CONSUMER PREFERENCE ANALYSIS OF SNACK USING CONJOINT ANALYSIS METHOD (CASE STUDY : TELUR GABUS)

IOP Conf. Series: Materials Science and Engineering **852** (2020) 012120 doi:10.1088/1757-899X/852/1/012120

CONSUMER PREFERENCE ANALYSIS OF SNACK USING CONJOINT ANALYSIS METHOD (CASE STUDY : TELUR GABUS)

[1*]Lithrone Laricha Salomon*, [1]Wilson Kosasih, [1]Carla O. Doaly, [1]Cindy
[1] Industrial Engineering Department, Faculty of Engineering
Universitas Tarumanagara
* lithrones@untar.ac.id

Abstract. *Recently, the production of snacks continues to experience developments ranging from types, variants of taste, basic ingredients, and appearance. The aim of this research is to develop snack products in an effort to increase market share of the product itself. The example of the product for this research commonly known as Telur Gabus. Conjoint analysis and cluster analysis methods are used in processing the data obtained. Through the distribution of questionnaires, was obtained attributes that are considered in the development of this product that consist of texture, variant of taste, how to open the package, the weigh of contents, how to carry the packaging, and packaging design. The number of combination profiles is 16 combination profile level attributes and analyzed so that the combination of attributes with the highest utility value is chosen. The combination of attributes with the highest utility value are products that have a solid texture, have a salty taste, use zipper packaging, contents inside the packaging is 100-150 gr, carried by hand and have a packaging product design with a sticker covering half the packaging.*
Keywords: *Conjoint Analysis, Cluster Analysis, Telur Gabus, Product Development, Product Design*

1. Introduction

Currently snack products are one of the products that has significant development in Indonesia. Mondelez's study of 1,500 adult consumers in Indonesia and 500 housewives with children aged between 3-12 years showed that 72% of respondents consumed food three times a day. 85% of them claimed to have never missed a meal three times a day. As can be seen in Figure 1, the majority of Indonesian consumers who have a hobby of enjoying snacks are dominated by young people.

Seeing the high number of snack lovers [1], Snack producers continue to compete for a place in the hearts of consumers ranging from the appearance of packaging, form, taste and other innovations. This also applies to manufacturers of Telur Gabus. Telur gabus is a snack that has the characteristic of an oval shape with two more pointed ends, the texture is crisp like cork and has a savory or sweet taste. Telur gabus much preferred by people of various age groups and economics. Telur gabus has an additional ingredient of cheese which creates a more savory flavor than ordinary telur gabus. The producer of telur gabus continues to develop its products to increase consumer loyalty by meeting consumer needs and avoiding mistakes before the product is consumed by consumers. Based on this case, producers are required to understand consumer desires in order to increase the sales of telur gabus.

Conjoint analysis is a decrease in psychological components that can be measured in terms of utility. In understanding consumer decisions, there are two basic objectives of conjoint analysis, namely determining the contribution of attributes and their levels in determining consumer needs and forming a valid model of consumer ratings making it possible to predict consumer acceptance of a combination of attributes [2]. The main purpose of conjoint analysis is to find out how consumers are willing to sacrifice attributes and the level of an attribute against other attributes.

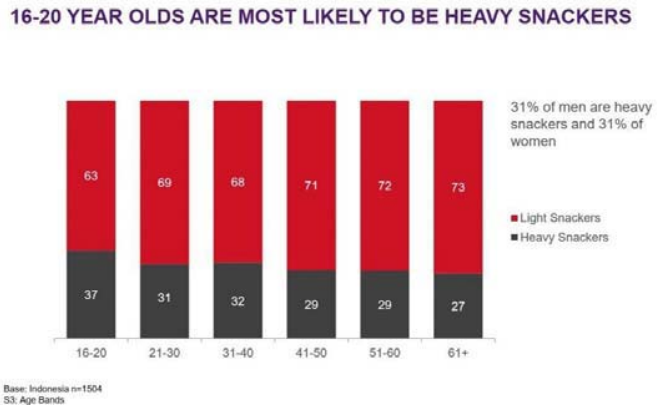

Figure 1. Level of Consumption of Snacks in Indonesia
(Source: www.mondelezinternational.com)

Attributes that might be considered in this study were obtained through a questionnaire with random sampling including the number of contents, flavor variants, form contents, form of packaging, packaging material, how to open packaging, how to bring packaging, packaging design, and so forth. If the desired attributes of consumers have been met, then product demand will also increase [3]. In this study, cluster analysis is carried out to facilitate the determination of market segmentation, so that several groups have the same attribute consideration.

2. Literature Review

2.1. Consumer Preferences

Consumer preference is the choice of whether or not someone likes the product (goods or services) consumed [4]. Consumer preferences indicate consumer preferences from a variety of product choices available. By analyzing consumer preferences, producers can find out what consumers like and dislike as well as determine the order of importance of a product attribute or the product itself. From this preference analysis we get the order of importance of product characteristics.

2.2. Conjoint Analysis

Conjoint analysis was developed from the fields of psychology and mathematics psychometry through the early work of Luce and Tukey in 1964 [5,6] introduced by Paul Green. Conjoint analysis is a decrease in psychological components that can be measured in terms of utility. The main purpose of conjoint analysis is to find out how consumers are willing to sacrifice attributes and the level of an attribute against other attributes.

Utility, which is the conceptual basis for measuring value in conjoint analysis, is an assessment of subjective preferences that are unique to each individual [7]. The results of conjoint analysis can be used to provide estimates of the utility of each level in each attribute, determine the total utility of each stimulus so that it can be compared with other stimuli to predict consumer choices. Basically, in conjoint analysis we want to measure the preferences of consumers. Preference is indirectly related to consumers' perceptions of the product that is the object of research, which in conjoint analysis is represented in the form of product

attributes. There are three presentation methods used when conducting conjoint analysis research as shown in Figure 2, namely:

1. *Full Profile Method*
   Full Profile Method is a method that has the ability to reduce the number of comparisons through fractional factorial designs. In this method, each combination is explained separately by using a combination card. This method is recommended if the number of factors is less than or equal to 6 factors.
2. *Pairwise Combination Method*
   This method involves comparing two combinations by using a rating scale to show the strength of preference for one combination over another. The distinguishing characteristic is the combination does not contain all the attributes.
3. *Trade-Off Method*
   The trade-off method compares two attributes at one time by comparing all combinations of levels. This method also has a limitation that is not being able to use fractional factorial designs to reduce the number of comparisons needed.

2.3. Cluster Analysis

Cluster Analysis is a technique used to classify objects or cases into relatively homogeneous groups, objects in each cluster tend to have similarities with each other and differ from objects in other clusters [8]. The characteristic of cluster are consist of:

1. Internal Homogenity (*within cluster*) namely the similarity between members in one cluster.
2. Eksternal Homogenity (*between cluster*) namely the difference between one cluster with another cluster.

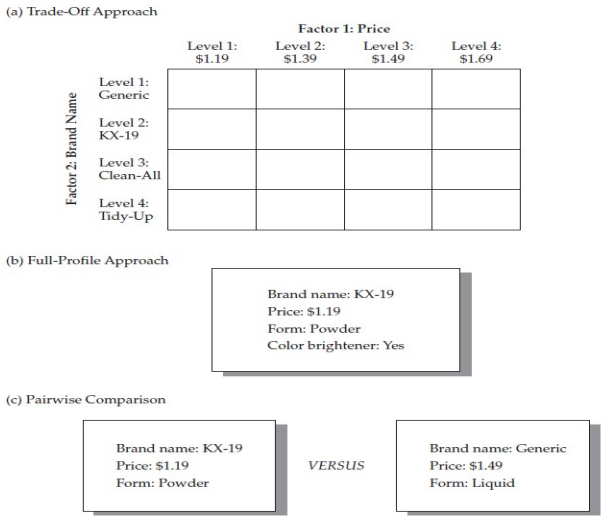

Figure 2. Stimuli Presentation From Conjoint Method
(Source: Hair, 2014)

2.4. Hierachy Method

The hierarchy clustering method is used to classify observations in a structured manner based on similarity in nature. There are two kinds of ways to get groups using the hierarchical grouping method, which is by combining (agglomerative) and separating (divisive) groups [10].

There are five agglomerative methods in cluster formation, namely:

1. *Single Linkage*, this procedure is based on the smallest distance. If two objects are separated by a short distance, the two objects will be combined into one cluster and so on.
2. *Complete Linkage*, in contrast to Single Linkage this procedure is grouped based on the farthest distance.
3. *Average Linkage*, this procedure is almost the same as Single Linkage or Complete Linkage, but the criteria used are the average distance of all individuals in a cluster with the distance of all individuals in another cluster.
4. *Ward's Method*, the distance between two clusters in this method is based on the total sum of square two clusters in each variable.
5. *Centroid Method*, the distance between two clusters in this method is based on the centroid distance of the two clusters in question.

2.5. Non-Hierarchy Method

Non-Hierarchy Method Clustering (*K-Means Method*) starting with determining the value of k (number of groups, and determining the centroid in each group), the second step is to calculate the distance between each object with each centroid, then proceed to the third step by recalculating the centroid for the newly formed group, and the fourth step repeats the second step until there is no more object transfer between groups. After the number of clusters is determined, the cluster process is carried out without following the hierarchical process. K-means Method aims to group data up to the distance of each data to the group centroid in one minimum group [10,11].

3. Research Methodology

This research began with the distribution of the initial questionnaire and the conjoin questionnaire. Based on the initial questionnaire distribution and discussion with the producers, the attributes and attribute levels obtained were considered by consumers in purchasing products. The next data is processed using conjoint analysis with the initial stage is the determination of attributes and attribute level followed by determining the presentation method where in this study the Full Profile method is used. Then the next step is determining the number of attribute level combination cards using the Fractional Factorial Design. Followed by compiling Likert scale-based conjoin analysis questionnaire. Then validate the goodness of fit. When the data is declared valid, it can be interpreted using Part Worth level attributes and the importance of the attributes and the results of the conjoin analysis will be applied to the cluster analysis.

The study continued with cluster analysis using the Ward's method and K-means method. Each cluster obtained was carried out by a conjoint analysis process. Conjoint analysis can be input to obtain the relative importance of each segment formed by cluster [11]. The results obtained in the form of *telur gabus* designs that have been adjusted to the desires of consumers. The product design will be realized in the form of physical results on this product.

4. Result And Discussion

Based on 261 respondents obtained from the initial questionnaire distribution, 9 respondents were not interested in trying *telur gabus* snack. Then the amount of respondent data used to determine the level of importance and attribute level is 252 respondents. 6 out of 10 attributes with the highest percentage, namely the variant of flavor is 33.7%, texture is 20%, how to open is 8.4%, lots of content is 8.3%, how to carry is 7.8% and packaging design

is 7.4%. Then determined the level of each attribute. The attribute that need to be consider in buying snacks can be seen in Table 1 and the Level of each attribute can be seen in Table 2

Table 1. Atributte Consideration

Attribute	Respondent	Percentage
Variant of flavor	273	33,7%
Texture	162	20,0%
How To Open	68	8,4%
Lots Of Content	67	8,3%
How To Carry	63	7,8%
Packaging Design	60	7,4%
Price	44	5,4%
Durability	34	4,2%
Shape of content	20	2,5%
Packaging Material	20	2,5%

Table 2. Level Of Atributte Consideration

Attribute	Attribute Information	Level Of Attribute
Variant of flavor	The added flavor creations are in the form of seasoning	Salty
		Spicy
Texture	Type Of Texture while consumed the product	Solid
		Hollow
How To Open	Packaging design to make it easier to open	Zipper
		Ripped
Lots Of Content	Net weight of product in one package	100 – 150 gr
		200 – 250 gr
How To Carry	Packaging design to make it easier to carry	Gripped
		Hole for hands
		Rope
Packaging Design	Attractive Display	Sticker Covered all the package
		Sticker Covered half the package
		Fully Printed

From the level of each attribute, a combination of each attribute level can be determined. The combined profile attribute level obtained amount to 144 profiles. The number of profile combinations was then reduced to 16 profiles using fractional factorial design. Data was collected using the full profile presentation method presented in the advanced questionnaire using a Likert rating scale (1-5). Scale 1 means strongly disagree with the profile and scale 5 means strongly agree with the profile. Measurement of goodness of fit can be seen from the correlation value of Pearson's R and Kendall's Tau. Pearson's R correlation is used to calculate data with rating scale with a requirement of R> 0.707, while Kendall's Tau is used to calculate data with ranking scale. In the follow-up questionnaire, 7 out of 100 respondents who had a Pearson correlation value below 0.707 were excluded. The results of each respondent's questionnaire data raises the value of part-worth utilities for each attribute level. At this stage the data calculated for the utility value were 93 respondent data. Part-worth utility values can be seen in Table 3.

Based on the overall utility value of part-worth, the combination of attribute levels of the product has a solid texture, has a salty taste, packaging using zipper, with lots of content 100-150 gr, carried by hand and has a sticker design covering half the packaging. With Pearson's R correlation value of 0.895 and significance value <0.05, it proves that there is a strong relationship between the utility of the model with the actual utility. A cluster analysis is performed using a hierarchical method that name the Ward's method. The number of clusters was obtained from the total number of respondents reduced by the number of respondents who experienced an elbow that is at 89 respondents, so we get 4 clusters. The next stage uses the K-Means method to improve the Ward's method results and shows the selection of respondents based on the group.

Based on the average cluster value for the product combination and respondent demographics, the four clusters can be interpreted as follows:

1. Cluster 1

   This cluster has the highest average value in product combination 11, while product 2 and product 5 have the lowest average. Consumers in this cluster consist of male and

female respondents ranging in age from 15 years and spending starting from Rp. 1,000,000 per month.

2. Cluster 2
   This cluster has the highest average value on product combination 7, while product 9 has the lowest average. Consumers in this cluster consist of male and female respondents with an age range below 40 years and spending from IDR 1,000,000 to IDR 15,000,000 per month.
3. Cluster 3
   This cluster has the highest average value on product combination 7, while product 3 has the lowest average. Consumers in this cluster consist of male and female respondents with an age range below 40 years and spending from IDR 1,000,000 to IDR 15,000,000 per month.
4. Cluster 4
   This cluster has the highest average value on product combination 5, while product 8 has the lowest average. Consumers in this cluster consist of male and female respondents with an age range starting from 15 years and spending from IDR 1,000,000 to IDR 15,000,000 per month.

Table 3. The Average of *Part-Worth Utilities*

Attribute	Level Of Attribute	Part – Worth Utilities
Variant of flavor	Salty	-,067
	Spicy	,067
Texture	Solid	,220
	Hollow	-,220
How To Open	Zipper	-,212
	Ripped	,212
Lots Of Content	100 – 150 gr	,044
	200 – 250 gr	-.044
How To Carry	Gripped	,194
	Hole for hands	,024
	Rope	-,218
Packaging Design	Sticker Covered all the package	,110
	Sticker Covered half the package	-,056
	Fully Printed	-,054
Konstanta		2,895

The F Test results show that there is a significant difference between the combination of products with 4 market groups because a p-value of <0.05 is obtained. Conjoint analysis processing for each cluster uses the same method as aggregate processing. The results of conjoint analysis in each cluster can be seen in Table 4. In table 4, each cluster has different preferences that can be seen in the highest relative importance of each cluster. Cluster 1 attaches importance to the texture attribute with a relative importance of 33.22%, Cluster 2 attaches importance to the method of carrying packaging with a relative importance of 25.58%, Cluster 3 attaches importance to the attribute of how to open the package with a relative importance of 30.81%, and Cluster 4 attaches importance how to carry attributes with relative importance of 38.12%.

Table 4. Conjoint Analysis Result In Every Cluster

Atribut	Level	Agregat		Cluster 1		Cluster 2		Cluster 3		Cluster 4	
		Part-Worth Utilities	Importance Values (%)	Part-Worth Utilities	Importance Values (%)	Part-Worth Utilities	Importance Values (%)	Part-Worth Utilities	Importance Values (%)	Part-Worth Utilities	Importance Values (%)
Texture	1	,220	22,57	,617	33,22	,085	15,71	,104	10,89	-,348	16,89
	2	-,220		-,617		-,085		-,104		,348	
Flavor	1	-,067	15,83	-,133	9,31	,147	22,92	,229	20,99	-,336	19,09
	2	,067		,133		-,147		-,229		,336	
How To Open	1	-,212	15,39	-,180	15,44	-,076	6,33	-,444	30,81	-,164	8,12
	2	,212		,180		,076		,444		,164	
Content	1	,044	6,45	,036	4,93	-,004	11,79	,076	8,18	,063	4,28
	2	-,044		-,036		,004		-,076		-,063	
How To Carry	1	,194	24,40	,335	20,82	,232	25,58	-,130	15,43	,179	38,12
	2	,024		-,349		-,036		,079		,726	
	3	-,218		,014		-,196		,051		-,905	
Design	1	,110	15,36	,281	16,29	,054	17,67	,046	13,70	-,123	13,50
	2	-,056		0,000		,027		-,127		-,159	
	3	-,054		-,281		-,080		,081		,282	

The results of the follow-up questionnaire showed that the flavor variants of interest by consumers were the taste of cheese, salted eggs, and roasted corn, while for the spicy variants the most popular was the flavor of balado. The packaging design for the 4 clusters is represented by two design concepts as shown in Figure 3, this is because the results of Table 4 show that each cluster has an attribute level equation. The combination of products that are consumers' preferences of each cluster can be seen in Table 5.

Gambar 3. Konsep Rancangan

Table 5. Consumer Preferences in each cluster

Attribute	Aggregate	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Texture	Solid	Solid	Solid	Solid	Hollow
Flavor	Salty	Salty	Spicy	Spicy	Salty
How to Open	Zipper	Zipper	Zipper	Zipper	Zipper
Content	100 – 150 gr	100 – 150 gr	200 – 250 gr	100 – 150 gr	100 – 150 gr
How to Carry	Gripped	Gripped	Gripped	Hole For Hand	Hole For Hand
Design	Sticker Covered Half The Package	Sticker Covered Half The Package	Sticker Covered Half The Package	Fully Printed	Fully Printed

5. Conclusion

From the initial questionnaire distribution obtained attributes that were considered to determine consumer preferences include 33.7% flavor variants, 20% texture, how to open 8.4%, the amount of contents 8.3%, how to carry 7.8% and packaging design 7 4%. The number of profile combinations were eliminated to 16 attribute level combination profiles and analyzed by conjoint analysis so that selected attribute combinations of products that were dense textured, had a salty taste, packaged using zipper, with many contents of 100-150 gr, were carried by hand and had a sticker design covering half the packaging. Based on segmentation, product preferences are divided into 4 clusters which consist of cluster 1 that emphasizes texture attributes, cluster 2 places attributes on how to carry packaging, cluster 3 places attributes on how to open packages, and cluster 4 places attributes on how to carry.

6. References

[1] Bella Annisa, (2017, 18 Desember), Kebiasaan Konsumsi Camilan Konsumen Indonesia, diperoleh 3 Agustus 2018 dari http://marketeers.com/produsen-kenali-kebiasaan-konsumsi- camilan-konsumen-indonesia/
[2] Hair, J. F., et al., 2014, Multivariate Data Analysis, 7th Pearson new international edition, Harlow: Pearson.
[3] Kosasih, W., L. L. Salomon, and R. Hutomo., 2017, Using conjoint and cluster analysis in developing new product for micro, small and medium enterprises (SMEs) based on customer preferences (Case study: Lampung province's banana chips). In AIP Conference Proceedings (Vol. 1867, No. 1, p. 020051). AIP Publishing.
[4] Kotler, P., 1997, Manajemen Pemasaran Analisis, Perencanaan, Implementasi dan Kontrol. Jakarta: Prenhallindo.
[5] Luce, D.R., dan Tukey, J.W., 1964, Simultaneous Conjoint Measurement: A New Type Of Fundamental Measurement, Journal of mathematical psychology, Vol. 1, hal. 1-27.
[6] Irawati, D. Y., M. L. Singgih, and B. Syarudin., 2014, Integrasi Quality Function Deployment (QFD) dan Conjoint Analysis Untuk Mengetahui Preferensi Konsumen. Jurnal Optimasi Sistem Industri Vol. 13. No. 2: 618-640.
[7] Surjandari, I., 2010, Conjoint Analysis: Konsep dan Aplikasi. Jakarta: Penerbit Universitas Trisakti.
[8]Malhotra, N.K., & Birk, D.F., 2007, Marketing Research An Applied Approach. New Jersey: Prentice Hall, Inc. Publication.
[10] Mattjik, A.A., & Sumertajaya, I. M., 2011, Sidik Peubah Ganda dengan Menggunakan SAS. Bogor: IPB Press.
[11] Tohari, A., 2016, Analisis Cluster Psikografis Konsumen Kediri Town Square (Cluster Analysis Psychographic Consumers Kediri Town Square). Jurnal Matematika dan Pendidikan Matematika. Vol. 1. No. 2: 109-118.
[12] www.mondelezinternational.com (has been access on 30 Agustus 2019)