Prioritized Attributes on Black Rice Product Development: Kano Model Application

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Abstract

Black rice is a functional food that contributes to its increasing of popular for consumption and the increasing consumer awareness of health. However, the quality of black rice products still needs to be improved to meet consumer needs. This research was conducted to determine how black rice consumers voice the attributes of black rice products circulating in the market and what priorities need to be made to develop black rice products. The research data was collected through a survey of 50 black rice consumers. The survey was conducted using a questionnaire prepared according to the Kano Model. Data analysis was carried out using the Kano Model, which was developed with the preparation of the House of Quality to determine the priorities that need to be carried out in developing black rice. The results show that the attributes of black rice are divided into two categories: attractive and indifferent. Attributes included in the attractive category are organic black rice, vacuum packaging, nutritional values , and cooking methods on the packaging. Other attributes fall into the indifferent category. Product development priorities focus on attributes that are in the attractive category. The priority for developing black rice products is planting with organic and certified methods, vacuum packaging, new packaging designs that include nutritional values , and cooking methods.

Keywords*: black rice, house of quality, kano model*

1. INTRODUCTION

Healthy food is becoming increasingly popular. The paradigm shift for food shifts people's lifestyles towards healthy food. Consumers no longer see food as a necessity for survival but interpret food as affecting their health in the future. This concept is known as the concept of functional food. Functional food is a term that was popularized in Japan in 1984 (Siro, et al., 2008). Functional food is food that contains nutrients that are beneficial to health. Some sources say that functional food is beneficial for physical health, while others say it is also beneficial for mental health (Schroeder, 2007; Siró et al., 2008). Since its introduction, functional foods have continued to develop. It is included in the functional food category, from local food to food with probiotics. One of them that can be found in Indonesia is black rice.

Black rice is rice with anthocyanin attached to the aleurone portion of the rice (Kristamtini, et al., 2014). Based on several studies, black rice contains antioxidants that can fight degenerative diseases such as cholesterol, heart attacks, and cancer (Suardi & Ridwan, 2009). Historically, black rice is rice that kings and nobles can only consume, so it is often called forbidden rice (Kushwaha, 2016). However, anyone can now obtain and consume black rice over time.

In Yogyakarta, black rice has been developed since 2006. Even though it has been running for 16 years, the popularity of black rice is less audible than the brown rice that was already known. Farmers still have the reluctance to grow black rice due to market uncertainty. The black rice market is still not well oriented compared to white rice. Farmers, as producers, do not yet know who and how the consumers of black rice are.

Based on previous research, black rice attributes are essential according to consumers. These attributes are the integrity of the grain, the density of color, and the cleanliness of the rice (Wuryandani, et al., 2018). At the retail level, black rice commodity players are pretty heterogeneous. They were starting from large companies, to the level of farmer groups. However, the two levels have a reasonably large gap in price, packaging, and the physical condition of black rice.

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This research was conducted to find out the voice of black rice consumers on the attributes of black rice products circulating in the market. The results of this study are expected to be input for farmers to produce black rice with attributes following consumer desires so that marketing becomes more manageable with the value of products that can compete with other black rice competitors.

2. MATERIAL AND METHODS

The research object is consumers who know about traditional and modern retail black rice products using an online questionnaire. There are several sections of the questionnaires arranged in Bahasa Indonesia. The first section is demographical information of the respondent that consists of age, gender, occupancy, monthly income, place of purchase, and black rice brand. The second section is the consumer's voice that includes questions about black rice attributes represented in the 5-Likert scale. In the second section, respondents should respond based on their preferences of the black rice attributes. The third section consists of questions about consumer satisfaction. The fourth part of the questionnaire is composed of questions about consumers' requirements. The last two sections of the questionnaires are composed of two question groups: positive and negative groups.

The online survey was carried out on 16-30 December 2018 in Yogyakarta involving black rice consumers. Data collection in this survey used a convenience sampling method combined with snowball sampling. It is distributed to respondents who have consumed black rice, and respondents can distribute them to other respondents they know. There were 50 respondents who joined the survey.

The data that has been collected is then evaluated for each question item according to Table 1. After that, the evaluation results are then tabulated according to the frequency of each category in the Kano Model. Kano Model is a valuable model for understanding the relationships between attributes and customer satisfaction and explaining human needs (Pizam & Sussmann, 1995). Kano's methodology could fulfill the promise of providing service designers with a method to establish the requirements most critical to customers and to cope with the dynamic nature of the highly competitive service market environment with emphasis on the non-linear relationship between customer satisfaction and customers' requirements fulfillment (Shahin & Zairi, 2009).

Table 1. Kano Model Evaluation Model

Customer requirements		**Dysfunctional**				
		1	2	3	4	5
		Like	Must-be	Neutral	Live with	Dislike
Functional	1. Like	Q	A	A	A	O
	2. Must-be	R	I	I	I	M
	3. Neutral	R	I	I	I	M
	4. Live with	R	I	I	I	M
	5. Dislike	R	R	R	R	Q

Customer Requirements are:

A : Attractive
M : Must-be
R : Reverse
O : One-dimensional
Q : Questionable result
I : Indifferent

The Kano Model questionnaire was made and consisted of questions categorized into positive and negative question groups. The questionnaire was tested for reliability and validity. The questionnaire results were tabulated into Microsoft Excel by translating the scale for each section. The data were processed using SPSS software version 22.0. The r-value of the results shows that all statements have an r value > 0.254. Therefore, all of these statements are declared valid.

In this study, reliability testing used Cronbach's Alpha method. The significance test was carried out at a significance level of 0.05, meaning that the instrument can be reliable if the Alpha value is greater than the critical product-moment r. Suppose certain limits are used, such as 0.6. Reliability less than 0.6 is not good, while 0.7 is acceptable and above 0.8 is good (Azwar, 2014).

The reliability test results from Kano's questionnaire showed the number of Cronbach's Alpha 0.776. The Cronbach's Alpha for consumer satisfaction and consumer preference section is 0.854. It means that the Cronbach's Alpha value of the questionnaire that has been made is included in the very

reliable category. In addition, these results indicate that the reliability or construct of the committed variable is relatively high.

The data adequacy test is carried out to test whether the amount of data obtained is sufficient for analysis. The data adequacy test is carried out by calculating Equation (1).

$$N' = \left[\frac{\frac{k}{s}\sqrt{N\sum x^2 - (\sum x)^2}}{\sum x} \right]^2 \qquad (1)$$

s is the degree of accuracy,
k is the level of confidence,
N number of observations,
N′ amount of theoretical data.

This study used a 10% degree of accuracy and a 90% confidence level (k=1.65), meaning that 90 out of 100 data were believed not to deviate more than 10%. With these calculations, it is found that all the data obtained are sufficient to apply the level of confidence and the degree of accuracy.

Furthermore, the analysis of the results according to the data obtained. Data processing will provide results which are then analyzed. The analysis process uses the literature and concepts learned in the literature study. Conclusions are drawn based on the results of data analysis, and conclusions become the core of the research that can be used as input for farmers.

3. RESULTS AND DISCUSSION

3.1 Characteristics of respondents

Data collection in this study was carried out from December 3, 2018, to December 16, 2018. The respondents of this study were 50 respondents who lived in Yogyakarta, Indonesia. The limited number of respondents obtained is caused by the number of black rice consumers who are not as many as consumers of other products consumed daily. Black rice, which has just increased in popularity, has only been consumed by a small number of consumers. It causes the market for black rice to be very small and segmented or often referred to as a niche market.

Most of the respondents had experience with health either for themselves or their families, so they decided to consume black rice every day or several times a week. Respondents are consumers who are familiar with black rice products. Respondents are dominated by 21-34 years old as much as 66% and then followed by respondents aged less than 21 years (12%), 55-64 years (8%), 35-44 years (8%), and 45-54 years (6%). Respondents were dominated by women (37%). Following previous research, women dominate consumers with a healthy lifestyle reflected in their consumption choices (Annunziata & Vecchio, 2013). Thirteen percent of the total respondents were male. Thirty-two percent of respondents are students. It is because many questionnaires are distributed surround the campus. The second-largest respondent is a private employee (24%). They were then housewives (16%) and others (16%). Other workgroups consist of freelancers, employees, entrepreneurs, teachers, lecturers, and others. The smallest occupational group participating among the respondents was civil servants at 12%.

Black rice is known to have a higher price, so this study also asked about the estimated monthly income of respondents. The assumption is that the income per month can describe their purchasing power. The results show that respondents are dominated by those with a monthly income range of Rp. 1 million to Rp. 3 million. It is considered reasonable to look at the distribution of workgroups in which students and private employees dominate.

3.2 Kano Model

There are 8 product attributes for black rice. The product attributes used for the questionnaire are displayed in Table 2.

Table 2. Black Rice Product Attributes

No	Product attributes
1	Black rice has whole grains
2	Black rice has long grains
3	Black rice has a dark color
4	Organic black rice
5	Black rice packaging has a variety of size
6	Vacuumed black rice packaging
7	Black rice packaging includes the nutritional content
8	Black rice packaging includes the cooking method

The attributes above are taken from a combination of attributes of pigmented rice which in previous studies have become attributes considered necessary by consumers (Wuryandani, et al., 2018; Anindita, et al., 2019; Putri, et al., 2019). Grain integrity, grain length, and color density are physical attributes consumers consider when buying colored rice. In addition, the information on the packaging also encourages consumers to make purchases (Nuringtyas & Ismoyowati, 2018). There are also additional attributes related to black rice packaging. Attributes related to packaging are arranged because competitors from other black rice producers, such as Tropicana Slim, have included nutritional content and cooking methods in their packaging. This study wants to determine whether this step can satisfy consumers and needs to be done by other black rice producers. A study found that the corporation highlights the characteristics of soybean obtained with innovative packaging that inhibits the oxidation process (Kanama & Nakazawa, 2017).

After obtaining data from the questionnaire, the category of consumer preferences was determined using the Kano model. In Kano's Model, preference identification is made by bringing together the results of functional and dysfunctional statements on each attribute (Matzler, et al., 1996). There are four categories of preference assessment, namely attractive (A), indifferent (I), one dimensional (O), must be (M), questionable (Q), and reverse (R). The tabulation results of consumer preference assessments and their categories are in Table 3.

Table 3. Kano Categories on Consumer Preferences

Attribute	A	M	R	O	I	Q	Category
1	17	6	0	5	22	0	I
2	17	4	0	3	21	5	I
3	9	3	1	11	25	1	I
4	29	2	0	14	4	1	A
5	12	7	0	14	16	1	I
6	22	3	1	6	18	0	A
7	22	7	0	12	9	0	A
8	25	2	0	11	11	1	A
Total	153	34	2	76	126	9	

From Table 3, it can be seen that there are two categories of Kano models that appear as the selected categories. Only Indifferent (I) and Attractive (A) categories are shown based on the consumer preference assessment.

3.2.1. Attractive Attribute

The attractive category is a category where consumers will feel more satisfied if these attributes are available, but the decrease in the performance of these attributes does not cause a decrease in the level of customer satisfaction. Attributes included in the attractive category are described in Table 4.

Table 4. Black Rice Product Attribute in Attractive Category

No	Product attribute in attractive category
4	Organic black rice
6	Vacuumed black rice packaging
7	Black rice packaging includes the nutritional content
8	Black rice packaging includes the cooking method

Organic farm products are considered better and healthier by consumers. It creates a consumer stigma that if the black rice product is organic, then the black rice product is better than non-organic black rice, so this attribute is an attribute that will increase consumer satisfaction. However, if this attribute is not present, consumers do not experience a decrease in satisfaction. Black rice without organic is already healthy, so it does not reduce their satisfaction. The demand for organic rice mostly comes from urban consumers. In Thailand, the retailers endeavored to offer organic food that is convenient to urban consumers' lifestyles (Kantamaturaproj & Marshall, 2020). In Indonesia, the demand for organic rice is influenced by other factors, such as the price of non-organic rice (Sulistyana, et al., 2016).

Vacuumed packaging also has a better and more durable stigma among consumers. It results in increased satisfaction when the packaging is vacuumed. The use of vacuum packaging on rice was reported to have a better effect on rice storage time than non-vacuum packaging (Hawa, et al., 2018). However, if the packaging is not vacuumed, consumers do not feel their satisfaction is reduced. Like many of today's products, black rice still has added value for consumers without being vacuumed. In South and Southeast Asia, where rice consumers are high, the demand for packaged rice is rising due to food safety and nutrition concerns driven by the consumers' socio-demographic factors (Bairagi, et al., 2021).

Packaging that includes nutritional value can increase consumer satisfaction. The inclusion of nutritional value will convince consumers to believe that black rice is healthy. However, consumers already trust it without this attribute, so it does not reduce customer satisfaction. Packaging has become a critical factor influencing consumer satisfaction with organic red rice in Denpasar City (Sianturi, et al., 2013). This informative packaging is also essential for pigmented rice consumers in Yogyakarta (Wuryandani, et al., 2018). Red rice consumers in Denpasar are even willing to devote their time and mind to paying attention to red rice information before deciding to buy it (Sianturi, et al., 2013).

Packaging that includes cooking method information is also an added value and will increase consumer satisfaction. New consumers feel the need for a cooking method because black rice has different material characteristics from white rice, so the cooking method is also different in terms of the amount of water mixed, cooking time, and cooking process. However, if this attribute does not exist, customer satisfaction does not decrease. Consumers in the digital era can easily find various ways to cook on the internet and social media so that without even cooking method information on the packaging, they can find out through other media. Millennial consumers who have a healthy lifestyle pay attention to details on the packaging. They read in detail the information written on the packaging. Besides, describing cues on the packaging would make the consumer less complicated to make their choices (Kuster, et al., 2019). The type of packaging is also the focus of consumers. Research suggests that the rice value chain actors in South Asia and Southeast Asia can further reinforce rice quality through labeling, branding, and packaging, where consumers are used to purchasing packaged rice (Custodio, et al., 2019).

3.2.2. Indifferent Attributes

Attributes that fall into this category do not affect customer satisfaction. The attributes of black rice products that fall into this category are described in Table 5.

Table 5. Black Rice Product Attributes in Indifferent Category

No	Attributes
1	Black rice has whole grains
2	Black rice has long grains
3	Black rice has a dark color
5	Black rice packaging has a variety of size

The whole grain attribute is included in this category because consumers are not too concerned about whether the black rice grains purchased are intact or broken. The condition of the integrity of the black rice grains does not affect consumer satisfaction. It has several possible reasons.

Figure 1. Black Rice
Source: vemale.com

Figure 2. White Rice
Source: tribunnews.com

First, when cooked, black rice will experience a slight change in grain shape, making the shape of the whole grain or broken grain not have a significant difference. In contrast to white rice, the whole grain is more visible when it has become cooked rice than cooked black rice. The difference in both types of rice can be seen in Figure 1 and Figure 2. The same thing happened to the grain length. Consumers are not concerned about whether the black rice has long or short grains. For them, the length of the grain does not reduce their satisfaction with black rice.

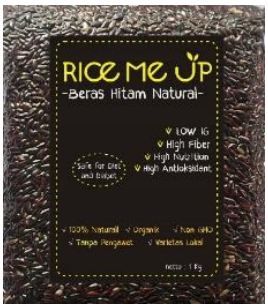

Figure 3. Black Rice A
Source: tokopedia.com

Figure 4. Black Rice B
Source: blibli.com

The black rice color density also does not affect consumer satisfaction. The color of black rice is more concentrated than other colored rice, such as brown rice. It is the assumption that the black rice color density does not affect satisfaction because the black rice concentration on the market is not much different when viewed with ordinary eyes (without tools). It can be seen in the illustrations in Figure 3 and Figure 4, which are two different black rice products but have a color density that is not much different when viewed with the ordinary eye. In addition, the choice of black rice products in modern retail is minimal. Usually, there are only two or three different brands of black rice in retail. Not many retailers provide many choices. Therefore, consumers feel no difference between pigmented rice and white rice.

Based on research, half of the consumers in South and Southeast Asia purchase packaged rice (Bairagi, et al., 2021). Nevertheless, this paper found that black rice packaging, which has a variety of sizes, does not affect consumer satisfaction with black rice. Some consumers buy black rice in traditional markets or through farmers. Through this network, consumers do not need to choose the type of packaging but can request the amount of rice according to their needs because, in both marketing agents, black rice is usually sold in bulk (Putri, et al., 2019).

3.3 Customer Satisfaction Coefficient

Then the calculation of the coefficient of consumer satisfaction (CS). Two formulas calculate this coefficient. The preference category of satisfied and dissatisfied consumers is calculated by Equations (2) and (3) (Berger, et al., 1993).

$$\frac{A+O}{(\mathrm{A+O+M+I})} \qquad (2)$$

$$\frac{O+M}{(\mathrm{A+O+M+I})} \times (-1) \qquad (3)$$

This calculation found that the value of positive satisfaction and negative dissatisfaction is obtained from this calculation. The CS coefficient from the calculation results is in Table 6.

Table 6. CS Coefficient

Attribute	A	M	R	O	I	Q	Category	EOS	EOD
1	17	6	0	5	22	0	I	0.44	-0.22
2	17	4	0	3	21	5	I	0.44	-0.16
3	9	3	1	11	25	1	I	0.42	-0.29
4	29	2	0	14	4	1	A	0.88	-0.33
5	12	7	0	14	16	1	I	0.53	-0.43
6	22	3	1	6	18	0	A	0.57	-0.18
7	22	7	0	12	9	0	A	0.68	-0.38
8	25	2	0	11	11	1	A	0.73	-0.27

The EOS is the abbreviation of the extent of satisfaction that indicates how much percentage of the customers' satisfaction increases if a certain service is provided. The EOD means the extent of dissatisfaction that indicates how much the percentage of the customers' satisfaction decreases if certain services are not provided (Gani, et al., 2019). The EOS value shows that product attributes influence consumer satisfaction. The EOS value was closer to 1 means that the greater the effect on consumer satisfaction. The EOD value close to -1 means the greater the effect on consumer dissatisfaction.

From the Table 6, then the data is mapped into the Kano Satisfaction Coefficient Graph. Each attribute's position can be seen based on the Kano category based on the graph. In addition, it can also be seen which attributes have a strong or weak influence on consumer satisfaction and dissatisfaction.

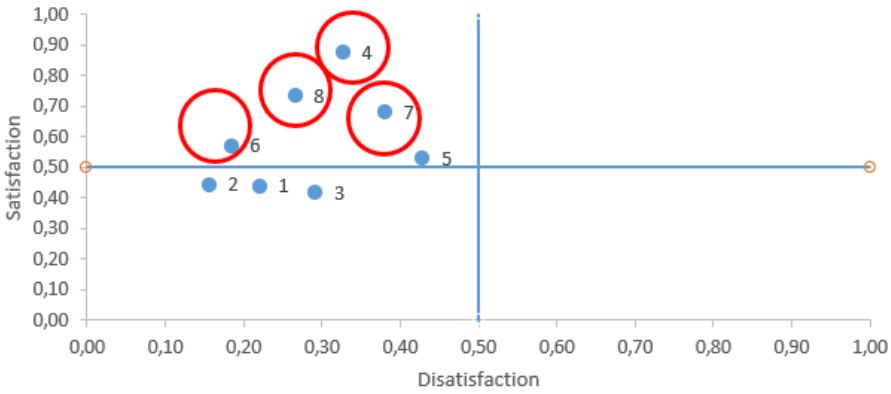

Figure 5. Satisfaction Coefficient

Figure 5 can determine the priority of developing black rice product attributes. Product development priorities are carried out on attributes with a satisfaction value above 0.5 and are included in the attractive category. The priorities are listed in Table 7.

Table 7. Black Rice Product Attribute Priority for Product Development

No	Attributes	Category
4	Organic black rice	*Attractive*
6	Vacuumed black rice packaging	*Attractive*
7	Black rice packaging includes the nutritional content	*Attractive*
8	Black rice packaging includes the cooking method	*Attractive*

Based on these results, all priorities are in the attractive category. It means that the presence of this attribute can increase customer satisfaction, but if this attribute is not available, it does not cause a decrease in customer satisfaction. Of the four priorities, there are three attributes related to packaging. Currently, the existing packaging looks the same, in plastic packaging, not vacuumed, and

without nutritional values or cooking methods information. Only a few manufacturers may have any of the three additional information on the packaging, usually the large manufacturers. For producers from farmer groups and small producers, the packaging they have does not have this information, and it only displays the brand and name of the producer.

Vacuum packaging makes rice last longer before opening. However, once opened, the packaging no longer maintains the condition of the material from external contamination. Vacuum packaging makes shipping easier and lasts when the goods are displayed in supermarkets. It has been done by large companies, such as Nutrifood with the brand Tropicana Slim, but has not been done by small and medium-sized manufacturers. In addition to the high cost of vacuum, small and medium producers do not store black rice for a long time.

Information about nutritional content will convince consumers, especially new consumers, that black rice has good nutritional content for health and has been scientifically tested. A cooking method makes it easier for consumers to cook black rice. Black rice has different characteristics from the previously famous white and brown rice.

Organic products can attract consumers to buy black rice to increase consumer satisfaction. Some black rice producers have done organic cultivation. However, they have not yet received an organic certificate, so they cannot affix this information on the packaging. If this is done, customer satisfaction will increase. The organic certificate is essential to get consumers' attention to buy the products (Bairagi, et al., 2021). In Indonesia, based on the Minister of Agriculture Regulation No. 48 years 2017, the organic certification must be issued by the Organic Certification Institute (LSO). The organic certification process has quite a lot of requirements and is rigid. Several small farmers revealed that the certification process was a problem for them in terms of process and cost (Anindita, et al., 2019).

3.4 Quality Improvement Index

Comparison of product quality with competitors is significant for product development strategy. The quality improvement index (QI) is a ratio calculated by multiplying the importance of the product with the satisfaction obtained from the rating scale in the questionnaire. The black rice Q1 index is shown in Table 8.

Table 8. Black Rice Q1 Index

No	Attributes	Relative importance	Gap value	QI index
1	Black rice has whole grains	6.06	5.88	35.63
2	Black rice has long grains	5.44	5.38	29.27
3	Black rice has a dark color	5.88	5.64	33.16
4	Organic black rice	5.9	5.68	33.51
5	Black rice packaging has a variety of size	5.86	5.54	32.46
6	Vacuumed black rice packaging	5.42	5.34	28.94
7	Black rice packaging includes the nutritional content	5.96	5.78	34.45
8	Black rice packaging includes the cooking method	5.56	5.46	30.36

From Table 8, the data is then mapped into a graph. This mapping aims to determine what strategy producers should do following interest and consumer satisfaction. The mapping is shown in Figure 6.

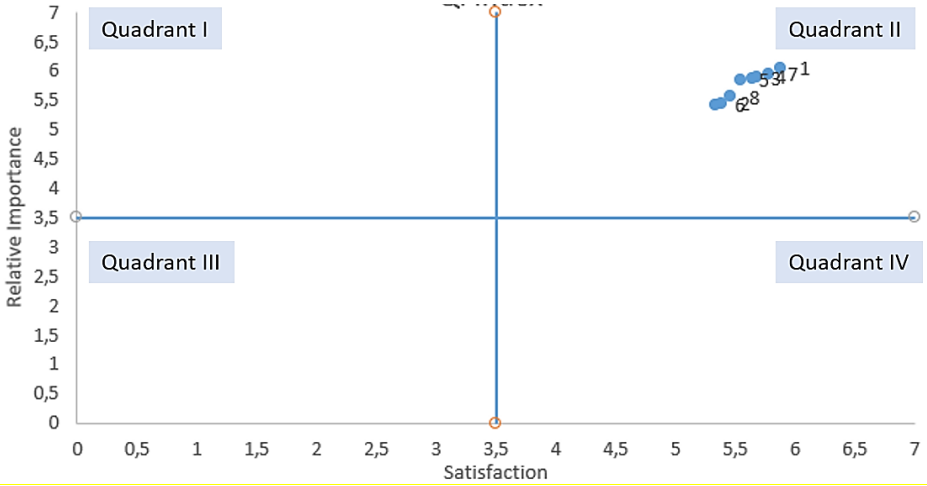

Figure 6. QI Index of Black Rice Product

From Figure 6, it can be seen that all attributes fall into quadrant II. In quadrant II, the strategic suggestion for the company is to manage or expand its strategic advantage. Black rice producers must manage the product attributes that are currently owned to maintain the satisfaction of existing consumers. In addition, black rice producers need to improve several attributes, especially those in the attractive category, to add value to customer satisfaction.

4. CONCLUSIONS

The results of the Kano method then become input for designing product quality. From the eight attributes studied, only four attributes are important to be developed. The four attributes are attributes classified as attractive: organic black rice, vacuum packaging, nutritional values on the packaging, and the inclusion of cooking methods on the packaging.

Based on attribute category, consideration of EOS score, EOD score, and testing of all attributes, the following are the attributes of black rice products that can be development priorities: (1) organic black rice, (2) vacuum packaging, (3) new packaging designs that include information on nutritional values and (4) cooking methods. This research recommends that black rice producers plant with organic and certified methods, vacuum packaging, and improve their packaging designs, including nutritional values and cooking methods.

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