

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

### *Model Pengembangan Produk Keripik Tempe Cokelat Berdasarkan Preferensi Konsumen di Kabupaten Banjarnegara, Jawa Tengah, Indonesia*

Hety Handayani Hidayat\*, Nur Wijayanti

Department of Agricultural Technology, Faculty of Agriculture, Universitas Jenderal Soedirman  
Jl. Dr. Soeparno No. 61, Purwokerto 53123, Indonesia

\*hety.hidayat@unsoed.ac.id

Received: 23<sup>rd</sup> November, 2019; 1<sup>st</sup> Revision: 27<sup>th</sup> November, 2020; 2<sup>nd</sup> Revision: 26<sup>th</sup> February, 2021; Accepted: 25<sup>th</sup> March, 2021

#### 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:** costumer's preferences, product development model, tempe chocolate chips

#### Abstrak

Penelitian ini bertujuan untuk menentukan atribut hingga kategori yang penting dalam pengembangan produk dan memodelkannya untuk memperoleh rekomendasi desain yang sesuai berdasarkan preferensi konsumen dengan menggunakan Quantification Theory Type 1 (QTT1). Jumlah responden yang terlibat sebanyak 250 responden di Kabupaten Banjarnegara yang dipilih dengan purposive sampling. Responden diminta untuk menilai tingkat preferensi terhadap 14 sampel produk keripik tempe cokelat. Hasil identifikasi atribut dan kategori yang memengaruhi preferensi diperoleh 7 atribut dan 19 kategori, yaitu atribut bentuk (bulat, kotak, segitiga, dan oval), ketebalan (tipis dan tebal), lebar (besar dan sedang), aroma khas (tempe, cokelat, dan buah-buahan), rasa (cokelat dan varian), lapisan permukaan (mengkilap, taburan, taburan & cokelat, serta tempe terlihat & ada taburan), serta pelapis (coating compound cokelat dan coating cokelat & taburan). Analisis data menghasilkan rekomendasi pengembangan produk keripik tempe cokelat adalah berbentuk bulat, tebal 0,15 mm, lebar 8 cm, beraroma dan berasa cokelat, lapisannya mengkilap dengan bahan pelapis coating cokelat dan taburan.

**Kata kunci:** keripik tempe cokelat, model pengembangan produk, preferensi konsumen

## 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 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 purposive 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):

$$y_s = \sum_{i=1}^E \sum_{j=1}^{C_i} x_{ij} \alpha_{ijs} + \varepsilon \quad (1)$$

where,

$s$  = product sample

$i$  = product attribute index

$E$  = number of product attributes

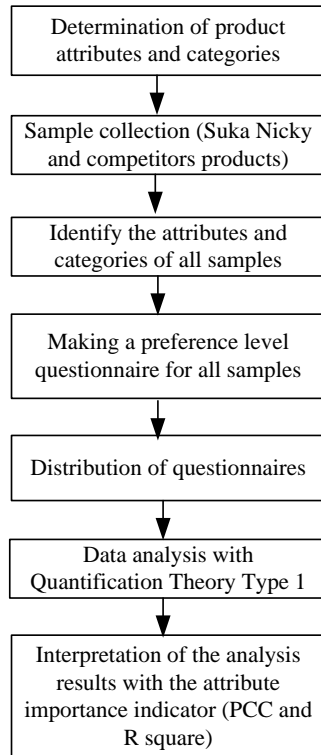
$j$  = category index on the product's  $i$ th attribute

$C_i$  = number of categories in the product's  $i$ th attribute

$\varepsilon$  = stochastic variable with the value  $E(\varepsilon) = 0$

$\alpha_{ijs}$  = dummy variable coefficient.

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



**Figure 1.** Research Flowchart

## 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 & Grujić, 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):

$$\begin{aligned} \text{Minimum} &= (\text{category} - \text{attribute}) + 1 \quad (2) \\ \text{sampel size (n)} &= (19 - 7) + 1 = 13 \text{ samples} \end{aligned}$$

**Table 1.** Chocolate tempe chips product attributes and categories

Attributes		Category Types			
		1	2	3	4
Shape	(X <sub>1</sub> )	Round	Square	Triangle	Oval
Thickness	(X <sub>2</sub> )	Thin (0.11 mm)	Thick (0.15 mm)		
Size	(X <sub>3</sub> )	Large (11 Cm)	Medium (8 Cm)		
Distinctive aroma	(X <sub>4</sub> )	Tempe	Chocolate	Fruits	
Flavors	(X <sub>5</sub> )	Chocolate	Variants		
Surface layers	(X <sub>6</sub> )	Glossy	Sprinkles	Sprinkles & chocolate	Visible tempe surface & sprinkles
Coating	(X <sub>7</sub> )	Chocolate Compound Coating	Chocolate coating & sprinkles		

**Table 2.** Chocolate tempe chips product sample specifications

No Sample	Shape (X <sub>1</sub> )	Thickness (X <sub>2</sub> )	Size (X <sub>3</sub> )	Distinctive Aroma (X <sub>4</sub> )	Flavors (X <sub>5</sub> )	Surface Layers (X <sub>6</sub> )	Coating (X <sub>7</sub> )
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	Chocolate coating & sprinkles
8	Round	Thick	Medium	Fruits	Variant	Sprinkles & chocolate	Chocolate compound coating
9	Round	Thick	Medium	Fruits	Variant	Sprinkles & chocolate	Chocolate coating & sprinkles
10	Oval	Thick	Large	Chocolate	Chocolate	Visible tempe surface & sprinkles	Chocolate coating & sprinkles
11	Oval	Thick	Large	Fruits	Variant	Visible tempe surface & sprinkles	Chocolate coating & sprinkles
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 coating & sprinkles

### 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:

$$n = \left[ \frac{Z_{\alpha/2}}{E} \right]^2 \quad (3)$$

$$n = \left[ \frac{1,96}{0,2} \right]^2 = 96 \text{ respondents}$$

where,  
 $n$  = total respondents

$Z_{\alpha/2}$  = 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

chips. The characteristics of the respondents are shown in Table 3.

### 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
	<b>Women</b>	<b>144</b>
Age	<b>&gt; 15 ≥ 25</b>	<b>117</b>
	> 25 ≥ 35	54
	> 35 ≥ 45	43
	> 45 ≥ 55	31
	> 55 ≥ 65	5
Profession	<b>College student / student</b>	<b>98</b>
	Entrepreneur	27
	Civil servants	57
	Private employees	28
	Housewife	40
Education	Elementary School	15
	Junior High School	23
	<b>High School</b>	<b>101</b>
	Diploma	35
	Bachelor	73
Income per month (IDR)	Postgraduate	3
	<b>≤ 1,500,000</b>	<b>103</b>
	> 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	<b>1 - 5 members</b>	<b>229</b>
	6 - 10 members	21
Marital status	Married	110
	<b>Single</b>	<b>127</b>
	Widow / widower	13
Purchasing Products Purpose	<b>Snacks / Personal Consumption</b>	<b>193</b>
	Gift	57

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

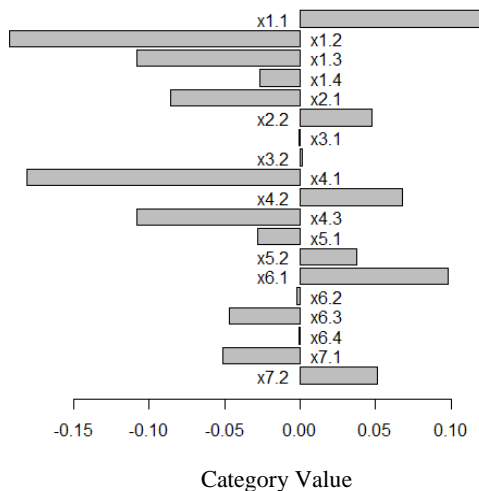
Sample No	Preference Average Level
1	3.566
2	3.325
3	3.241
4	3.386
5	3.466
6	3.386
7	3.410
8	3.446
9	3.546
10	3.474
11	3.333
12	3.394
13	3.554
14	3.703

**Table 5.** The analysis of Quantification Theory Type 1 (QTT1) results

Attributes	Categories	Categories Value	Partial Correlation Coefficient (PCC)
Shape ( $X_1$ )	x1.1	0.121	0.991
	x1.2	-0.192	
	x1.3	-0.108	
	x1.4	-0.026	
Thickness ( $X_2$ )	x2.1	-0.086	0.963
	x2.2	0.048	
Size ( $X_3$ )	x3.1	-0.001	0.07
	x3.2	0.002	
Distinctive aroma ( $X_4$ )	x4.1	-0.181	0.975
	x4.2	0.068	
	x4.3	-0.108	
Coating ( $X_5$ )	x5.1	-0.028	0.887
	x5.2	0.037	
Surface layers ( $X_6$ )	x6.1	0.098	0.931
	x6.2	-0.002	
	x6.3	-0.047	
	x6.4	-0.001	
Flavors ( $X_7$ )	x7.1	-0.051	0.96
	x7.2	0.051	
Intercept		3.3170	
R		0.9899	
R <sup>2</sup>		0.8685	

**Table 6.** Recommendations for the development of chocolate tempe chips

Attributes	Categories
Shape ( $X_1$ )	Round
Thickness ( $X_2$ )	Thickness (0.15 mm)
Size ( $X_3$ )	Medium (8 cm)
Distinctive aroma ( $X_4$ )	Chocolate
Flavor ( $X_5$ )	Chocolate
Surface layer ( $X_6$ )	Glossy
Coating ( $X_7$ )	Chocolate coating and sprinkles

**Figure 2.** Dashboard of Chocolate Tempe Chips Product Development Model

The value of R is the multiple correlation coefficient that determines how well the estimation model fits the observed data, while the R<sup>2</sup> 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.

## References

- Adner, R., & Levinthal, D. (2001). Demand heterogeneity and technology evolution: Implications for product and process innovation. *Management Science*, 47(5), 611–628. <https://doi.org/10.1287/mnsc.47.5.611.10482>
- Caracciolo, F., El-Nakhel, C., Raimondo, M., Kyriacou, M. C., Cembalo, L., De Pascale, S., & Roupheal, Y. (2020). Sensory attributes and consumer acceptability of 12 microgreens species. *Agronomy*, 10(7), 1–15. <https://doi.org/10.3390/agronomy10071043>
- Chittapalo, T., & Songsanandr, P. (2014). Product development of black glutinous rice cracker with Panang flavor and its quality changes. *International Food Research Journal*, 21(5), 2025–2029.
- Cooper, R. G. (2001). *Winning at New Products: Accelerating the Process from Idea to Launch* (3rd ed.). Basic Books.
- Costa, A. I. A., & Jongen, W. M. F. (2006). New insights into consumer-led food product development. *Trends in Food Science & Technology*, 17(8), 457–465. <https://doi.org/10.1016/j.tifs.2006.02.003>
- Djatna, T., & Hidayat, H. H. (2014). Real time key element extraction for design of in flight meal services based on passenger's personality traits. *International Conference on Information Technology and Electrical Engineering (ICITEE)*, 1–6. <https://doi.org/10.1109/ICITEED.2014.7007910>
- Gous, A., Almli, V., Coetzee, V., & de Kock, H. (2019). Effects of varying the color, aroma, bitter, and sweet levels of a grapefruit-like model beverage on the sensory properties and liking of the consumer. *Nutrients*, 11(2), 464-. <https://doi.org/10.3390/nu11020464>
- Grujić, S., & Grujić, M. (2016). Consumer's research for new functional bakery product development. *Applied Technologies and Innovations*, 12(1), 1–16. <https://doi.org/10.15208/ati.2016.01>
- Grujić, S., & Grujić, R. (2012). Food product development as opportunity for success or survival in the market. *6th Central European Congress on Food*, 1202–1206.
- Hardiningtyas, D., Tama, I. P., Eunike, A., & Andriani, D. P. (2016). Studi faktor kansei pada produk berbasis kearifan lokal (studi kasus: batik malangan). *JEMIS (Journal of Engineering & Management in Industrial System)*, 4(2), 151–160. <https://doi.org/10.21776/ub.jemis.2016.004.02.6>
- Hui, S., Li, Z., Yang, F., Liu, Q., & Li, L. (2009). The application of quantification theory i in site quality evaluation of Japanese larch-tree (*Larix kaemferi*). *International Journal of Information and Systems Sciences*, 5(3–4), 528–531.
- Jaffe, T. R., Wang, H., & Chambers, E. (2017). Determination of a lexicon for the sensory flavor attributes of smoked food products. *Journal of Sensory Studies*, 32(3), 1–9. <https://doi.org/10.1111>

- |   |   |
|---|---|
| <p>/joss.12262</p> <p>Jreissat, M., Isaev, S., Moreno, M., &amp; Makatsoris, C. (2017). Consumer driven new product development in future re-distributed models of sustainable production and consumption. <i>Procedia CIRP</i>, 63, 698–703. <a href="https://doi.org/10.1016/j.procir.2017.03.314">https://doi.org/10.1016/j.procir.2017.03.314</a></p> <p>Juanda, B. (2009). <i>Ekonometrika: Pemodelan dan Pendugaan</i>. IPB Press.</p> <p>Lai, H.-H., Lin, Y.-C., Yeh, C.-H., &amp; Wei, C.-H. (2006). User-oriented design for the optimal combination on product design. <i>International Journal of Production Economics</i>, 100(2), 253–267. <a href="https://doi.org/10.1016/">https://doi.org/10.1016/</a></p> | <p>j.ijpe.2004.11.005</p> <p>Linnemann, A. R., Benner, M., Verkerk, R., &amp; van Boekel, M. A. J. S. (2006). Consumer-driven food product development. <i>Trends in Food Science &amp; Technology</i>, 17(4), 184–190. <a href="https://doi.org/10.1016/j.tifs.2005.11.015">https://doi.org/10.1016/j.tifs.2005.11.015</a></p> <p>Masrukhi, &amp; Arsil, P. (2008). Kajian mutu keripik tempe di Kabupaten Banyumas. <i>Seminar on Application and Research in Industrial Technology, SMART</i>, E-048-E-053.</p> <p>Nagamachi, M. (2010). <i>Kansei/Affective Engineering</i>. CRC Press. <a href="https://doi.org/10.1201/EBK1439821336">https://doi.org/10.1201/EBK1439821336</a></p> |
|---|---|