

Consumer Preference for Mocaf Packaging using Analytical Hierarchy Process (AHP)

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Abstract. Wheat flour consumption in Indonesia continues to increase, so the government must import wheat on a large scale. One of the ways to reduce wheat consumption is by using substitutes. Mocaf (modified cassava flour) is a kind of flour that derived from cassava plants (*Manihot esculenta*). This flour can be used as a substitute for wheat flour due to its similar characteristics. Even though it has high economic potential, mocaf has only been marketed locally. One of the reasons is the lack of quality packaging. The purpose of this study is to identify consumer preferences for mocaf packaging so that they can market the product not only locally but also nationally. In this study, AHP (Analytical Hierarchy Process) method with four alternatives (plastic stand up pouch combination, Aluminium foil stand up pouch combination, screen printing plastic pouch, and paper pouch combination) and three criteria (price, model, and durability) is used to determine consumer preferences for mocaf packaging. This research obtained the conclusion that the highest weight for criterion and alternative are price and the screen printing plastic pouch.

Keywords. mocaf, AHP, packaging, consumer preference

I. INTRODUCTION

Wheat flour consumption in Indonesia continues to increase because it is used for various needs (Damayanti et al., 2014; Riza et al., 2018; Rosmeri & Monica, 2013; Waryat & Handayani, 2014). Existing resources do not support this increasing need because Indonesia is not a wheat-producing country (Afifah & Ratnawati, 2017; Damayanti et al., 2014; Riza et al., 2018). Therefore, the Indonesian government has imported large quantities of wheat each year (Damayanti et al., 2014; Fadilah et al., 2016; Pradeksa & Darwanto, 2014; Waryat & Handayani, 2014; Yulifianti et al., 2018). Even in 2002, the number of wheat imports in Indonesia reached 4.3 million tons per year and became the fourth largest wheat importer in the

world (Pradeksa & Darwanto, 2014). One of the ways to reduce import dependence and make Indonesia a food self-sufficiency country is to use wheat flour substitutes. Many ingredients can be used, but the substitutes that have great potential to be developed in Indonesia is mocaf flour. It is because the amount of cassava production as mocaf flour material is very abundant and easily cultivated in Indonesia (Afifah & Ratnawati, 2017; Fadilah et al., 2016; Riza et al., 2018).

Mocaf is a product of cassava (*Manihot esculenta*) processed by modifying cassava cells through fermentation that involves microbes. It also has similar characteristics to wheat flour (Subagyo et al., 2011). Mocaf is the substitute for wheat flour that has a lot of advantages, including high fiber content and low gluten (Fadilah et al., 2016). It has also been used for various products such as noodles, cake, donuts, bread, pastries, cookies (Afifah & Ratnawati, 2017; Fadilah et al., 2016; Rosmeri & Monica, 2013; Yulifianti et al., 2018). Despite its high economic potential, mocaf flour has only been marketed locally. One of the reasons is the lack of quality packaging. The example of mocaf packaging on the market can be seen in Figure 1. The current packaging is only a transparent plastic with an incomplete information sticker label.

The packaging is an important marketing tool. Not only as a protector or wrapper to prevent damage or defects in the product, but the

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Figure 1 Mocaf Packaging on the market

packaging is also an attraction to increase consumer interest to buy because of its aesthetic value (Tjiptono & Fandy, 2007). According to Kotler and Keller (2009), packaging involves designing and producing container or cover for a product. By understanding the basic nature of packaging and related parties in the entire design process, several factors must be considered in designing a package (Susanti, 2002). They are security and protection, production, distribution, information, ergonomics, aesthetics, and product identity. In some studies, the packaging is known as a solution to improve quality and marketing (Izzhati et al., 2018; Mastrisiswadi et al., 2018). Producers require consumer opinion to decide the type of packaging to use.

There have been many studies on consumer preferences (Jatiningrum & Mastrisiswadi, 2017; Mastrisiswadi & Herianto, 2017), as well as packaging a product, including smoked fish packaging (Izzhati et al., 2018; Izzhati et al., 2017; Mastrisiswadi et al., 2018), Lomed salted fish packaging (Mardiana & Wardah, 2018), secondary chili block packaging (Sinaga et al., 2012), and packaging of the Torabika Sejodoh coffee cup (Siswanto et al., 2011). Various methods have been used to solve problems with consumer preferences. However, in this study, AHP (Analytical Hierarchy Process) method is used to determine the best packaging alternative for

mocaf products. It can be used to help decision-makers in selecting the best alternative or ranking a series of alternatives based on various criteria considered (Azimifard et al., 2018). The AHP method was developed by Thomas Saaty (1988), and it is useful for solving problems related to complex decision making and involving various criteria. This method begins by describing the problem in the form of a hierarchical structure that contains goals, criteria, and alternatives, then pairs in comparison at each level in the hierarchical structure (Hillerman et al., 2017).

II. RESEARCH METHOD

This research was conducted in several stages according to the stages of AHP by Saaty (1988), that is:

- a. Make a hierarchical structure. The hierarchical structure consists of general objectives, criteria, and alternatives.
- b. Data collection. Data collection was conducted on respondents who used to buy mocaf. The number of respondents used in this study was 30 respondents. Data collection is done by using a questionnaire comparison between criteria and alternatives.
- c. Make a pairwise comparison matrix. Pairwise comparison matrices are based on data obtained from respondents. This matrix describes the influence of each element on the criteria above it.
- d. Data normalization. The data obtained in the pairwise comparison matrix is then normalized. The way to normalize the data is by dividing the value of each element with the total value of each column
- e. Consistency test. A consistency test is conducted to determine whether the data has been produced is consistent or not. Consistent data has a CR value of < 0.1 . If this condition is not met, it is necessary to do data retrieval.
- f. Preferences calculation. Preference calculation is the last step to determine the weight of each criterion and alternative. The highest value of criterion and alternative will be used as input to the packaging of mocaf flour products.

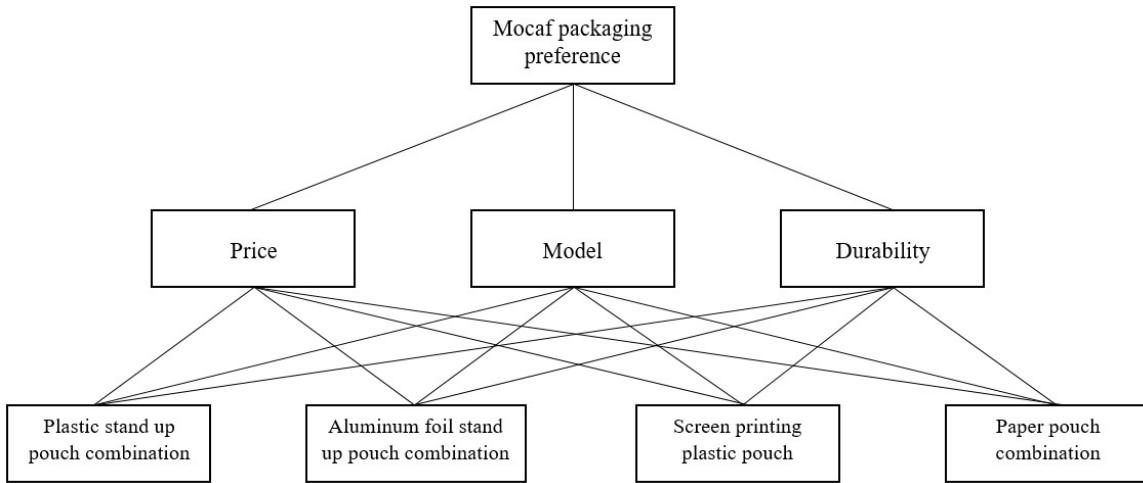


Figure 2 Alternative hierarchical structure of Mocaf packaging

III. RESULT AND DISCUSSION

Hierarchical Structure

The hierarchical structure used in the selection of mocaf packaging is shown in Figure 2. In Figure 2, there are 3 criteria in selecting mocaf packaging:

- Price is a total cost of packaging material on the market; it is charged by the producer to the consumer.
- Model is the form and design of packaging that leads to aesthetic factors offered to consumers.
- The durability of the packaging is how resistant the packaging to maintain the quality of the mocaf products.

Four packaging design alternatives are developed in this study. They are plastic stand up pouch combination (Figure 3 a), Aluminum foil stand up pouch combination (Figure 3 b), screen

printing plastic pouch (Figure 3 c), and paper pouch combination (Figure 3 d). All packaging design alternatives already contain complete information about the product, such as product name, manufacturer, production code, net product weight, composition, and expiration date.

Plastic stand up pouch combination packaging is made using plastic material withstanding vertical model. The thickness is about 120-140 microns. The top of the packaging is equipped with a zipper lock. The label containing product information is put on the front of the packaging. While stand up pouch Aluminum foil combination is made using Aluminum foil material with a window in front of the packaging. The packaging label is also affixed on the front. The third alternative is screen printing plastic pouch. It is made for a size of 1 Kg with a thickness of 0.8. The front and back of the

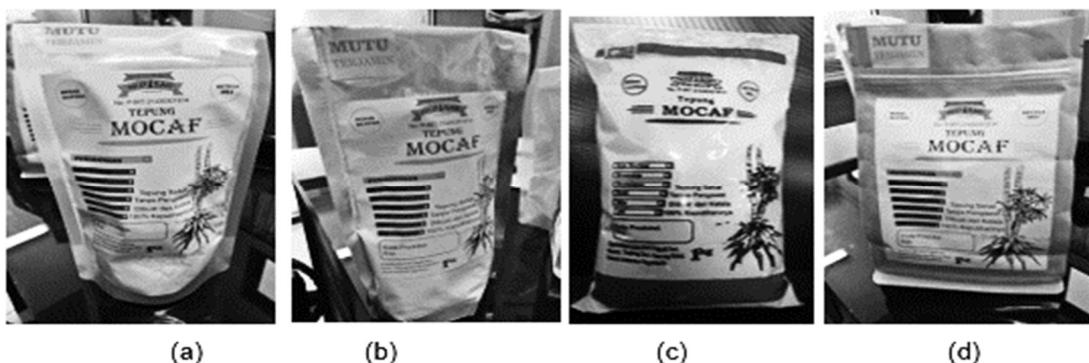


Figure 3. Alternatives of mocaf packaging (a) Plastic stand up pouch combination (b) Aluminum foil stand up pouch combination, (c) Screen printing plastic pouch, (d) Paper pouch combination

Table 1. Pairwise comparison matrix for criteria

Criteria	Price	Model	Durability
Price	1.00	4.15	1.21
Model	0.24	1.00	0.75
Durability	0.83	1.33	1.00

Table 2. Alternative Pairwise Comparison Matrix

		Price			
Alternatives		Plastic stand up pouch combination	Aluminum foil stand up pouch combination	Paper pouch combination	Screen printing plastic pouch
Plastic stand up pouch combination		1	1.88	3.7	0.14
Aluminum foil stand up pouch combination		0.532	1	1.95	0.17
Paper pouch combination		0.270	0.513	1	0.16
Screen printing plastic pouch		7.143	5.882	6.25	1
		Model			
Alternatives		Plastic stand up pouch combination	Aluminum foil stand up pouch combination	Paper pouch combination	Screen printing plastic pouch
Plastic stand up pouch combination		1	0.77	0.33	2.25
Aluminum foil stand up pouch combination		1.299	1	0.72	1.87
Paper pouch combination		3.030	1.389	1	4.04
Screen printing plastic pouch		0.444	0.535	0.247	1
		Durability			
Alternatives		Plastic stand up pouch combination	Aluminum foil stand up pouch combination	Paper pouch combination	Screen printing plastic pouch
Plastic stand up pouch combination		1	0.93	0.73	3.19
Aluminum foil stand up pouch combination		1.0752	1	0.66	1.81
Paper pouch combination		1.3698	1.5151	1	3.77
Screen printing plastic pouch		0.3134	0.5524	0.2652	1

packaging contain information on two-color printed products that are blue and black. The last alternative is paper pouch combination. It is made using brown paper bags affixed with packaging labels that contain product information. The top of the packaging is equipped with a zipper-lock so that consumers feel easier to open and close the packaging. Paper pouch combination functions as secondary packaging, the product is still protected with clear plastic.

Data collection

Data collection was conducted by distributing questionnaires to respondents. The percentage of female respondents was 67%, and the male was

33%. Respondents used as research samples were mocaf consumers and potential consumers.

Pairwise comparison matrix

The results of the questionnaire from all respondents were added and calculated using a geometric mean (geomean). The geomean formulation is shown in (1).

$$GM = \sqrt[n]{a_1 x a_2 x a_3 \dots x a_n} \quad \dots(1)$$

Where: GM = geometric average

a_1 = value from respondent 1

a_2 = value from respondent 2

a_n = value from respondent n

The results of calculating using geomean can be seen in Table , while the results of the alternative pairwise comparison matrix of each criterion can be seen in Table .

Data normalization

According to the result of the pairwise comparison criteria matrix from the geomean calculation, the weight calculation was conducted for each criterion using the column normalization method. The weight calculation results for each criterion, as shown in Figure 4.

Weighting results of the criteria indicate that price has the greatest weight or become the most considered priority criterion by consumers in choosing alternative packaging. The weight of the price criterion is 51.1%. Packaging costs will be charged by the producer to the consumer, so the higher price of the packaging causes the higher price of the product on the market. The money was given by consumers to get a product and service is called price (Kotler & Armstrong, 2015). It is a very important factor in a purchase decision (Herrmann, Xia, Monroe, & Huber, 2007; Martinho, Pires, Portela, & Fonseca, 2015; Padel & Foster, 2005; Wickliffe & Pysarchik, 2001). In general, consumers certainly want an affordable product price.

The criterion with the second-largest weight is durability. It is equal to 31.4%. Packaging with good durability is not only capable of protecting but also maintaining product durability well. Consumers want a kind of packaging equipped with a protective function so that there is no risk of defective or a damaged product (Barnes et al., 2003; Bix et al., 2003; Simamora, 2007; Wambugu, 2014).

The last priority of criteria for consumers in the selection of alternative packaging is the model. It is equal to 17.5%. The results of this study are in line with the research of Martinho et al. (2015), where design is a factor that is not too important for consumers. The model relates to aesthetic or beautiful packaging design. For consumers, this criterion becomes less important because the product to be consumed is a functional product.

Normalization column methods are also used to calculate alternative local weights based on each criterion and alternative global weights, as shown in Figure 5 and Figure 6.

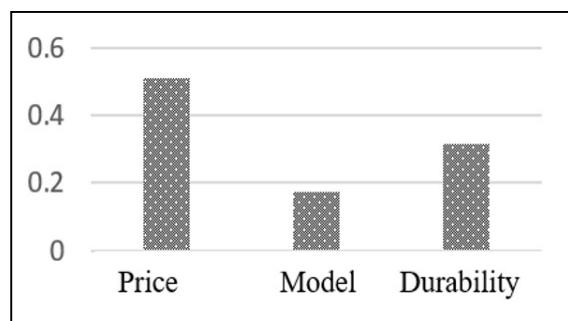


Figure 4 Weight of packaging criteria

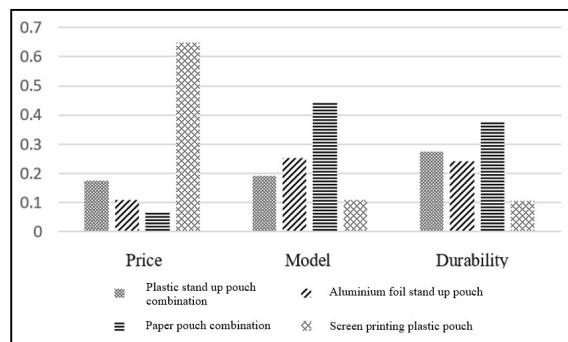


Figure 5 Local weight of alternative packaging based on criteria

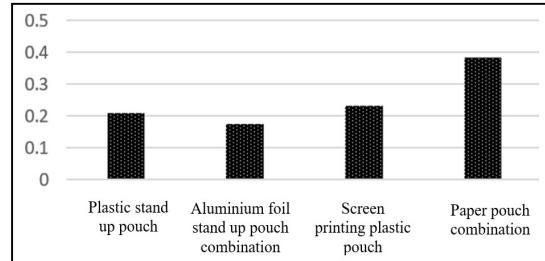


Figure 6 Global weight of alternative packaging

Consistency test

Calculation of Consistency Ratio (CR) was also carried out in each paired comparison matrix. CR calculation was conducted to ensure that the matrix does not contain many inconsistencies (Saaty, 1988). CR values for the criteria matrix, packaging alternatives based on price criterion, packaging alternatives based on a model criterion, and packaging alternatives based on the durability criterion are 0.087, 0.076, 0.022, and 0.013, respectively. A good model is a model with a CR value of less than 0.01 or 10% (Saaty, 1988). Based on the calculations performed, all CR values are below 0.01, so it is concluded that the model made is acceptable.

Preferences Calculation

According to the weighting results for each alternative, it was found that screen printing plastic pouch was the most popular packaging for consumers, with a weight of 38.4%. This is caused by screen printing plastic pouch is ranked first in consumer choice packaging based on price criterion. The price criterion has a major influence because of the greatest weight of 64.9%. Nevertheless, based on the other criteria, which are models and durability, screen printing plastic pouch has the least weight compared to other types of packaging alternatives. However, the analysis of the calculations showed that the price criterion is the first priority to consumers for packaging selection. The price of screen printing plastic packaging is quite affordable. It is cheaper than the other three types of packaging.

The second rank of alternative packaging, according to consumer choice, was the paper pouch combination with a weight of 23.1%. Based on the price criterion, the paper pouch combination occupies the lowest priority with a weight of 6.8%. This is caused by the prices for paper pouch combination are quite expensive compared to other packaging alternatives. However, based on the model and durability criteria, packaging with paper bag material is ranked first. Its weight is 44.4% and 37.6%, respectively. Consumers choose paper pouch combination because of its attractive and aesthetic packaging design. According to observation, there are not many flour products that use this kind of packaging in the market. However, based on the calculation analysis, it shows the model has a small weight (or not a priority) criteria considered by consumers in choosing packaging design. According to the criteria for packaging durability, paper pouch combination is also ranked first for consumers because they are considered to have the best packaging durability. This is due to the top of the package is equipped with a zipper lock. In addition, a paper pouch combination also has functioned as secondary packaging. Inside of the packaging is protected by clear plastic so that the product has better durability.

The third rank of alternative packaging chosen by consumers is a plastic stand up pouch combination, with a weight of 20.9%. According to price criterion, plastic stand up pouch combination

is the second priority of consumer choice because the price is quite affordable compared to paper pouch combination packaging and Aluminum foil stand up pouch combination. Based on model criterion, a plastic stand up pouch combination has a weight of 19.3% or the third rank chosen by consumers. While based on the criterion of durability, a plastic stand up pouch combination has a weight of 27.5% or the second rank chosen by consumers. This is due to the fact that plastic packaging material is thick enough so that it is considered to provide good protection for the product. Moreover, the package is equipped with a zipper-lock, which makes the mocaf not easily spilled when used by consumers.

The last priority for consumer choice packaging is Aluminum foil stand up pouch combination, with a weight of 17.6%. The price for this kind of packaging is also quite high compared to screen printing plastic pouch, and plastic stand up pouch combination. Nevertheless, it is more affordable when compared to paper pouch combination. Based on model criterion, Aluminum foil stand up pouch combination is ranked second after paper pouch combination, with a weight of 25.3%. Attractive design and packaging colors make consumers choose this packaging. However, the model criterion is not so important for consumers in packaging selection. This causes Aluminum foil to stand up pouch combination has the smallest global weight for packaging alternative.

IV. CONCLUSION

According to consumer preferences, the order of criteria priority considered in the selection of mocaf packaging is price, durability, and model. The weight of each criterion consecutively is 51.1%, 31.4%, and 17.5%. By considering all criteria, kilo screen printing plastic pouch is chosen to be the most desirable mocaf product packaging for consumers

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