Product Development Model for Tempe Chocolate Chips
Based on Customer Preferences in Banjarnegara, Central Java, Indonesia

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Abstract
This study aims to determine the attributes and categories that are important in product development and its model to obtain appropriate design recommendations based on consumer preferences using Quantification Theory Type 1 (QTT1). The number of respondents involved was 250 respondents in Banjarnegara Regency who were selected on purposive sampling. Respondents were asked to rate the level of preference for 14 samples of chocolate tempe chips. The results of the identification of attributes and categories that affect preferences obtained seven attributes and 19 categories, namely shape attributes (round, square, triangle, and oval), thickness (thin and thick), size (large and medium), distinctive aroma (tempe, chocolate, and fruits), flavors (chocolate and variants), surface layers (glossy, sprinkles, sprinkles & chocolate, visible tempe surface & sprinkles), as well as coatings (chocolate compound coating and chocolate coating & sprinkles). Based on the data analysis, some recommendations for product development of chocolate tempe chips are: round, 0.15 mm thick, 8 cm wide, flavored and chocolatey, glossy coating with chocolate coating and sprinkles.

Keywords: customer’s preferences, product development model, tempe chocolate chips

INTRODUCTION
Tempe chips is a snack that has become a typical souvenir from Banjarnegara and Banyumas areas, Central Java, Indonesia (Masrukhi & Arsil, 2008). This product is also considered as an added value for tourism in those areas, so that many tempe chips industries are growing in these two districts, one of which is Suka Nicky. This company has been around for a long time, and currently, its products
are marketed in Banjarnegara and Banyumas Regencies. This company's management realizes that continuous product development is needed to survive in the fierce competition. The concept of product development is oriented towards business opportunities and exploring existing potentials (Cooper, 2001). Suka Nicky's company management innovated tempe chips with chocolate coating into chocolate tempe chips to expand its market share in sweet snacks.

Tempe chocolate chips are already on the market, but none of them are produced and marketed from Banjarnegara and its surrounding areas. Suka Nicky cannot directly imitate products that are already on the market. The company needs to diversify their products to meet customer preferences. Suka Nicky have experienced product development failures, primarily due to unfulfilled consumer needs and sensory preferences that do not suit consumer tastes (Caracciolo et al., 2020; Grujić & Grujić, 2012). This diversification is also a sustainability form of product development because development must be continuous. Product development must follow consumer preferences that change over time and not get bored easily even with products they like (Costa & Jongen, 2006; Linnemann et al., 2006). Therefore, this study aims to determine the product attributes and their categories and to build a product development model based on those attribute and categories. The result of this study can be used as recommendations for the company Suka Nicky in developing its chocolate tempe chips product.

Consumer preferences can be identified using many methods; one of them is Quantification Theory Type 1 (QTT1). QTT1 is a qualitative method and takes the form of a mathematical equation. QTT1 is defined as multiple categorical regression involving independent variables of categorical data type (Lai et al., 2006). The QTT1 method is suitable for assessing the dependent variable with various independent variables, which each has many categories. Hui et al. (2009) have used QTT1 to evaluate the quality of the Japanese Larch Tree, which has six attributes, 1-4 categories each. The results of this study are the weight of the influence of each attribute on product quality. The QTT1 method has also been used to determine consumer preferences. This preference is then used as a basis for product development to suit the consumer's personality (Djatna & Hidayat, 2014). Both studies build a real-time system for product customization development with a focus on personality identification. Both of these studies have been able to formulate product and service designs using QTT1. The formulation consists of a categories combination from each attribute with the aim of maximizing consumer preferences. Previous research does not explain how to determine the attributes and categories of products and services being developed. This determination is an important stage so that the resulting product development model answers consumer needs and conforms to the ability of producers. This is in line with Jreissat et al. (2017) study which integrates product development based on consumer preferences with economic capabilities and other industry limitations.

**METHODS**

This research was conducted in Banjarnegara Regency, Central Java, Indonesia. The sample of products tested for their preference level was 14 types of chocolate tempe chips. Respondents were selected using the purposeful sampling technique. Respondents were 250 people who bought sweet snacks to be consumed by themselves or given as souvenirs with a minimum frequency of 4 times a month or bought sweet snacks within the maximum duration of the last one week. Data processing was carried out with the help of R Studio software using Quantification Theory Type 1; the equation is as follows (Lai et al., 2006):

\[
y_i = \sum_{i=1}^{E} \sum_{j=1}^{C_i} x_{ij}\alpha_{ij} + \varepsilon
\]

(1)

where,

- \(s\) = product sample
- \(i\) = product attribute index
- \(E\) = number of product attributes
- \(j\) = category index on the product's ith attribute
- \(C_i\) = number of categories in the product's ith attribute
- \(\varepsilon\) = stochastic variable with the value \(E (\varepsilon) = 0\)
- \(\alpha_{ij}\) = dummy variable coefficient.

The stages of this research in more detail shown in Figure 1:
RESULTS AND ANALYSIS

Identification of Product Attributes and Categories

The method used to determine the attributes and categories is by studying the literature and by conducting interviews with people in Suka Nicky company. Interviews with companies is needed so that the attributes or categories match the company's capabilities. This capability includes employee skills, machine specifications, and the ease of obtaining materials or other additional materials. The attributes and categories identified in this study include shape, thickness, size, flavor, distinctive aroma, surface layers, and coating (Gous et al., 2019; Jaffe, Wang, & Chambers, 2017; Chittapalo & Songsanandr, 2014; Grujić & Grujičić, 2016). In detail, the attributes and categories of chocolate tempe in this study are shown in Table 1.

Collection of Product Samples

The product collection is carried out after determining the attributes and product categories. The chocolate tempe chips is an innovation from the tempe chips. This product has been marketed in Jakarta, Bogor, Depok, Tangerang, Bekasi, and Bandung with an online marketing system. The results of this product search obtained ten samples from six brands of chocolate tempe chips with several flavors. Suka Nicky Company produces chocolate tempe chips with four shape variants which can also be sampled so that the total sample used in this study is 14. Table 2 shows each chocolate tempe chips sample's specifications, the first four samples are chocolate tempe chips produced by the company Suka Nicky, and the following ten samples come from six competing company brands. The number of samples is set based on the calculation of the minimum number of samples. The sample products used in this study consisted of 19 categories and seven attributes so that the minimum number of samples can be calculated as follows (Hardiningtyas et al., 2016):

\[
\text{Minimum sample size (n)} = (\text{category - attribute}) + 1 \quad (2)
\]

\[
= (19 - 7) + 1 = 13 \text{ samples}
\]

Table 1. Chocolate tempe chips product attributes and categories

| Attributes          | Category Types          | 1   | 2       | 3       | 4       |
|---------------------|-------------------------|-----|---------|---------|---------|
| Shape (X₁)          | Round                   |     |         |         |         |
| Thickness (X₂)      | Thin (0.11 mm)          | Square | Thick (0.15 mm) | Triangle | Oval    |
| Size (X₃)           | Large (11 Cm)           |     |         |         |         |
| Distinctive aroma (X₄) | Tempe                   |     |         | Chocolate | Fruits |
| Flavors (X₅)        | Chocolate               |     |         |         |         |
| Surface layers (X₆) | Glossy                  |     |         | Sprinkles |         |
| Coating (X₇)        | Chocolate Compound      |     |         | Sprinkles & chocolate |         |
|                     | Coating                 |     |         | Visible tempe surface | & sprinkles |

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Table 2. Chocolate tempe chips product sample specifications

| No Sample | Shape (X1) | Thickness (X2) | Size (X3) | Distinctive Aroma (X4) | Flavors (X5) | Surface Layers (X6) | Coating (X7) |
|-----------|------------|---------------|-----------|------------------------|--------------|---------------------|-------------|
| 1         | Round      | Thin          | Large     | Chocolate              | Chocolate    | Glossy              | Chocolate compound coating |
| 2         | Square     | Thin          | Medium    | Chocolate              | Variant      | Visible tempe surface & sprinkles | Chocolate coating & sprinkles |
| 3         | Triangle   | Thin          | Medium    | Chocolate              | Chocolate    | Visible tempe surface & sprinkles | Chocolate compound coating |
| 4         | Oval       | Thin          | Large     | Chocolate              | Variant      | Visible tempe surface & sprinkles | Chocolate compound coating |
| 5         | Round      | Thin          | Large     | Chocolate              | Chocolate    | Sprinkles & chocolate | Chocolate compound coating |
| 6         | Square     | Thin          | Large     | Chocolate              | Chocolate    | Glossy              | Chocolate compound coating |
| 7         | Round      | Thick         | Medium    | Tempe                  | Chocolate    | Sprinkles & chocolate & sprinkles | Chocolate coating & sprinkles |
| 8         | Round      | Thick         | Medium    | Fruits                 | Variant      | Sprinkles & chocolate & sprinkles | Chocolate compound coating |
| 9         | Round      | Thick         | Medium    | Fruits                 | Variant      | Sprinkles & chocolate & sprinkles | Chocolate compound coating |
| 10        | Oval       | Thick         | Large     | Chocolate              | Chocolate    | Visible tempe surface & sprinkles | Chocolate compound coating |
| 11        | Oval       | Thick         | Large     | Fruits                 | Variant      | Visible tempe surface & sprinkles | Chocolate compound coating |
| 12        | Oval       | Thick         | Large     | Fruits                 | Variant      | Visible tempe surface & sprinkles | Chocolate compound coating |
| 13        | Round      | Thick         | Large     | Chocolate              | Chocolate    | Sprinkles & chocolate   | Chocolate compound coating |
| 14        | Round      | Thick         | Large     | Chocolate              | Chocolate    | Sprinkles             | Chocolate compound coating |

Respondents Characteristics

Data were collected in Banjarnegara Regency by giving questionnaires to respondents. Requirements for respondents in this study are people who have bought chocolate tempe chips or often buy other sweet snacks with a minimum frequency of four times per month or in the last week at least have bought sweet snacks either for their consumption or for souvenirs. The number of population in this study is uncertain, so the respondents were taken with an assumption that the population is normally distributed is carried out using the following formula:

\[ n = \left[ \frac{Z_{\alpha/2}}{E} \right]^2 \]  \hspace{1cm} (3)

where, 
\[ Z_{\alpha/2} \] = the standard value of the normal distribution for the confidence level \( \alpha = 95\% \)
\[ E \] = the level of provision used by stating the maximum error magnitude of 20%.

The minimum number of required respondents is 96 people, while this research uses 250 respondents who meet the requirements and are willing to participate. The number of respondents is more than the minimum value required, so that the number is assumed to be more than sufficient to represent the expected model.

Previous respondents were asked to do a taste test by trying all the samples. The recapitulation was then carried out on the data from the questionnaire that the respondents had filled in. The questionnaire contains the respondent's personal data and the respondent's assessment of the product sample. Closed questionnaires were distributed to obtain preference values for 14 samples of chocolate tempe
Modeling of Chocolate Tempe Chips Product Development

Product development requires the use of technology and needs to be oriented towards consumer and market desires (Adner & Levinthal, 2001). Information on consumer preferences for each sample is needed in designing a marketable chocolate tempe chips product. Respondents were asked to perform an organoleptic test on 14 samples then asked to provide a preference rating by providing a value on a questionnaire based on a Likert scale of 1 to 5 which shows an assessment of very dislike to very fond of the sample product. The results of the average preference of 250 respondents for each sample shown in Table 4.

This preference is then used as an independent variable to analyze its relationship with the multi-attribute specification and each sample category as the dependent variable. The analysis uses the Quantification Theory Type 1 (QTT1) equation (1) with the help of R studio software for coding. QTT1 is a statistical analysis that can be used to design new products or services. QTT1 was used in this study because the grouping of respondents was not carried out. QTT1 can also explain in detail down to the design category level so that the chocolate tempe chips product design recommendation can be preferred because it suits the consumer's preferences. The analysis results using QTT1 shown in Table 5, which shows the category value, Partial Correlation Coefficient (PCC), and the category value, which is the t value of each attribute. The category value shows the level of influence of each category. The greater the value of this category means the increase of consumer preferences on this category, while the category's negative value indicates the decreases of customer's preference on the category. The recommended design is the product with the highest positive category value. The PCC value in Table 5 shows that this attribute's level is able to explain consumer preferences.

Table 3. Respondent characteristics

| Profiles             | Criteria                  | Frequency |
|----------------------|---------------------------|-----------|
| Gender               | Man                       | 106       |
|                      | Women                     | 144       |
| Age                  | > 15 ≥ 25                 | 117       |
|                      | > 25 ≥ 35                 | 54        |
|                      | > 35 ≥ 45                 | 43        |
|                      | > 45 ≥ 55                 | 31        |
|                      | > 55 ≥ 65                 | 5         |
| Profession           | College student / student | 98        |
|                      | Entrepreneur              | 27        |
|                      | Civil servants            | 57        |
|                      | Private employees         | 28        |
|                      | Housewife                 | 40        |
| Education            | Elementary School         | 15        |
|                      | Junior High School        | 23        |
|                      | High School               | 101       |
|                      | Diploma                   | 35        |
|                      | Bachelor                  | 73        |
|                      | Postgraduate              | 3         |
| Income per month (IDR) | ≤ 1,500,000              | 103       |
|                      | > 1,500,000 ≥ 2,500,000   | 39        |
|                      | > 2,500,000 ≥ 3,500,000   | 62        |
|                      | > 3,500,000 ≥ 4,500,000   | 21        |
|                      | > 4,500,000               | 25        |
| Number of family members | 1 - 5 members        | 229       |
|                      | 6 - 10 members            | 21        |
| Marital status       | Married                   | 110       |
|                      | Single                    | 127       |
|                      | Widow / widower           | 13        |
| Purchasing Products  | Snacks / Personal         | 193       |
|                      | Consumption               |           |
| Purpose              | Gift                      | 57        |

Table 4. The mean results evaluation of the respondents' preferences

| Sample No | Preference Average Level |
|-----------|--------------------------|
| 1         | 3.566                    |
| 2         | 3.325                    |
| 3         | 3.241                    |
| 4         | 3.386                    |
| 5         | 3.466                    |
| 6         | 3.386                    |
| 7         | 3.410                    |
| 8         | 3.446                    |
| 9         | 3.546                    |
| 10        | 3.474                    |
| 11        | 3.333                    |
| 12        | 3.394                    |
| 13        | 3.554                    |
| 14        | 3.703                    |
Table 5. The analysis of Quantification Theory Type 1 (QTT1) results

| Attributes    | Categories | Categories Value | Partial Correlation Coefficient (PCC) |
|---------------|------------|-----------------|---------------------------------------|
| Shape (X₁)    | x1.1       | 0.121           |                                       |
|               | x1.2       | -0.192          |                                       |
|               | x1.3       | -0.108          |                                       |
|               | x1.4       | -0.026          |                                       |
| Thickness (X₂) | x2.1       | -0.086          |                                       |
|               | x2.2       | 0.048           | 0.963                                 |
| Size (X₃)     | x3.1       | -0.001          |                                       |
|               | x3.2       | 0.002           | 0.07                                  |
| Distinctive aroma (X₄) | x4.1   | -0.181          |                                       |
|               | x4.2       | 0.068           | 0.975                                 |
|               | x4.3       | -0.108          |                                       |
| Coating (X₅)  | x5.1       | -0.028          | 0.887                                 |
|               | x5.2       | 0.037           |                                       |
| Surface layers (X₆) | x6.1   | 0.098           |                                       |
|               | x6.2       | -0.002          |                                       |
|               | x6.3       | -0.047          |                                       |
|               | x6.4       | -0.001          |                                       |
| Flavors (X₇)  | x7.1       | -0.051          | 0.96                                  |
|               | x7.2       | 0.051           |                                       |

Table 6. Recommendations for the development of chocolate tempe chips

| Attributes    | Categories                                      |
|---------------|-------------------------------------------------|
| Shape (X₁)    | Round                                           |
| Thickness (X₂)| Thickness (0.15 mm)                             |
| Size (X₃)     | Medium (8 cm)                                   |
| Distinctive aroma (X₄) | Chocolate                              |
| Flavor (X₅)   | Chocolate                                       |
| Surface layer (X₆) | Glossy                              |
| Coating (X₇)  | Chocolate coating and sprinkles                 |

The value of R is the multiple correlation coefficient that determines how well the estimation model fits the observed data, while the R² value is the coefficient of determination which shows how well the data points fit the statistical model (Juanda, 2009). R must be more than 0.8 in order to be declared good and must be more than 0.6 to evaluate the model data (Nagamachi, 2010). Several correlation coefficients in all models in this study have a value of more than 0.8. This means that the chocolate tempe chips development model that has been made has been declared reliable or in accordance with the observed data and can be applied.

The analysis results are also visualized in Figure 2 to simplify the process of drawing recommendations. The length of the bar on the dashboard...
shows the value of each sample product category; for example: attribute X1 (shape) has a PCC value of 0.991 (Table 5) which means that shape can explain 99.1% of consumer preferences. The shape attribute has four categories, with the highest category value is X1.1 (round) of 0.121, so that the recommended product is round chocolate tempe chips. This becomes simpler, seen from the length of the bar on the dashboard in Figure 2. The same is true for the other categories. Recommendations for chocolate tempe chips products as a whole can be developed with the specifications shown in Table 6.

CONCLUSIONS

The average preference level of consumers for the chocolate tempe chips produced by Suka Nicky company before the development was 3.3795. This figure is still below the average preference for its competitors. Increased preference is carried out by utilizing product development involving seven attributes and 19 categories, namely shape attributes (round, square, triangle, and oval), thickness (thin and thick), size (large and medium), distinctive aroma (tempe, chocolate, and fruits), flavors (chocolate and variants), surface layers (glossy, sprinkles, sprinkles & chocolate, and visible tempe surface & sprinkles), as well as coatings (chocolate compound coating and chocolate coating & sprinkles). Based on the data analysis, recommendations for product development of chocolate tempe chips based on consumer preferences are round, 0.15 mm thick, 8 cm wide, flavored and chocolatey, glossy coating with a chocolate coating material and some sprinkles. Further research can be carried out on developing a package design and differentiation based on market segmentation.

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