The Product Quality Improvement: An Example from a Rice Milling in Indonesia

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Abstract. This study aimed to determine the quality attributes of rice products which were important for the consumers and the level of consumer satisfaction with these attributes. Recommendations were then given to improve the quality of rice products based on consumer voices. The research was conducted at the Sri Margo Joyo (SMJ) rice milling that produces packaged rice with the King Banana brand. QFD was used in this study for product design, process planning, process design, and process control. Variables in this research were determined based on quality dimension. Respondents in this study were 60 King Banana rice consumers and 2 expert respondents. The results showed that King Banana rice products need to make improvements to the attributes of colour, texture, product damage level when received by the consumers, and variations in packaging weight. The priority of technical response to improve the quality attributes of rice products were the improvement of storage processes, proper maintenance of machinery and equipment, and scheduling of spraying and fumigation every 1 month. Process control that needs to be applied to the SMJ rice mill were monitoring the mixing of grade A and grade B grain, adding the process of ignition, monitoring temperature, humidity, and insecticide use in the rice storage room, monitoring the maintenance scheduling of rice processing machinery and equipment, and monitoring the vacuum packaging.

Keywords: Packaged Rice, Quality, Rice Mill, Voice of Consumers

1. Introduction

Rice is the main staple food consumed by the people of Indonesia. Rice has an important component in compiling the human body. According to [1], rice is a group of grains (cereals) from the family of grasses (graminae) which are rich in carbohydrates so that it is made a staple food for humans. Rice consumed by humans in the form of rice which has been milled. The nutritional content of rice per 100 gram are 360 kcal of energy, 6.6 gram of protein, 0.58 gram of fat and 79.34 gram of carbohydrate [2]. The high carbohydrate content of rice makes rice called the most important staple for the people of Indonesia.

The process of milling of grain into rice has an influence on the nutrition and quality of the rice [3]. Quality reflects all dimensions of product offerings that produce benefits for customers [4]. According to [5], a product is able to satisfy consumers when it meets or exceeds their desires and expectations. Quality is the basis of customer satisfaction and success in competition.

Rice milling companies must always develop and improve the quality of their products in order to create consumer buying interest and be able to compete with other companies. The rice mills can
improve the quality of their products can be carried out by knowing the wants and needs of consumers for the quality attributes of these products. Therefore, this study aimed to determine the quality attributes of rice products that were important to consumers and the level of consumer satisfaction with these attributes. Recommendations were then given to rice milling companies to improve the quality of rice products based on consumer voices.

Research related to improving product quality has been conducted by many researchers. According to [6], used Quality Function Deployment (QFD) to improve service quality at Ngodoe Café. [7] had conducted research on the use of QFD to increase customer satisfaction with Pesona products of “alang-alang” juice. The research aimed to analyze the level of consumer satisfaction with “alang-alang” juice and determine the company's strategy in responding to consumer expectations to improve the quality of its products. According to [8] had conducted research on the use of QFD to improve the quality of fermented cassava cake. The research aimed to identify the needs and expectations of consumers through defining the attributes of fermented cassava cake. Several studies related to improving the quality of products indicate that QFD can be used as a means to determine product quality attributes that are important to consumers and the level of customer satisfaction with these attributes and determine recommendations for improvement that must be done in improving product quality. This study aimed to determine the quality attributes of rice products that were important to consumers and the level of consumer satisfaction with these attributes. Recommendations were then given rice milling companies to improve the quality of rice products based on consumer voices

2. Methods
The study was conducted at the Sri Margo Joyo (SMJ) rice milling company located on Jalan Sariman Number 128, Glenmore District, Banyuwangi Regency, East Java. Improvements in the quality of rice in this study only focused on medium quality King Banana rice products, which are widely consumed by consumers. Costs were not considered in the recommendations for improving rice quality given in this study.

2.1 Variables
The variables of this research were determined according the priority attributes desired by the customer. This study used variables that indicate the dimensions of the quality of rice products. The use of 8 quality dimensions developed by [9] can determine the attributes associated with consumer needs. The operational definition of the attributes of each product quality dimension used in this study can be seen in Table 1.

2.2 Questionnaire design
There were 2 types of questionnaires used in this study, i.e. a questionnaire for consumer respondents and a questionnaire for expert respondents. Questionnaires for consumer respondents use the Likert scale of 1-5 as an instrument of assessment of importance level and satisfaction level of respondents on the given quality attributes. Questionnaires for expert respondents were used to provide expert respondent responses to consumer needs, provide an assessment of the relationship between these responses and consumer needs, and provide an assessment of the relationship between responses.

Validity test using Pearson Product Moment correlation was done on a questionnaire for consumer respondents so that the questionnaire used can guarantee the suitability of the results or accuracy of research measurements with the actual situation. Each statement item score was correlated with the total score. Statement items that correlate significantly with the total score indicated that these items were able to measure as desired by the gauge. If r value ≥ r table (2-side test with a significance of 0.05), then the questionnaire was declared valid [10]. Validity test on the questionnaire for expert respondents was done using face validity. According to [11], face validity is the simplest test of validity because it is only based on the opinions of experts in the field of research regarding the accuracy of the measuring instruments used.
Reliability tests were also conducted on the questionnaire for consumer respondents. This was done to determine the consistency of measurement results from time to time. According to [12], Cronbach alpha is the most commonly used reliability coefficient to test consistency between items in the questionnaire. An instrument is reliable if it has a Cronbach alpha value $> 0.6$.

**Table 1. Operational Definition of the Attributes of Each Product Quality Dimension**

| Dimension        | Attribute                          | Definition                                      | Citation |
|------------------|------------------------------------|-------------------------------------------------|----------|
| Performance      | Colour                             | White rice                                      | [13]     |
|                  | Aroma                              | Scented rice                                    | [13]     |
|                  | Texture                            | Whole rice, not broken                          | [13]     |
|                  | Taste                              | Tasteful, a little bit sweet                    | [14]     |
| Features         | No chemical ingredients            | Consumers can get qualified non-chemical rice   | [15]     |
| Reliability      | Product damage level when received by consumers | No bugs                                        | [15]     |
|                  | No defect on product packaging     | Product packaging is still tightly closed when received by consumers | [13]     |
| Conform to Specification | Consistent product weight | Product weight is according to the weight information listed on the packaging label | [15]     |
| Aesthetic        | Weight variation of product packaging | Weight variation of product packaging          | [13]     |
|                  | Attractive packaging design       | Transparant packaging                           | [13]     |
| Perceived Quality | Product popularity               | King Banana rice products are famous for being sticky in texture and shiny in appearance | [16]     |
| Serviceability   | Price Guarantee after sales       | The affordable price                            | [13]     |
|                  | Affordable selling location       | If the quality of rice received by consumers is not in accordance with consumer standards, then the rice can be returned to SMJ | [17]     |
|                  |                                    | The rice products selling are not only at SMJ, but their selling also at shops | [13]     |

Validity and reliability tests on the questionnaire for consumer respondents were conducted in this study after the questionnaire was filled out by 30 consumer respondents. The results of the validity and reliability test showed that the questionnaire for consumer respondents was valid because $r$ value $> r$ table and reliable because the Cronbach alpha value $> 0.6$ so that the questionnaire could be used to retrieve further data. The validity test results on the questionnaire for expert respondents were also conducted by expert respondents and academics before the questionnaire was filled by expert respondents. The face validity results on the questionnaire for expert respondents indicated that the questionnaire was appropriate for measuring actual conditions.

### 2.3 Respondents

Respondents in this study were 60 consumer respondents and 2 expert respondents. Consumer respondents in this study were all buyers of King Banana rice at SMJ rice milling and had consumed
rice produced by SMJ competitor rice milling with an age limit of 19-60 years. The expert respondents in this study were the owner and head of production at SMJ rice milling. Sampling in this study used a purposive sampling technique because the sample was selected through criteria determination by the researcher. The number of consumer respondents is determined based on a linear time function by considering the time available for research, sampling time, and the time needed to fill out a questionnaire.

2.4 Quality Function Deployment (QFD)

QFD is a technological innovation that will translate customer expectations into more specific characteristics to produce appropriate products. QFD has a main focus on the development and improvement of the desires and needs of consumers by making comparisons with other competitors [18]. The use of QFD focuses on the main causes of customer satisfaction and dissatisfaction, making it a useful tool for competitive analysis of product quality by companies [19]. According to [20], the initial QFD activities were carried out by listening to the customer's voice and there were 4 main activities in making QFD, i.e. product planning, product design, process planning, and process control. The product which is the object of this research had been produced and marketed (not a new product) so modifications were made to the phase in the analysis using this QFD. Product planning was not needed in this study, but the process planning needs to be done to improve the rice products that were the object of this research.

The House of Quality (HoQ) matrix is the best known form of QFD representation. According to [14], the general form of the HoQ matrix consists of 6 main components, i.e. customer need and benefit, planning matrix, technical response, relationship, technical correlation, and technical matrix. Customer needs and benefits in the form of data or information obtained from basic research on the needs and desires of consumers. Planning matrix in the form of the level of importance of each customer's needs, data on the level of customer satisfaction, and strategic objectives for the product to be developed. Technical response in the form of a description of consumer needs into product or service planning so that products can be developed according to customer desires. Relationship in the form of a relationship between each element of the technical response to the desires and needs of consumers. Technical correlations contain a way to establish the implementation of relationships between technical response elements. Technical matrix contains information related to the ranking sequence of technical responses, information on comparison with technical performance, and performance targets.

2.4.1 Phase 1 of House of Quality (Product Design)

The product design process is done by translating the wants and needs of consumers into technical requirements. The preparation of the phase 1 of HoQ matrix can be done by compiling a matrix of consumer needs and making the design matrix as follows:

1. Determination of Importance to Customer (ItC) value
   The ItC value is obtained from the average value of questionnaire results of consumers’ importance (expectations) level which then used to calculate the value of Raw Weight (RW)

2. Determination of Consumer Satisfaction Performance (CSP) value
   CSP values obtained from the average results of the total questionnaire attribute value of King Banana rice product satisfaction

3. Determination of goal value
   The target value is determined by the company by showing the goals to be achieved for each customer's needs.

4. Determination of Improvement Ratio (IR) value
   IR value can be obtained from the comparison between the value of the goals or objectives of the company's plans with the CSP value or customer satisfaction of King Banana rice products. The greater the value of IR, the greater the effort that must be done. According to [21], the formula for Improvement Ratio is as follows:
5. Determination of Sales Point (SP) value
Determination of SP value to provide an assessment of the attributes that need to get corrective action in an effort to increase the ability of competition in a product. Determination of SP values in this study can be seen in Table 2 [21].

| Sales Point Value | Definition       |
|-------------------|-----------------|
| 1.0               | No sales        |
| 1.2               | Moderate sales point |
| 1.5               | High sales point |

6. Determination of Raw Weight (RW) value
The formula for RW is as follows [21]:

\[
RW = IC \times IR \times SF
\]  

(2)

7. Determination of Normalized Raw Weight (NRW) value
NRW value is a RW value determined on a scale between 0-1 or can be expressed as a percent. NRW can be calculated using the following formula [21]:

\[
NRW = \frac{RW}{\sum RW}
\]  

(3)

8. Determination of technical responses
The determination of technical responses aims to obtain responses from producers or companies that can be used to determine customer needs and focus on product quality.

9. Determination of the relationship between technical responses and quality attributes that are of the highest importance to consumers
This determination is carried out in order to be able to know the relationship of each technical component in meeting consumer needs. Symbols of the relationship between technical responses and consumer needs can be seen in Table 3 [22].

| Symbol | Definition       | Value |
|--------|-----------------|-------|
|        | Strong relationship | 9     |
|        | Moderate relationship | 3     |
|        | Weak relationship  | 1     |
|        | No relationship   | 0     |

10. Determination of the value of interaction matrix of technical responses with consumer expectations
This value determination serves to link between product satisfaction attributes that are considered important by consumers with technical responses. The formula in finding the absolute value of technical responses to consumer expectations is as follows [23]:

\[
KTi = \sum (BTi \times Hi)
\]  

(4)

where:
\[ KT_i = \text{absolute value of the technical response for each } i \text{ attribute} \]
\[ BT_i = \text{relative importance (weighting / normalizing weights) of the desired product satisfaction} \]
\[ Hi = \text{value of the relationship of } i \text{ technical responses with consumer expectations} \]

11. Determination of technical relationship
Determination of technical relations aims to make it easier to determine the decision to be taken by using symbols that can be seen in Table 4.

| Symbol | Definition            |
|--------|-----------------------|
| ++     | Strong positive relationship |
| +      | Positive relationship |
| No symbol | No relationship |
| -      | Negative relationship |
| --     | Strong negative relationship |

12. Determination of technical contributions based on relative importance
The determination of technical contributions becomes the basis for determining the priority of technical responses that will be developed first which is computed using the following formula [23]:

\[
\text{Relative Importance} = \frac{A_{\text{technical needs}}}{C_{\text{technical needs}}} \times 100\% 
\]

13. Benchmarking and Targetting
Benchmarking (B) is an ongoing measurement activity and compares one or more company business processes with the best companies in the business process [24]. The highest value of benchmarking is the value used as a target. Determination of the benchmarking value can be calculated using the following formula:

\[
B = \frac{CSP \times \text{Relationship value between technical response and consumer’s need}}{\Sigma \text{Relationship value between technical response and consumer’s expectation}} 
\]

2.4.2 Phase 2 of House of Quality (Process Planning)
The process planning is the stage for developing technical requirements in phase 1 according to the creativity and innovation of the company. The planning process is obtained from research based on pre-existing product design [25]. Phase 2 of HoQ is made by translating the technical requirements into the planning process. This phase is almost the same as phase 1, but only carried out at the stage of determining the technical response to the determination of technical contributions based on relative importance.

2.4.3 Phase 3 of House of Quality (Process Design)
The process design phase is developing the technical requirements of phase 2 by determining the appropriate process standards for the company to improve the quality of its products. The process design is related to the development of process planning in more detail to produce better product characteristics. Phase 3 is made by translating the characteristics of the process in each part in phase 2 and determine the standard of each process. This phase is the same as phase 2, where the first step starts from the technical response to the determination of technical contributions based on relative importance.
2.4.4 Phase 4 of House of Quality (Process Control)
The process control phase deals with performance indicators created to monitor the production process, maintenance schedule, and skills training for operators [25]. Phase 4 of HoQ is made for the process of forming relationships and hardness between the characteristics of the process produced in phase 3. The stages for making phase 4 are the same as phase 3, i.e. the first step starts from the technical response to the determination of technical contributions based on relative importance.

3. Results and Discussion

3.1 General Overview of Sri Margo Joyo Rice Milling
Sri Margo Joyo (SMJ) Rice Milling is one of the businesses engaged in rice processing. The company is located at Jalan Sariman No 128, Dusun Tulungrejo, Glenmore District, Banyuwangi, East Java. SMJ was established in 1970 with initial business only as a rice milling service. Equipment and machinery used were only limited to grind rice owned by local farmers.

This rice mill in 1987 began to develop by starting to produce and market rice. The rice production process in the SMJ rice milling begins with the purchase of rice grain from farmers. The partially purchased grain is stored in a warehouse to wait for the processing queue. Grain that has been stored must be completely dry to avoid loss of quality. Some of the grain is processed in stages such as drying, cleaning, grinding rice, packaging rice, and storing it before it is marketed.

The rice brand from SMJ rice milling has various names in accordance with consumer demand and market conditions, but many people are familiar with the rice brand with the brand “Pisang Emas”. The owner of SMJ rice milling in 2017 decided to choose the King Banana brand as the name for their rice products. This rice is marketed with the weight of rice per package of 5 kg, 10 kg and 25 kg.

Marketing is an important thing carried out by SMJ rice milling in supporting their business activities in order to obtain profits. King Banana rice products are marketed around the East Java region, such as Jember, Banyuwangi, Malang, and Bali. This rice milling markets its products to the whole community as the final consumer, distributor or other sales agents. The final consumers buy 40,000 tons / week of King Banana brand rice. Market competition causes producers to be able to improve the quality of their products so as to create consumer buying interest. Product quality that is always well maintained is able to satisfy and maintain customer loyalty.

3.2 Phase 1 of HoQ
The first step in HoQ phase 1 was the determination of Importance to Customer (ItC). The highest ItC value for King Banana rice products was 4.65 in the attribute of chemical free rice products. Consumers generally prefer products that are free of chemicals (no bleach or preservatives), especially rice products that as a staple food for humans. This encourages conscientious consumers in choosing their products. According to Amina, et al. [28], rice mixed with chemicals is very dangerous to health and can even result in death. One of them is rice mixed with chlorine. Chlorine is used in rice as an antifungal and white effect, clean shiny, and not easily damaged.

The next step in the design matrix was assessing the level of satisfaction or Customer Satisfaction Performance (CSP) for King Banana rice products and competing rice products. The attribute values of competing rice products that have a higher value were color, texture, the product damaged level when received by consumers, and the packaging weight variation. This shows that King Banana rice still needs to improve the quality of its product attributes which were still below the competing rice products. The highest value of CSP of King Banana rice products was 4.35, which was the attribute of chemical free rice products and affordable sales locations. The lowest CSP value of King Banana rice was 3.48, which is the aroma attribute, but this attribute is the least important for consumers compared to other quality attributes in rice products.

The target value in this study used the highest value in the CSP calculation. The results showed that there were 4 attributes of King Banana rice products that have a value below competing rice products, i.e. color, texture, the product is not damaged when received by consumers, and packaging weight.
variation. The improvements made by the SMJ on the quality attributes of rice products should reach at least the same quality level as the quality attributes of competing rice products.

Determination of Improvement Ratio (IR) was done in the next step. The results of the calculation of IR values indicated that the SMJ must give the greatest effort to achieve the target of improving texture attributes. According to Mardiah et al. [29], factors that can be directly assessed by consumers and used as a determinant in rice selection are physical characteristics, such as color, shape, aroma, percentage of head rice, and impurities. The texture of rice when cooked also influences consumer purchasing decisions.

The effect of the relationship between attributes on product sales activities was also done by determining the value of the Sales Point (SP) of the rice milling. SP values that indicated a strong selling point are found in the color attributes, no chemical ingredients, product damage level when received by consumers, no defect on product packaging, weight variation of product, attractive packaging designs, product popularity, prices, and affordable selling locations. According to Xie et al. [30], the higher the SP value, the more influence the customer in making purchasing decisions.

Determination of Raw Weight (RW) was then made from the results of the multiplication between the values of ItC, IR, and SP [31]. The highest RW value was the attribute of no chemical ingredients with a value of 6.98. In order to find out the weight of the interaction matrix value, normalization was carried out on RW to produce NRW. NRW value calculation results showed that the highest value was found in the attribute of no chemical ingredients with a value of 0.09. This showed that the quality attribute of chemical free rice products needs to be maintained by the SMJ because it most strongly influenced consumer decisions on purchasing King Banana rice products. SMJ also did not need to give great effort in maintaining these quality attributes because the quality attributes of no chemical ingredients in King Banana rice products were satisfying their consumers and were considered better than those quality attributes in competing rice products. Phase 1 of HoQ is shown in Table 5.

Technical responses were determined from the results of interviews between researchers and companies. The technical response given was the planning of the production process that must be carried out by the SMJ rice milling company to improve the quality of King Banana rice products, i.e. the selection of raw materials (TR1), improvement of storage processes (TR2), improvement of post-harvest handling technology (TR3), and innovation and packaging weight variation (TR4). The color of the rice that is not white can be caused by unfavorable raw material conditions, for example: rice grain. Grain that is not dried immediately will cause the color of the resulting rice not white. Storage of grain or rice also causes changes in physicochemical properties and quality in storage during the first 4-6 months, especially if the storage temperature is above 15oC. High humidity will also cause mold growth and black spots on rice. The humidity in the storage room must be kept as low as possible at <65% [32]. Another improvement that needs to be done by the SMJ rice milling company was the improvement of post-harvest technology. Poor post-harvest handling activities can affect the texture of the rice produced, for example: the drying process. Drying process is too fast causing cracked seeds so that there is a lot of broken rice during the grinding process [33].

The relationship between technical responses shows that there is a strong positive and positive relationship between technical responses if the technical responses support one another. If the relationship between the technical responses is opposite, then a strong negative and negative relationship occurs. The calculation results showed the highest value of the interaction matrix was the technical response to the improvement of the storage process by 3.22 with a contribution value of 35.15%.

Benchmarking was then carried out between King Banana rice products and competing companies' rice products. Benchmarking is a tool that can be used to measure performance levels and develop a product, service, and others for a company [34]. Calculation of benchmarking value was determined from the value of customer satisfaction with King Banana rice products and competing companies' rice products. The results of the benchmarking showed that the satisfaction of King Banana rice on the attributes of color, texture, the level of damaged when received by consumers, and the weight of the packaging variation depending on the level of technology in the SMJ rice milling. The highest value of
the technological level in the technical response was the improvement of the storage process because the process was strongly related to the attributes of color, aroma, texture, taste, and the level of damaged when received by consumers. Phase 1 of HoQ matrix can be seen in Figure 1.

| No | Product Attribute                                      | ItC | CSP of King Banana | CSP of Competitor Product | Goal | IR   | SP   | RW   | NRW |
|----|--------------------------------------------------------|-----|--------------------|---------------------------|------|------|------|------|------|
| 1  | Colour                                                 | 4.17| 3.93**             | 4.00                      | 4.00 | 1.02 | 1.5  | 6.38 | 0.08 |
| 2  | Aroma                                                  | 3.43| 3.48               | 3.35                      | 3.48 | 1    | 1    | 3.43 | 0.04*|
| 3  | Texture                                                | 4.30| 3.72**             | 3.87                      | 3.87 | 1.04 | 1.2  | 5.37 | 0.07 |
| 4  | Taste                                                  | 4.07| 4.02               | 3.38                      | 4.02 | 1    | 1    | 4.07 | 0.05 |
| 5  | No chemical ingredients                               | 4.65| 4.35               | 3.88                      | 4.35 | 1    | 1.5  | 6.98 | 0.09**|
| 6  | Product damage level when received by consumers       | 4.47| 4.25*              | 4.32                      | 4.32 | 1.02 | 1.5  | 6.84 | 0.08 |
| 7  | No defect on product packaging                         | 4.35| 4.33               | 4.08                      | 4.33 | 1    | 1.5  | 6.53 | 0.08 |
| 8  | Consistent product weight                             | 4.45| 4.33               | 4.17                      | 4.33 | 1    | 1    | 4.45 | 0.05 |
| 9  | Weight variation of product packaging                 | 4.22| 4.25**             | 4.25                      | 4.25 | 1.02 | 1.5  | 6.46 | 0.08 |
| 10 | Attractive packaging design                           | 3.93| 4.17*              | 3.62                      | 3.88 | 1    | 1.5  | 5.90 | 0.07 |
| 11 | Product popularity                                    | 4.17| 3.88               | 3.75                      | 4.12 | 1    | 1.5  | 6.26 | 0.08 |
| 12 | Price                                                  | 4.40| 4.12               | 3.12                      | 4.05 | 1    | 1.5  | 6.60 | 0.08 |
| 13 | Guarantee after sales                                 | 4.37| 4.05               | 3.30                      | 4.20 | 1    | 1.2  | 5.25 | 0.06 |
| 14 | Affordable selling location                           | 4.37| 4.20               | 3.78                      | 4.35 | 1    | 1.5  | 6.56 | 0.08 |

Love value (*), High value (**)
3.3 Phase 2 of HoQ

The process planning is the stage for developing technical requirements in phase 1 according to the creativity and innovation of the company. The planning process is obtained from research or development from pre-existing designs [27]. The process of making a phase 2 of HoQ matrix is almost the same as the process of making a phase 1 of HoQ, but the initial step of making a phase 2 of HoQ starts from determining the technical response and ending with the priority setting phase. The results of interviews with the company produced 4 technical responses to meet the desires and satisfaction of consumers, i.e. grading the grain (TR1), implementing system of aeration, spraying and fumigation (TR2), implementing appropriate machine and equipment maintenance (TR3), as well as the manufacture of 2.5 kg packaging (TR4). The relationship between technical responses and attributes and the relationship between technical responses can be seen in Figure 2.
3.4 Phase 3 of HoQ

The process design stage was developing phase 3 technical requirements by determining appropriate quality standards for companies to improve the quality of their products. The process design is related to the development of process planning in more detail to produce better product characteristics [27]. The design process for rice milling is aimed to make the rice was whiter, the texture of broken rice was reduced, the product was not damaged when received, and the packaging weight varies. The result of interviews with the company produced 5 technical responses to meet customer desires and satisfaction, i.e. mixing grade A and grade B grain with a ratio of 10: 1 (TR1), ventilation and stacking arrangements for aeration (TR2), scheduling spraying and fumigation activities every 1 once a month (TR3), cleaning bucket elevators once a week and replacing rubber rollers in the husker (TR4), as well as determining the type of nylon plastic packaging for 2.5 kg rice packaging and coordination with suppliers (TR5). The relationship between technical responses and attributes and the relationship between technical responses can be seen in Figure 3.

| No | TR 1  | TR 2  | TR 3  | TR 4  | Weight |
|----|-------|-------|-------|-------|--------|
| 1  | ☐     | ☐     | ☒     | ☐     | 33.30  |
| 2  | ☐     | ☐     | ☒     | ☐     | 35.15  |
| 3  | ☐     | ☒     | ☐     | ☐     | 17.70  |
| 4  | ☐     | ☐     | ☒     | ☐     | 13.67  |
| 5  | Value of interaction matrix | 299.7 | 508.95 | 564.45 | 123.03 |
| 6  | Contribution (%) | 20.03 | 34.02 | 37.73 | 8.22  |
| 7  | Priority | 3     | 2     | 1     | 4     |

**Figure 2. Phase 2 of HoQ**
3.5 Phase 4 of HoQ

The process control phase was the development of the technical requirements of phase 4 by determining the right process performance indicators to address customer needs. Performance indicators are created to monitor the production process, maintenance schedule, and skills training for operators [27]. The results of interviews with the company produced 5 technical responses to meet the desires and satisfaction of consumers, i.e. monitoring the mixing of grade A and grade B grain as well as the addition of the process of scraping, monitoring temperature and humidity in the rice storage room, monitoring the use of insecticides in the rice storage room, monitoring scheduling maintenance rice milling machines and equipment, as well as vacuum packaging monitoring processes. The relationship of technical responses to attributes and the relationship between technical responses can be seen in full in Figure 4.
4. Conclusion
The results showed that King Banana rice products need to make improvements to the attributes of colour, texture, product damage level when received by the consumers, and variations in packaging weight. SMJ rice milling can implement several recommendations for improvement the quality of King Banana rice products, i.e. the monitoring of grade A and grade B grain mixing, as well as the addition of the milling process, monitoring temperature and humidity in the storage room, monitoring the use of insecticides in the chamber storage, monitoring of machine and equipment maintenance scheduling, and vacuum packaging monitoring. All technical responses that must be carried out by the company cause the company must increase the cost of the production process. Companies must consider the long-term benefits of doing the technical response compared to the cost. The results of the study indicate that the application of monitoring temperature, humidity, and the use of insecticides in storage rooms is a technical response that must be prioritized by the company.

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