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Designing food packaging of bitter melon chips using Kano and quality function deployment: case study in KRIPIK Pare Pak IPHE

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6
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Abstract

16
As the economic in Indonesia growing each and every year, Small Medium Enterprises (SMEs) become one of the cornerstones of economic development in Indonesia. Yogyakarta, known as one of the biggest provinces in Indonesia, has many kinds of SMEs in order to foster its economic, by not relying solely in its tourism. One of the promising SMEs in Yogyakarta, is Kripik Pare Pak Iphe located in Bantul, Yogyakarta. Specializing in bitter melon chips and cassava chips, this SMEs sadly has not fully optimizing their business, take example their food packaging, that only use regular plastic wrapper to pack the chips. Using both Kano and QFD, authors aim to redesign the current food packaging by adding several exciting or attractive elements. The result of this research is a brand-new food packaging that could attract more customers and also giving more attractive feels to the them.

Keywords: Small medium enterprises (SMEs), Kano, Quality function deployment (QFD), Food packaging

7
1. Introduction

Small and Medium Enterprises (SMEs), is the backbone of economic growth and development in Indonesia, even in South East Asia [1]. Yogyakarta, as one of the biggest province in Indonesia, is also getting benefit of the SMEs growth by pushing its economics. In 2018, there are at least 259.581 SMEs, spread across Yogya, this number is increasing by 2 % compared to the previous year [2], thus, helping the economic condition of Yogyakarta's people that mostly rely on creative aspect and tourism aspect. SMEs in Yogyakarta also played an important role by decreasing the numbers of unemployment in Yogyakarta, Central Bureau of Statistic (BPS) of Yogyakarta, stated that since 2017 to 2019 there are at least 150.000 male workers and 266.000 female workers employed, by doing so, SMEs helping the regional government reducing the unemployment rate, especially in Yogyakarta [3]. Furthermore, food and beverages SMEs in Yogyakarta hold quite a number, approximately 18%, while the biggest SMEs categories goes to retailers followed by small industrial business [4].

Unfortunately, even though the numbers of the SMEs are flourishing, especially in the F&B business, they fall short in quality especially in their packaging aspect [5]. Most of the SMEs, are neglecting the quality of the product, some of the main reason of this cases are inept human resources and even the low budget for production [6].

This paper mainly discuss about the packaging design in one of SMEs, named, Kripik Pare Pak Iphe. Kripik Pare Pak Iphe, is one of the promising SMEs in Yogyakarta Province, located in Bantul Regency that mainly selling two kind of chips : Cassava and bitter melon. The bitter melon, become this SME main product, over it increasing sales number in several months. Despite the rise of their both chips sales, this SME still not having a proper food packaging, that actually could help to promote the business also, increasing the brand awareness. The research only focusing on creating a new packaging design for the bitter melon chips because of it higher sales compared to the cassava one.

2. Materials and methods

2.1 Defining Kano attribute

Kano is one of the product design methods that usually used in order to find the needs of the customers, it also can be used to categorized and identifies customer's satisfaction whether it's a product or even service [7]. The tool was founded by Noriaki Kano in 1984, and it could help to recognize and differentiate what the product that should be produce according to the customer's requirement [8]. There are at least 5 attributes that could affect customer's satisfaction, namely: Must Be, One-Dimensional, Attractive, Indifferent, Questionable and Reverse [9]. The first step in this research, is defining the attribute of the demanded food packaging. In order to get the attributes the authors want, it is imperative to know what and how does the current product that being shown in Figure 1 shown below.



Figure 1 Current product packaging

Figure 1 shows the current state of the product package. The packaging itself, does not look appetizing and attractive for the customers, the bitter-melon chips package, is just using a regular plastic wrap, and not even have any logos or whatsoever that could represent the SME.

Based on the current product package, authors then using Kano Model in order to create a better package for the chips. The first step in this research, is by creating several attributes for the newly make packaging. Questionnaire is being used in order to get the proper attributes, there are 64 respondents filling the questionnaire ranging 21 years old up to 51 years old. The first Kano questionnaire that will produce the proper attributes for the designated package, will be used as a Need Statement in the following method, namely Quality Function Deployment that will be explained later on in this part of the text.

2.2 Quality function deployment (QFD)

Quality Function Deployment (QFD) is one of the most popular and also mostly used tools in product design, it can be easily described as a tool in product development, starting from understanding the qualities demanded by the customers up to establishing quality planning and determining the design quality [10]. The tool itself is found in 1972 by Yuji Akao and it was first used in Mitsubishi company in Japan. QFD basically revolve around the needs of the customer interpreted by the developer, and finding the suitable technical requirements at the end of the developing process [11]. This process, in order to fulfill the requirement demanded by the customers, is worked based on the matrix framework called the "House of Quality" (HoQ) which is used to intertwine what the customer needs, managing the product requirement, creating the goals of the target design and ended up evaluating the competitiveness of the soon be made product [12]. In this research, QFD is being used to translate the captured attribute of the Kano questionnaire to find what the customer needs, in creating a newly package of the bitter melon chips. The Final design is derived from the final specification in the final step of the QFD process. Both Kano and QFD, could help in the product development process, as both method focusing on the quality of the product demanded by customers. One of the example in integrating both method in product design and service, is determining the attributes and the customer needs in a healthy food, in this case is the black bean based food. Using the questionnaire to find out what the attributes, it is found that there are several attributes such as "natural ingredients", "product shows the effectiveness", "Product is certified", "Indication of intake amount", "safety test conducted", "reasonable price", "convenient of purchase" and "good after sale services", using those attributes, it could be used to develop a new healthy food product [13]. Another example of the integration both method is the improvement of service in healthy fast-food restaurant. In this research, it is found that there are 14 attributes, and it stressed out that fast-food restaurant must have their distinctive features, because of this business is easily to be copied, so quality become the main feature in fast food restaurant business [14].

3. Results

The first part of the research, is finding what attributes is needed in order to create a new packaging design for the bitter melon chips. 64 respondents are chosen randomly in this research, with different age range, starting from 21 years old as the youngest respondent up to 51 years old as the oldest and it is shown in Table 1 below

Table 1 Respondents age grouping

Age	Numbers of Respondents	Percentage
<21	0	0%
21-26	16	25%
27-32	25	39%
33-38	11	17%
39-44	8	13%
45-50	3	5%
51-56	1	2%
57-62	0	0%
Total	64	100%

The age group in the questionnaire, is subjectively chosen by authors, and it is assumed that respondents are mature enough to choose their own preference and attributes given in the Kano questionnaire. Based on the questionnaire, result can be found, and there are 9 attributes that could be used in Kano modeling process, and it is shown in Table 2 below.

Table 2 Attributes of Kano

No	Variable	Attribute	Attributive Questions
1	Safety Factors of Package	Protecting and Covering the food package	The package should have a plastic wrap in order to easily open-and-close the food lids The Food package materials should be safe from any dangerous chemical substance
2	Economic Factors	Using a efficient Production Materials	The package should have a unique and distinguishable shape and form, so it could be easy to be carried The package should be available in different size and shape, furthermore, it should have different design The package should be using a food friendly material based on standards
3	Distributing Factors	Package should have a proper information	Package should contain a proper information such as the price of the product and the net weight of the product
4	Communication Factors	Package should have its own identity of its product	Giving extra design on the package to differentiate from other product Should be giving the customer's service number on the package
5	Ergonomic Factors	The package is comfortable when being used	Putting ingredients information Putting expired date
6	Aesthetic Factors	Having an aesthetic feels	Putting the benefit of the bitter melon chips using and giving an appropriate color in the package
7	Identity Factors	The packaging has a distinguished design	The package inserting the picture of the bitter melon chips as an identifier
8	Promoting Factors	Has a various kind of choice and promoting in social media	Promoting different kinds of flavor Using Instagram as a tool of promotion
9	Environmental Factor	The package can be recycled	The package can be recycled

The following step of the research is conducting both validity and reliability test for the attributes. The test is meant to find which attributes that are not both valid and reliable, in order to create a new packaging design for the chips. The test results are shown in both Table 3 and 4 below.

Table 3 Validity test

Question number	Pearson test result	Validity
P1	444	Valid
P2	514	Valid
P3	318	Valid
P4	515	Valid
P5	407	Valid
P6	620	Valid
P7	432	Valid
P8	423	Valid
P9	279	Valid
P10	483	Valid
P11	487	Valid
P12	328	Valid
P13	556	Valid
P14	522	Valid
P15	447	Valid
P16	423	Valid

Table 4 Reliability test

Reliability statistics		
Cronbach's alpha	N of items	
808	16	

Based on the data shown in both Table 3 and 4, it is known that all of the attributes are valid, after being tested with the validity test, and all of the attributes are reliable enough, thus, it can be proceed further, by checking all of the current attributes and matching it with Kano criteria, that shown in Table 5 below

Table 5 Tabulation of needs

Attributes		A	M	O	R	Q	I	Total	Grade
		1	2	3	4	5	6		
Question numbers	1	16	0	0	0	0	48	64	I
	2	22	0	0	0	0	42	64	M
	3	30	2	1	0	0	31	64	M
	4	23	1	1	0	0	39	64	M
	5	33	0	0	0	0	31	64	I
	6	23	0	0	0	0	41	64	O
	7	26	0	2	0	0	36	64	M
	8	23	1	0	0	0	40	64	M
	9	24	2	0	0	0	38	64	M
	10	25	1	4	1	0	33	64	M
	11	17	3	0	1	0	43	64	O
	12	15	1	1	2	1	44	64	O
	13	35	1	2	0	0	26	64	M
	14	15	2	1	1	0	45	64	O
	15	16	1	0	6	0	41	64	O
	16	36	0	0	2	2	24	64	I

Table 5 shown the total calculation of the Kano attributes. Based on 64 respondents that filled up the questionnaire, authors could put and grouping several questions in the questionnaire to the appropriate Kano criteria. Question numbers 2,3,4,7,8,9,10 and 13 goes to Must-be criteria, and it is imperative to be available in the upcoming design, question number 1,5 and 16 goes to Indifferent criteria in Kano, while question number 6,11,12,14 and 15 are One-dimensional Criteria. Using the current tabulation in Table 5, the attributes will be plotted in scatter diagram, in order to find which attribute play an important role in packaging design. In order to know, which attribute should be plotted in the scatter diagram, authors need to know both the satisfaction and dissatisfaction result, by calculating all the Kano attribute, shown in Table 6 below.

Table 6 Satisfaction and dissatisfaction index

Attributes	A										Satisfaction			Dissatisfaction		
	1	2	3	4	5	6	Total	Grade	A+O	A+O+M+I	Satisfaction Result	O+M	A+O+M+I	Dissatisfaction Result	O+M	A+O+M+I
Question Numbers	1	16	0	0	0	0	48	E	16	64	0.25	0	64	0	0	64
	2	22	0	0	0	0	42	M	22	64	0.34	0	64	0	0	64
	3	30	2	1	0	0	31	M	31	64	0.48	3	64	0.04	0	64
	4	23	1	1	0	0	39	M	24	64	0.37	2	64	0.03	0	64
	5	33	0	0	0	0	31	I	33	64	0.51	0	64	0	0	64
	6	23	0	0	0	0	41	O	23	64	0.35	0	64	0	0	64
	7	26	0	2	0	0	36	M	28	64	0.43	2	64	0.03	0	64
	8	23	1	0	0	0	40	M	23	64	0.35	1	64	0.01	0	64
	9	24	2	0	0	0	38	M	24	64	0.37	2	64	0.03	0	64
	10	25	1	4	1	0	33	M	29	63	0.46	5	63	0.07	0	63
	11	17	3	0	1	0	43	O	17	63	0.26	3	63	0.04	0	63
	12	15	1	1	2	1	44	O	16	61	0.26	2	61	0.03	0	61
	13	35	1	2	0	0	26	M	37	64	0.58	3	64	0.04	0	64
	14	15	2	1	1	0	45	O	16	63	0.25	3	63	0.04	0	63
	15	16	1	0	6	0	41	O	16	58	0.27	1	58	0.01	0	58
	16	36	0	0	2	2	24	I	36	60	0.6	0	60	0	0	60

Using the result in Table 6, it can be plotted then in this scattered diagram shown in Figure 2 below

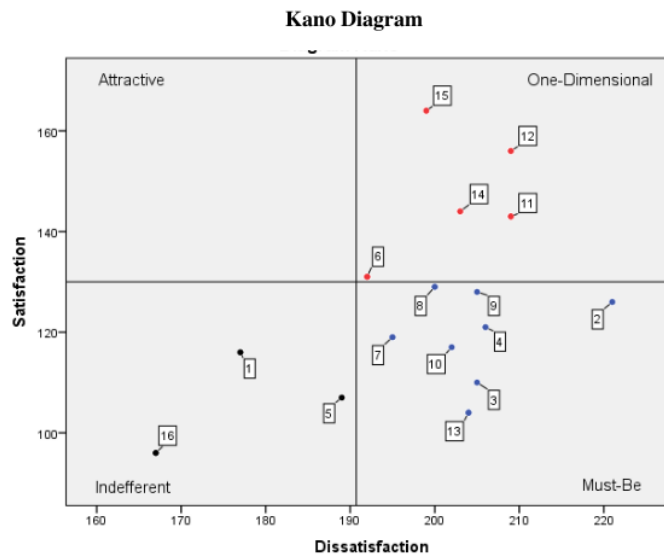


Figure 2 Kano diagram

The next step, is integrating the Kano Attribute, into the QFD model, the Voice of Customers (VoC) for the QFD model, is derived from the Kano attribute. From 16 Questions found in the previous steps, 3 questions are removed, because of their lack of contribution in finding what the customer's want, following the elimination process, the 9 attributes of Kano, were reduced into 8 because of the reduction. The 8 attributes of Kano, is plotted and become the customer needs, the following step in this research, is finding the technical responses in order to create the House of Quality (HoQ) that could be used in the next step of creating the new package. The HoQ of the designed package is shown in Figure 3. The HoQ acted as a connector between what the consumers wanted as in the customers needs with the technical responses, in other word, it translating the qualitative aspect in customers need into quantitative aspect as it is shown in the technical responses. The developer also could understand, which aspect should get more attention in order to satisfy what the customers want by seeing the ranking for each and every technical response. Based on the result found in HoQ, in Figure 3, we can proceed to the next step in creating the new design of the bitter melon chips. The next step, is rounding up all the result in HoQ, and creating the Final Specification of the new design. Result taken from the HoQ, can be inferred into the new design by rounding them up in Final Specification. The Final Specification also acted as a guidance for the developer to create the designated design, before validating it to the respondent and creating the final design. The Final Specification of the new design, is shown in table 7 below

Table 7 Final specifications

No	Technical responses	Metric	Final specification
1	Having a Distinctive Feature	Shape	Rectangle/Triangle
2	Using a proper material and substance	Gram	Composition
3	Having a Simple Design	Cm	20 x 13 x 8
4	Providing the Packaging Size while used	Cm	20 x 13 x 8
5	Advertising method	Internet	E-commerce
6	Simple Labeling Product	List	Listed
7	Reasonable Price	Rp	10.000,-
8	Waterproof,air sealed tight and safe from any dangerous substance	List	Listed
9	Provide the weight of the package	Gram	100
10	Providing proper and clear information	List	Listed

Based on the result in Table 7, we can find the designated design that the customers demanded, and it shown in Figure 4 below

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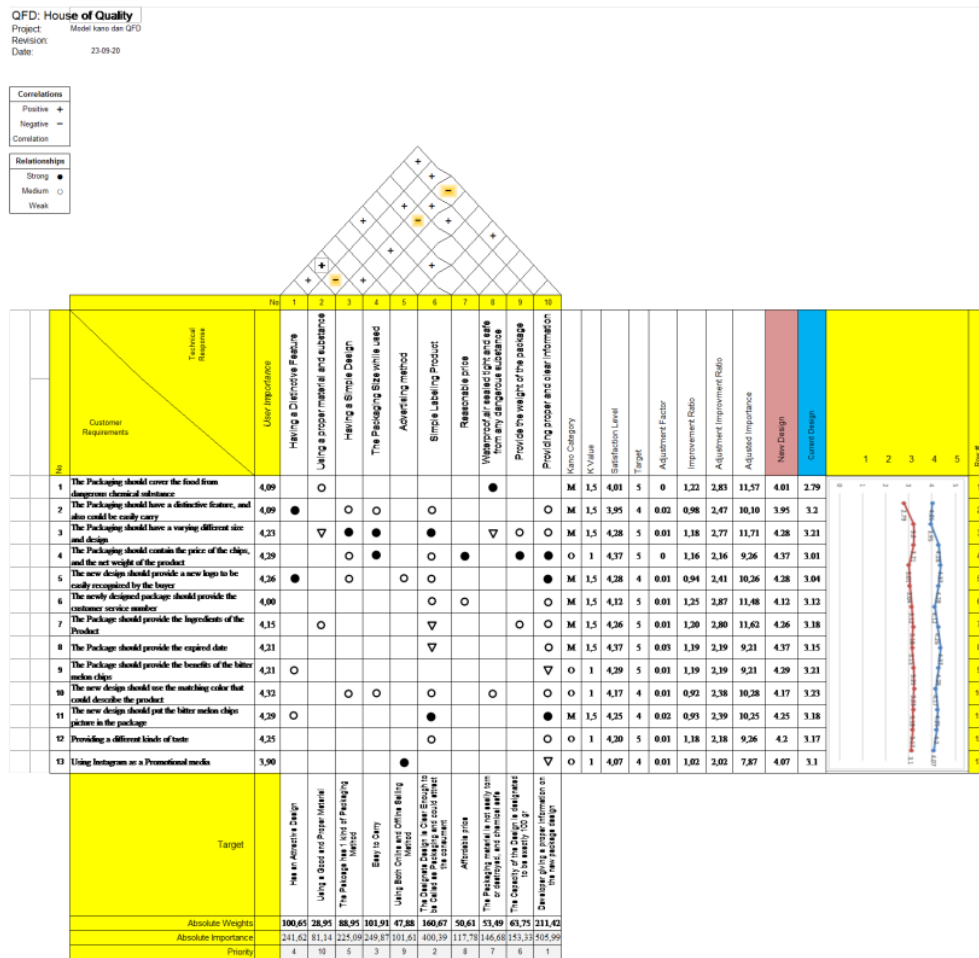


Figure 3 House of quality



Figure 4 Final design of the package

The final design give a distinctive features compared to the old packaging design, the most prominent feature in this new package is the shape of the package, compared to the old design, the new one looks more promising as a food package. Several information are also provide in the new design such as the benefits of the bitter melon chips, the ingredients of the product, and even the information regarding the SME, Kripik Pare Pak Iphe. The final specification also putting the bitter melon chips photo's in the cover of the package, thus helping the upcoming customers to recognize the product and helping the SME to branding their most favoring item.

5. Conclusions

Both Kano and QFD could be merged as a method in finding a better service or design, in this paper, Kano and QFD is being used to create a new package for the bitter melon chips. Kano model is being used to find the proper attributes needed in order to recreating the current design, and it is found there are 9 attributes. The attributes is then translated and carried over in the next step in QFD, in order to find what the customers need for the new design. The translated Kano model then being paired with the technical responses and creating the House of Quality (HoQ), based on this, authors could infer what the final specification for the new design, thus recreating the new design. The most prominent feature of the new design is the bitter melon chips picture upfront and several important information in the back of the package that could make customers buying the product more by seeing the newly make design

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