Makara Journal of Technology

Volume 24 | Issue 2 Article 3

11-2-2020

Redesign of Product Packaging with Kansei Engineering: Empirical Study on Small-medium Enterprises in Indonesia

Amalia Suzianti
Department of Industrial Engineering, Faculty of Engineering, Universitas Indonesia, Depok 16424, Jawa Barat, suzianti@eng.ui.ac.id

A. Aldianto
Department of Industrial Engineering, Faculty of Engineering, Universitas Indonesia, Depok 16424, Jawa Barat

Makara J. Technol. 24/2 (2020), 65–71
doi: 10.7454/mst.v24i2.2990

Redesign of Product Packaging with Kansei Engineering: Empirical Study on Small-medium Enterprises in Indonesia

Amalia Suzianti* and A. Aldianto

Department of Industrial Engineering, Faculty of Engineering, Universitas Indonesia, Depok 16424, Jawa Barat

**e-mail: suzianti@eng.ui.ac.id*

Abstract

Small-medium enterprises (SMEs) in Indonesia have been proven to be one of the important pillars of the national economy. Unfortunately, some problems hinder their development, and one of the critical problems is the quality of product packaging. The packages of SME products are considered poor, dirty, and unattractive. Packaging problem is one of the factors why consumers are less interested in buying and why SME products always lose in the competition with other products. This study discusses how to employ Kansei engineering to design better SME product packaging with a focus on psychological (affective) aspects. This research concludes that there are four components that represent consumers' desires: Attractiveness, Robustness, Handy & Green, and Lightness. The final result of this research is the creation of four new designs for a product package that satisfies each of the above components.

Abstrak

Rancang Ulang Kemasan Produk dengan Rekayasa Kansei: Kajian Empiris pada Perusahaan Kecil-Menengah di Indonesia. Usaha kecil menengah (UKM) di Indonesia telah terbukti menjadi salah satu pilar terpenting dalam perekonomian Indonesia. Akan tetapi, ada beberapa tantangan dan permasalahan yang menghalangi perkembangan produk UKM di Indonesia, salah satunya adalah permasalahan kualitas kemasan produk. Kemasan produk UKM kebanyakan masih terlihat seadanya, kotor dan tidak menarik. Berdasarkan hasil survey, desain tampilan dan kualitas kemasan produk merupakan salah satu alasan utama mengapa konsumen tidak tertarik untuk membeli produk-produk UKM. Oleh karena itu, penelitian ini bertujuan untuk menghasilkan keluaran desain kemasan produk yang memiliki nilai tambah dan lebih menarik berdasarkan aspek afektif melalui *Kansei Engineering*. Hasil penelitian menunjukkan bahwa ada empat karakteristik utama yang perlu ditampilkan dalam kemasan produk sesuai aspek afektifitas dari konsumen yaitu: *Attractiveness, Robustness, Handy & Green, and Lightness.* Keluaran akhir penelitian juga menampilkan usulan desain kemasan produk UKM yang sesuai dengan empat karakteristik utama tersebut.

Keywords: SME, affective redesign, product packaging, Kansei engineering

1. Introduction

Small and medium enterprise (SME) is one of the most important sectors supporting the national economy. Based on data from the Central Bureau of Statistics, SMEs account for 99.9% of the total enterprises in Indonesia. In year 200, the number of workers absorbed by the SME sector stood at 99.4% of the total national workforce [1]. Similarly, SMEs significantly contribute to the gross domestic product (GDP), supporting more than half (59.3%) of the GDP. However, SMEs have since been facing challenges regarding their products. The influx of imported goods into Indonesia weakens the sales of SME products. Moreover, the government policy (Presidential Decree No. 48 of 2004) endorsing free trade between ASEAN countries and China (ACFTA), enacted on January 1, 2010, also affects the commercial success of SME products. Unfortunately, the products of Indonesian SME entrepreneurs are still weak in terms of packaging and marketing; therefore, these aspects need improvements. Most SME product packages are unattractive, resulting in low levels of consumer awareness and interest in the products.

Depok, one of the city suburbs of Jakarta is highly supported by its SMEs. Based on the Department of Revenue, Finance, and Asset Management, Depok, the SME sector has the potential to increase the revenue of the city, along with industrial and residential sectors. Various types of products have been produced by SMEs in Depok. Depok has 168 SMEs that are divided into 13 major sectors. Among these sectors, the culinary sector accounts for the greatest percentage (31%), and moreover, within the culinary sector, SMEs which also designed and used their own food packaging have the greatest market proportion [2].

Packaging is not only a medium to protect products. Generally, a package has three main functions: (1) to protect products from contaminants, (2) to determine a unit scale of product sold, and (3) to provide essential information about the product [3]. Apart from the various primary functions of packaging, which include serving as a protective medium, in the era of global competition, packaging has much larger functions. Product packages have now become a media that influence consumers' decision on whether to buy a product [3].

Considering the above, this study explores the need to redesign SME product packages to improve the competitiveness of SME products in the national market and increase consumers' interest to buy SME products. The ultimate goal of this research is the creation of a design for the packaging of new SME products that can meet consumers' affective aspects.

2. Methods

Kansei engineering (KE) or "affective engineering" is a product development methodology that involves translating consumer's psychological feelings into the design specifications of a product. KE is a technology that unites Kansei (feelings and emotions) with the engineering disciplines [4]. This method was developed by Prof. Mitsuo Nagamachi in 1970 (at that time, it was known as emotion engineering) at Hiroshima University.

Figure 1 describes a simple framework of KE in creating new product concepts. The early stages involve gathering Kansei consumers against products. Afterward, measurements/assessments are performed to know which Kansei words are relevant and used frequently in the field of the research. Furthermore, the Kansei words are analyzed by referring to the technical specifications of the new products to be created, and a new concept of product design is formed.

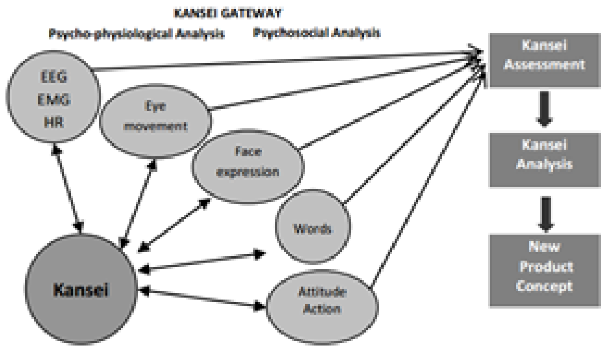

Figure 1. Kansei Gates

Referring to this, Kansei engineering is classified as user oriented product development approach [5]-[7].

There are three types of KE technique [4], [8]-[11]. Generally, these are techniques based on the availability of information, complexity analysis, and performance [12], [13]. KE type I was selected in this study based on the output to be achieved, which is the technical specifications, and the main tool used was statistics.

The general procedures of KE are as follows: (1) Selection of product domains. Selecting the right target and scope of observation of the products is the first step, and it is fundamental to KE implementation. The set of products that will be observed must come from the same product family. (2) Collection of Kansei words. Kansei words are words that are in the consumer's mind when they see, touch, or interact with the product. Kansei words can be collected through dialogues with consumers or sellers and observations of diverse media-related information of products. Each Kansei word is then designed with a semantic differential (SD) scale for assessment/weighting. (3) Collection of product samples. At this stage, the product observations are collected. The collected products should belong to one family. (4) Evaluation of product samples vs. Kansei words. This evaluation is performed by displaying product images (slideshow) to the respondents. Then respondents are asked to assess each product sample with all Kansei words that have been designed with SD. (5) Customer requirements identification using principal component analysis. The assessment data of Kansei words in each sample product are then transformed to know customer requirements for product design. Principal component analysis (PCA) is used to determine the correlation structure between related Kansei words. (6) Identification of product design elements using partial least squares regression to meet customer requirements.

After the customer requirements are known, the design elements that can fulfill those requirements are analyzed. For this, calculations are performed using partial least squares regression (PLSR), with the design elements as the independent variables and customer requirements as the response variable.

3. Results and Discussion

Selecting product domains. This study focuses on SMEs processing food products, and therefore, only food products processed by SMEs in Depok city are examined in this study.

Collection of Kansei words. Twenty Kansei words were extracted by the subjects in this study (Table 1). Kansei words were obtained from interviews with sellers and buyers, as well as information from the various media related to products.

Each Kansei word was assigned to an SD scale as in Figure 2.

Collection of product samples. Twenty-one samples of SME-processed food products from the Depok SME Center were selected in this study, as shown in Figure 3. All the product samples were captured in pictures for further evaluation.

Evaluation of product samples vs. Kansei words. In this study, 20 respondents were asked to assess the 21 product samples using 20 Kansei words. The respondents were shown pictures of products with a slideshow, and they were asked to weight all Kansei words for each product sample. The Kansei word weights for the samples will be used to determine the customer requirement. The average weights of Kansei words were then calculated as shown in Table 2.

Identification of customer requirement. After all the required data were obtained, the next step was to identify the customer requirement. This was done using PCA. At this stage, the weight data of Kansei words in each sample were used. These data were analyzed considering the correlation between the Kansei words to determine the fundamental structure of the collection of Kansei words. Structures/components representing the customer requirements were formed from this analysis (Table 3).

Table 1. Kansei Words used in This Study

No.	Kansei words
1	Hygienic
2	Strong
3	Elegant
4	Durable
5	Attractive
6	Unique
7	Environment-friendly
8	Easy to open
9	Easy to handle
10	Informative
11	Creative
12	Simple
13	Representative to product
14	Light
15	Persuasive
16	Easy to store
17	Ethnical element
18	Recyclable
19	Artistic
20	Innovative

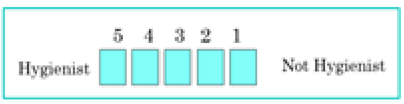

Figure 2. SD scale on Kansei words

Figure 3. List of Packaging Product Samples

Table 2. Overview of Weighted Kansei Words

No	Kansei Words	Sample					
		1	2	3	…	…	21
1	Hygienist	3.36	3.44	3.88	…	…	3.86
2	Strong	3.36	3.48	3.44	…	…	3.71
3	Elegant	1.48	2.04	2.88	…	…	3.14
…	…	…	…	…	…	…	…
20	Innovative	1.56	2.20	2.96	…	…	2.71

Table 3. Kansei Words Component

	Component			
	1	2	3	4
Hygienist		.805		
Strong		.904		
Elegant	.738			
Durable		.970		
Atractive	.858			
Unique	.885			
Environment Friendly			.686	
Easy to Open			.830	
Easy to Handle			.726	
Informative		.630		
Creative	.858			
Simple				
Representative to Product	.686			
Light				.934
Persuasive	.931			
Easy to Store		.764		
Ethnical Element	.908			
Recyclable			.669	
Artistic	.925			
Innovative	.881			

The extracted components from PCA are as follows:

First component. The first component comprised nine variables (Kansei words). Those Kansei words are *elegant*, *attractive*, *unique*, *creative*, *product representative*, *persuasive*, *ethnical element*, *artistic*, and *innovative*. In this component, *persuasive* had the greatest weight, 0.931, while *product representative* had the least, 0.686. Based on an analysis of the various Kansei words that constitute this component, the component is named as Attractiveness.

Second component. The second component comprised five variables (Kansei words): *hygienic*, *strong*, *durable*, *informative*, and *easy to store*. In this component, *durable*, had the greatest weight, 0.970, while *informative* had the least, 0.630. Based on an analysis of the various Kansei words that constitute this component, the component is named as Robustness.

Third component. The third component comprised four variables (Kansei words): *environment-friendly*, *easy to open*, *easy to handle*, *recyclable*. *Easy to open* had the greatest weight, 0.830, while *recyclable* had the lowest weight, 0639. Based on an analysis of the various Kansei words, the component is named as Handy & Green.

Fourth component. The fourth component comprises one variable (Kansei words): *lightness*. Based on this Kansei word, the component is named as Lightness.

Thus, it can be concluded that at the stage of customer requirement identification using PCA, the extracted components are Attractiveness, Robustness, Handy & Green, and Lightness.

Identification of product design elements. After the four components were obtained, the next step was to determine the design specifications that meet those components. Every element of the design of the scope of the product (referred to as "item" in this paper) was extracted, and then each element of the design was divided into several categories (called "category" in this paper). From the initial data, there are 28 items and 107 categories. The evaluation results of product samples in the item/category list are summarized in Table 4.

At this stage, there are two matrices: component matrix and item/category matrix. The second matrix was further analyzed by PLSR (item/category and components), in which item/category was treated as the independent variable (X) and components as the dependent variable (Y).

Table 5 presents the coefficients of each category of the component. In each component column, the category with the greatest coefficient most represents the component, and vice versa. Thus, the category with the greatest coefficient was used as the main reference in determining the design specifications of the product. Based on the technical specifications obtained from PLSR analysis, the visual images of the designs are created. One design is generated from each component of Kansei words. Here is the proposed design of the packaging of processed food products:

Attractiveness. Based on Table 5, the packaging design specification that represents the Attractiveness component are dimensions of (17–21) × (10–12) × (6–9) cm; box-shaped packaging; red as the dominant color; brown logo/label; upper-centralized logo/label position; carton material; circular label/logo with a size of 10 × 10 cm, font size of 95–100, white in color, and without a tagline; distribution of license information on the packaging, cavity resembling a finger grip; glue cover; representative image; product "taste" information; flavor information and taste information written in green with a font size of 18–20 pt. An image depicting the technical specifications is displayed in Figure 4.

Table 4. Matrix of Item/Category

No.	ITEM	CATEGORY	Sample											
			1	2	3	4	5	6	7	8	9	…	…	21
1	Height	10-14 cm	—	√	√	—	√	√	√	—	—	…	…	—
		14-17 cm	—	—	—	√	—	—	—	—	—	…	…	√
		17-21 cm	√	—	—	—	—	—	—	√	—	…	…	—
		21-24 cm	—	—	—	—	—	—	—	—	√	…	…	√
2	Width	10-12 cm	√	√	—	—	√	√	√	√	—	…	…	√
		12-14 cm	—	—	—	√	—	—	—	—	—	…	…	—
		14-16 cm	—	—	—	—	—	—	—	—	√	…	…	—
		16-18 cm	—	—	√	—	—	—	—	—	—	…	…	—
3	Thickness	3-6 cm	√	—	√	√	√	√	√	√	√	…	…	—
		6-9 cm	—	—	—	—	—	—	—	—	—	…	…	—
		9-12 cm	—	√	—	—	—	—	—	—	—	…	…	—
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
28	Color of product excellence information	Red	—	—	—	√	—	—	—	—	—	…	…	—
		Green	—	—	—	—	√	—	—	—	—	…	…	—
		White	—	—	√	—	—	√	—	—	—	…	…	—
		Black	—	—	—	—	—	—	√	√	—	…	…	—
		No Color	√	√	—	—	—	—	—	—	√	…	…	√

Table 5. Coefficient Value of Each Category

No.	CATEGORY	CONSTANT	Attractiveness	Robustness	Handy & Green	Lightness
			2.92021	3.27999	3.22368	3.39024
1	Height	10-14 cm	0.023035742	0.044658441	0.014191882	-0.028974
		14-17 cm	-0.10513987	-0.0501135	-0.005846858	0.0332981
		17-21 cm	0.068716028	0.003593398	0.038229728	0.0336326
		21-24 cm	-0.012953346	-0.01139415	-0.006843449	-0.029299
2	Width	10-12 cm	0.036272288	0.0455367385	0.043950481	0.0056354
		12-14 cm	-0.033333645	0.030062279	-0.070340663	0.0246482
		14-16 cm	0.000114383	-0.09879398	-0.04856062	-0.070677
		16-18 cm	-0.02200088	0.004182441	0.028107421	0.0320995
3	Thickness	3-6 cm	-0.027193776	-0.00703832	-0.056088159	-0.00655
		6-9 cm	0.037127466	0.011837853	0.04794322	0.0316831
		9-12 cm	-0.031903898	-0.03017137	-0.045267447	-0.024264
…	…	…	…	…	…	…
…	…	…	…	…	…	…
28	Color of product excellence information	Red	-0.014556314	0.057771192	-0.006209007	-0.026448
		Green	-0.006426178	0.033567659	0.04195201	0.0242203
		White	-0.022084796	-0.0338964	0.001422	-0.036077
		Black	0.137110307	0.098566601	0.074898885	0.0445494
		No Color	-0.062704944	-0.05980929	-0.049116692	-0.010104

Figure 4. A Visual Image Depicting the Technical Specifications based on the Attractiveness Component

Figure 4 shows an overview of the technical specifications based on the Attractiveness component. In this packaging, the visual elements significantly different from those of other packaging designs are the box shape, the packaging and logo dominant colors of red and brown, the circular logo shape, and the composition of the supporting information on the package.

Figure 5. Image Depicting Technical Specifications based on the Robustness Component

Robustness. Based on Table 5, the packaging design specification that represents the Robustness component are dimensions of (10–14) × (10–12) × (6–9) cm; cylindrical packaging, red as the dominant color; yellow logo/label; logo/label positioned central-upper; PVT plastic material; circular logo/label, with a size of 3 × 3 cm, font size of 95–100, black font color, and without a tagline; information on circulation permit on the packaging; glue cover; representative images; information about taste; taste information written in red, with a font size of 22–24 pt; manufacturer's information; expiration information; information about product superiority, written with font size 18–20 pt, and in black. An image of the technical specifications is displayed in Figure 5.

Figure 5 depicts the technical specifications based on the Robustness component. In this packaging, the visual elements significantly different from those of other packaging designs are the shape, the logo dominant color, and the composition of supporting information on the package.

Handy & Green. Based on Table 5, the packaging design specifications that represent the Handy & Green component are dimensions of (17–21) × (10–12) × (6–9) cm; standing pouch shape; red as the dominant color; black logo/label, central position of logo/label; Kraft paper material; rectangular label/logo, with dimensions of 10 × 10 cm, a font size of 95–100 pt, font color as green, tagline present; tagline written in white, with font size 16–18 pt; information of circulation permit; glue cover; representative image; information of product taste, written in brown; flavor information written with a font size of 22–24 pt; no manufacturer's information. An image depicting the technical specifications is displayed in Figure 6.

Lightness. Based on Table 5, the packaging design specifications that represent the Lightness component are dimensions of (17–21) × (16–18) × (6–9) cm; standing pouch shape; blue as the dominant color; blue logo/label; centralized logo/label; plastic material; rectangular label/logo, with dimensions of 5 × 5 cm, 75–85 pt font size, blue text color, and with a tagline; tagline with 16–18 pt font size, brown color; information of circulation permit; information of food composition; the presence of a handle; heat-sealed cover; the use of persuasive image; no information about product "taste"; manufacturer's information on the package; information about product's excellence on the package, written in black, with a font size of 18–20 pt. An image depicting the technical specifications is displayed in Figure 7.

Figure 7 illustrates the technical specifications based on the Lightness component. In this packaging, the distinctive elements significantly different from those of other packaging designs are a standing pouch shape, blue as the dominant packaging and logo colors, and the composition of supporting information on the package.

Confirmation of the new design. The confirmation of the new design was conducted to identify whether the new package design results in a significant increase in valuation compared with the previous design. The confirmation assessment (significance tests) for the new design involved the respondents who also participated in the previous assessment. Seven respondents (30% of the total initial respondents) were asked to assess the four new designs using the same Kansei word form in the previous assessment.

Figure 6. Image Depicting Technical Specifications based on the Handy & Green Component

Figure 7. Image Depicting Technical Specifications based on the Lightness Component

Table 6. Coefficient Value of Each Category

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Attractiveness–Attractiveness 2	-.80250	.64479	.32240	-1.82851	.22351	-2.489	3	.089
Pair 2	Robustness–Robustness2	-.01500	.39820	.19910	-.64863	.61863	-.075	3	.945
Pair 3	Handy Green–Handy Green 2	-.60250	.62740	.31370	-1.60083	.39583	-1.921	3	.151
Pair 4	Lightness–Lightness 2	-/22500	.79601	.39801	-1.49163	1.04163	-.565	3	.611

The weighted Kansei words were then assigned into a group the same as that produced during the PCA. Then the values of the component couples were compared, and the significance between the pair of components was analyzed.

Table 6 presents the P-value (significance) of each pair of tested components. Attractiveness-Attractiveness2 pair had a value of 0.089, which means there is a significant change, because the parameter value is significant at $P > 0.05$. Other couples also had P-values greater than 0.05. The values of Robustness-Robustness2, HandyGreen-HandyGreen2, and Lightness-Lightness2 pairs were respectively 0.945, 0.151, and 0.611. From the significance test of the final results above, it can be concluded that the new proposed design for SME product packaging had significantly higher valuation based on the affective aspects of consumers.

4. Conclusion

Kansei engineering is a method of emotion-based product development to meet the challenges of design innovation with a focus on satisfying the affective aspects of the consumer. The resulting design of Kansei engineering creates an emotional attachment between the product and the consumer that increases the product attractiveness. Such design was successfully carried out in this study, considering SME products packaging. The proposed new design contributes to consumers' interest in the product.

There are four attributes (components) that represent consumers' affective aspects of a product packaging design: Attractiveness, Robustness, Handy & Green, and Lightness. Four new packaging designs were obtained in this research. The new packaging design resulted in a significant increase in the values of these attributes (components) compared with previous designs.

References

[1] Data Biro Pusat Statistik, 2001.
[2] Data UKM Center Depok, 2013.
[3] C. Barnes, T. Childs, B. Henson, S. Emerald Group Publishing Limited, 2008, p. 1754.
[4] M. Nagamachi, A. Lokman, Innovation of Kansei Engineering, Ohio: CRC Press Taylor & Francis Group, 2003.
[5] C. Yang, Elsevier: Comput. Ind. Eng. 60 (2011) 760.A.
[6] H. Yuexiang, C. Chun, K. Li Pheng, Elsevier: Int. J. Ind. Ergon. 42 (2012) 416.
[7] K. Yuji, S. Hisao, J. Modell. Manag. 4/1 (2009) 19.
[8] H. Ming-Shyan, T. Hung-Cheng, H. Tzu-Hua, Int. J. Ind. Ergon. 41 (2010) 72.
[9] M, Nagamachi, M, Tachikawa, N, Imanishi, T, Ishizawa, S. Yano, Hiroshima International University, Tsumura Life Science Co., Ltd., 1997.
[10] O. Ricardo, M. Hirata, I. Nagamachi, Shigekaszu, Hiroshima International University, 2001.
[11] W. Wassanai, R. Tanitta, Environ. Nat. Resour. J. 10/2 (2012) 1.
[12] A. Lokman, Malaysia, Universiti Teknologi MARA (UiTM), 2010.
[13] M. Yukihiro, M. Nagamachi, Elsevier: Int. J. Ind. Ergon. 19 (1997) 81.