symbolized by s(pi), the terminology scores symbolized by s(tj), and (tj) are weighting factors for terminology tj, which can be calculated using the following formula.

\[ \alpha(t_j) = \log \left( \frac{M}{M_g} \right) \]

where \( \alpha(t_i) \) is weight factor for terminology \( t_i \), \( M \) is the number of comments, and \( M_g \) is the number of words or terminology \( t_i \). The calculation of KEE algorithm is done by using Microsoft Excel. The steps of KEE Algorithm to calculate the terminology score are as follows.

(i) Determine the initial participant score \( s^0(p_i) = 1 \) for all participant and initial terminology score \( s^0(t_j) = 1 \) for all Kansei words.
(ii) Calculate and update the score for each participant \( s^k(p_i) \) using the following formula

\[ s^k(p_i) = \sum_{t_j \in V_T} s^{k-1}(t_j)w(p_i, t_j)\alpha(t_j) \]

(iii) Calculate the normalization score for each participant \( \bar{s}^k(p_i) \) for each Kansei words using the following formula

\[ \bar{s}^k(p_i) = \frac{s^k(p_i)}{\sqrt{\sum_{p_i \in V_P} [s^k(p_i)]^2}} \]
(iv) Calculate and update the terminology score for each Kansei words \( s^k(t_j) \) using the following formula

\[ s^k(t_j) = \sum_{p_i \in V_p} s^{k-1}(t_j) w(p_i, t_j) \alpha(t_j) \]

(v) Calculate the normalization terminology score for each Kansei words \( \overline{s^k(t_j)} \) for each Kansei words using the following formula

\[ \overline{s^k(t_j)} = \frac{s^k(t_j)}{\sqrt{\sum_{t_j \in V_T} [s^k(t_j)]^2}} \]

(vi) Calculate again the participant score and terminology score until \( k \) iteration. In this research, iteration is done 6 times \((k=6)\).

3. Result and Discussion

3.1. Design Elements and Product Samples

Design elements are the attributes that build up a product to be designed. The chocolate product design elements identified in this study consist of four types, namely brands, geometry shapes, sizes, and types.

Determination of chocolate products to be used as samples must be done first. The samples of chocolate products used in this study consisted of 10 types of 4 brands of chocolate products, such as Silverqueen, Toblerone Fruit & Nut, Toblerone Dark Chocolate, Toblerone Plain, Toblerone White Chocolate, Toblerone Crunchy Almond, Kitkat, Kitkat Ruby, Kitkat Wafer, and Delfi Premium Bar. The design elements for each product samples can be seen in Table below

| Table 1. Design Element for Each Product Samples. |
|-----------------------------------------------|
| **Product** | **Brand** | **Geometry Shapes** | **Sizes** | **Types** |
| Silverqueen | Silverqueen | Flat | Long | Cashew |
| Toblerone Fruit \\ & Nut | Toblerone | Triangle | Long | Fruit & Nut |
| Toblerone Dark Chocolate | Toblerone | Triangle | Long | Dark |
| Toblerone Plain | Toblerone | Triangle | Long | Plain |
| Toblerone White Chocolate | Toblerone | Triangle | Long | White |
| Toblerone Crunchy Almond | Toblerone | Triangle | Long | Crunchy Almond |
| Kitkat | Kitkat | Flat | Wide | Plain |
| Kitkat Ruby | Kitkat | Flat | Wide | Strawberry |
| Kitkat Wafer | Kitkat | Flat | Long | Wafer |
| Delfi Premium Bar | Delfi | Chunky Bar | Wide | Milk |

3.2. Data Acquisition

Data acquisition is the stage of data retrieval in the form of comments on social media taken from accounts related to chocolate products. These accounts are searched on social media by searching for the word chocolate on search engines, then comment on the account is copied to Microsoft Word. This research uses social media in the form of Instagram and Facebook as data source.
3.3. Identification of Kansei Words

The identification or search of Kansei’s words contained in comment in social media is done through manual language processing. Manual Language Processing is a process for identifying and discovering Kansei’s words contained in social media related to chocolate products. The identification of Kansei’s words is done by searching for the adjectives that are contained in the comment on social media as well as the accompanying design elements.

The example of some comments from social media and identification of Kansei words are as follows.

jakeline.duarte I love tobleroneglobal !
maritereg Mi chocolate favorito
maritereg Mi favorito
leahwhat Can I get a free big Toblerone pls
wbur6 Yum
happyhatershare I feel like a bar of Toblerone is such a classic!!! You know what you’re doing when it comes to chocolate and you’re doing it well!!!!

3.4. Key Element Extraction (KEE)

Key Element Extraction (KEE) is a key element extraction or key phrase to find important Kansei words in social media comment. The selection of Kansei words is done by calculating the terminology score for each Kansei word obtained. The threshold for the terminology score is 0.1.

The calculation result of key terms score for each product samples can be seen in Tables below.

| Kansei Word | Score | Kansei Word | Score |
|-------------|-------|-------------|-------|
| Special     | 0.3348| Fun         | 0.3348|
| Memorable   | 0.2692| Addicted    | 0.2507|
| Sweet       | 0.4485| Delicious   | 0.1953|
| Sticky      | 0.5567| Soft        | 0.2523|

| Kansei Word        | Score |
|--------------------|-------|
| Love               | 0.6596|
| Favourite          | 0.5719|
| Best               | 0.4787|
Table 4. Terminology Score of Key Terms for Toblerone Dark Chocolate.

| Kansei Word | Score  |
|-------------|--------|
| Favourite   | 0.4653 |
| Best        | 0.1343 |
| Delicious   | 0.8654 |
| Classic     | 0.1244 |

Table 5. Terminology Score of Key Terms for Toblerone Plain.

| Kansei Word | Score  |
|-------------|--------|
| Best        | 0.3572 |
| Love        | 0.5972 |
| Big         | 0.6189 |
| Amazing     | 0.3482 |

Table 6. Terminology Score of Key Terms for Toblerone White Chocolate.

| Kansei Word | Score  |
|-------------|--------|
| Love        | 0.3331 |
| Favourite   | 0.4912 |
| Best        | 0.7734 |
| Delicious   | 0.1947 |

Table 7. Terminology Score of Key Terms for Toblerone Crunchy Almond.

| Kansei Word | Score  |
|-------------|--------|
| Delicious   | 0.3197 |
| Super       | 0.4719 |
| Cute        | 0.4719 |
| Favourite   | 0.4719 |
| Good        | 0.4719 |

Table 8. Terminology Score of Key Terms for Kitkat.

| Kansei Word | Score  | Kansei Word | Score  |
|-------------|--------|-------------|--------|
| Love        | 0.1967 | Good        | 0.1345 |
| Favourite   | 0.1598 | Sweet       | 0.1571 |
| Delicious   | 0.2803 | Best        | 0.1944 |
| Addicted    | 0.4035 | Soft        | 0.4679 |
| Crunchy     | 0.6116 |             |        |
Table 9. Terminology Score of Key Terms for Kitkat Ruby.

| Kansei Word | Score  |
|-------------|--------|
| Good        | 0.4532 |
| Love        | 0.7611 |
| Perfect     | 0.4595 |

Table 10. Terminology Score of Key Terms for Kitkat Wafer.

| Kansei Word | Score  |
|-------------|--------|
| Favourite   | 0.5389 |
| Amazing     | 0.3837 |
| Love        | 0.1158 |
| Cool        | 0.6290 |
| Impressive  | 0.3770 |

Table 11. Terminology Score of Key Terms for Delfi Premium Bar.

| Kansei Word       | Score  |
|-------------------|--------|
| Love              | 0.1034 |
| Sweet             | 0.1300 |
| Calming           | 0.1069 |
| Delicious         | 0.4230 |
| International Taste| 0.5154 |
| Inspiring Taste   | 0.5154 |
| Melted            | 0.4977 |

The Kansei words obtained as results from KEE can be seen in Table below.
Table 12. Kansei Words Obtained from Key Element Extraction (KEE).

| Love        | Sweet       | Calming | Delicious | International Taste |
|-------------|-------------|---------|-----------|---------------------|
| Inspiring taste | Melted      | Favourite | Best     | Classic             |
| Super       | Cute        | Good    | Big       | Amazing             |
| Special     | Memorable   | Sticky  | Fun       | Addicted            |
| Soft        | Crunchy     | Perfect | Cool      | Impressive          |

4. Conclusion and Future Work

The conclusion of this research can be described as follow. The design elements of chocolate product that affect the customer preferences are brand, geometry shape, sizes, and types. Customer preferences can be analyzed from social media trends by identifying Kansei words from comments on social media. Based on social media trends and Key Element Extraction, there are 25 Kansei words that describe customer preference, feeling, and emotion for chocolate product with terms score above 0.1.

This paper suggests that future research should apply Natural Language Processing (NLP) to identify and analyze the comments from social media effectively. KEE software can also be applied in calculating the participant and terms score faster. Future research also have to design a system that can translate social media trends into product design visualizations directly.

5. References

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