



# Application of Quality Function Development (QFD) to Improve Quality and Develop Porang Rice Product XYZ

Nova Pangastuti

Industrial Engineering, Universitas Bina Sarana Informatika, Jalan Kramat 98, Jakarta Pusat 10450 Indonesia

## ARTICLE INFORMATION

Article history:

Received: 13 September 2023

Revised: 10 November 2023

Accepted: 21 November 2023

Category: Research paper

Keywords:

EFAS

IFAS

QFD

HoQ

DOI: 10.22441/ijiem.v5i1.23104

## ABSTRACT

Porang rice is one of the alternatives to rice but porang rice producers are still very few and fairly new in the field. XYZ porang rice is one of the porang rice products that is quite in demand by various groups. The purpose of this research is to provide information to companies to develop their products. Because developing this product requires the voice of consumers in the product development process with the hope that if the company develops the product in accordance with consumer expectations, an increase in sales will occur. So that later this XYZ brand porang rice can continue to improve its products and services for consumers. In this study, the steps taken at the beginning were to deepen the strengths and weaknesses of the product using the EFAS and IFAS matrices This study uses the Quality Function Development (QFD) approach with the initial stage of identifying customer needs and getting 19 attributes of consumer expectations of XYZ brand porang rice products. After that, a customer satisfaction performance (CSP) is made by comparing other brand products. related to determining the CSP value, the CSP value for XYZ Brand Porang Rice is 4.75 with a durable attribute within a day and the lowest is on a more creative and attractive product packaging model with a value of 2.35 while for its competitors with Shirataki Rice with the K brand, the attribute that has the greatest value is the high fiber and the size of the intact rice grains with a value of 4.70 and the lowest is the attribute of the packaging model with a variety of sizes, namely 1.45. Then processed into HOQ calculations and obtained the results of the 3 largest value of priority improvements in the production tool, then followed by marketing, and the third is in the texture produced.

\*Corresponding Author

Nova Pangastuti

E-mail: nova.not@bsi.ac.id

This is an open access article under the [CC-BY-NC](https://creativecommons.org/licenses/by-nc/4.0/) license.



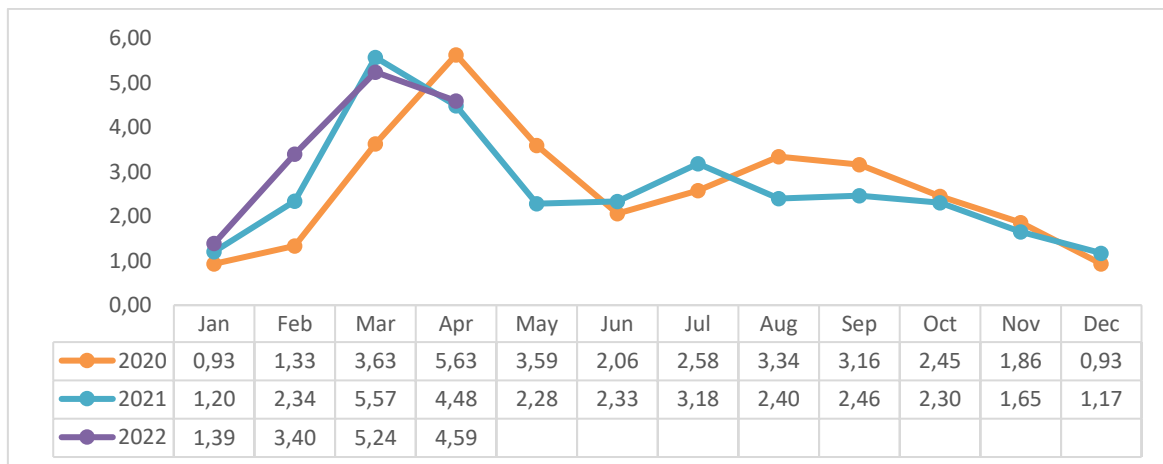
## 1. INTRODUCTION

The trend of consuming porang rice has been on the rise lately. Porang rice is known to be

low in calories and high in fiber, so it is often consumed to support weight loss programs. However, there are also many other benefits of

rice derived from porang tubers. Porang rice is one form of processed porang which is included in the Analog Rice type. This processed Porang contains high sugar levels which are believed to be good for health. Porang rice can help lose weight and help diabetics in Indonesia as a substitute for rice. Because the calorie content is not as much as the content in white rice or other carbohydrate sources. In addition to being healthy, Porang Rice will also open up the industrial market to be even bigger. Porang is a commodity that is currently being discussed. Previously considered a wild plant, Porang is now considered a potential commodity that has high economic value. A number of countries such as the United States, Korea, China, Vietnam, Australia, and others, rely on porang from

Indonesia. At present, the world's demand for flour and porang tuber chips has only been met by about 20 percent (Source: PanganNews.id). Based on data from the Central Bureau of Statistics in its presentation, the rice harvest area in 2021 reached around 10.41 million hectares, a decrease of 245.47 thousand hectares or 2.30 percent compared to 2020 which amounted to 10.66 million hectares and rice production in 2021 was 54.42 million tons of milled dry grain (MDG), a decrease of 233.91 thousand tons or 0.43 percent compared to 2020 which amounted to 54.65 million tons of MDG. Of course, these two things affect rice production in Indonesia where rice production in 2021 is shown in the Figure 1.



**Figure 1.** Graph of the decline in rice production in 2020-2022  
(Source: Badan Pusat Statistik Indonesia (BPS))

There is a decrease in rice production in Indonesia, this makes the influence of this porang rice product an alternative and has a great opportunity to meet food needs in Indonesia. Porang tuber plant which has the Latin name *Amorphophallus muelleri*. Porang tubers can be diet food. This plant is still related or similar to suweg, or walur. so it is still confused to distinguish it because of many similarities. Although now there is a lot of cultivation, the use or change into food in the country is still relatively small (Bambang Nurcahya et al., 2022). Porang rice with the XYZ brand has been on the market since 2022. Enthusiasm due to unique serving techniques and great benefits for health make porang rice with the XYZ brand get good attention by

consumption. Although the competitiveness associated with this industry is still not large, the quality of this XYZ Brand Porang Rice product must be maintained properly because with good quality consumers will be convinced to replace ordinary rice with XYZ Brand Porang Rice. Based on calculation using QFD method, it shows that split liner has the highest percentage of technical requirement in tire industry about 30, 57%. The second factor is pattern design about 25, 98% (Hadi et al., 2017). Previous research Quality Function Development (QFD) is a method that can be used for the planning process, development or quality improvement of a product and service. The approach of applying the QFD method in the manufacturing seat industry can analyze

customer needs, know what to do by the company, and apply it to the product and manufacturing process (Purba et al., 2020).

## 2. LITERATURE REVIEW

The quality function deployment is generally integrated into the New Product Development process, involving a cross multi-functional team approach with R&D, marketing, engineering, and production). With the aim of identifying the customer requirements and translating then into technical requirements. The QFD starts with the identification of the customer and the determination of their true voice (Fonseca et al., 2020). The QFD model helps generate effective strategies by considering customer needs and technical requirements together and the Theory of the Solution of Inventive Problems (TRIZ) is an important technique applied to develop

innovative solutions to problems (Li et al., 2022). The QFD method by making some adjustments to the house of quality (HOQ) matrix. We eliminated several matrices to be more efficient for the purpose of this study (Mubarok & Sasongko, 2023). The expert team participated extensively in translating and determining the relationship to each term and variable used in this study. We propose several priority improvement actions that can have a significant impact and meet the priority requirement of customers as a result from the quality perspective (Wicaksono et al., 2021). The QFD method uses the HoQ, which is a tool in the form of graphical techniques to accurately translate the relationship between customer needs requirements so that companies can design products, to meet customer needs (Nalhadi et al., 2022).

## 3. RESEARCH METHOD

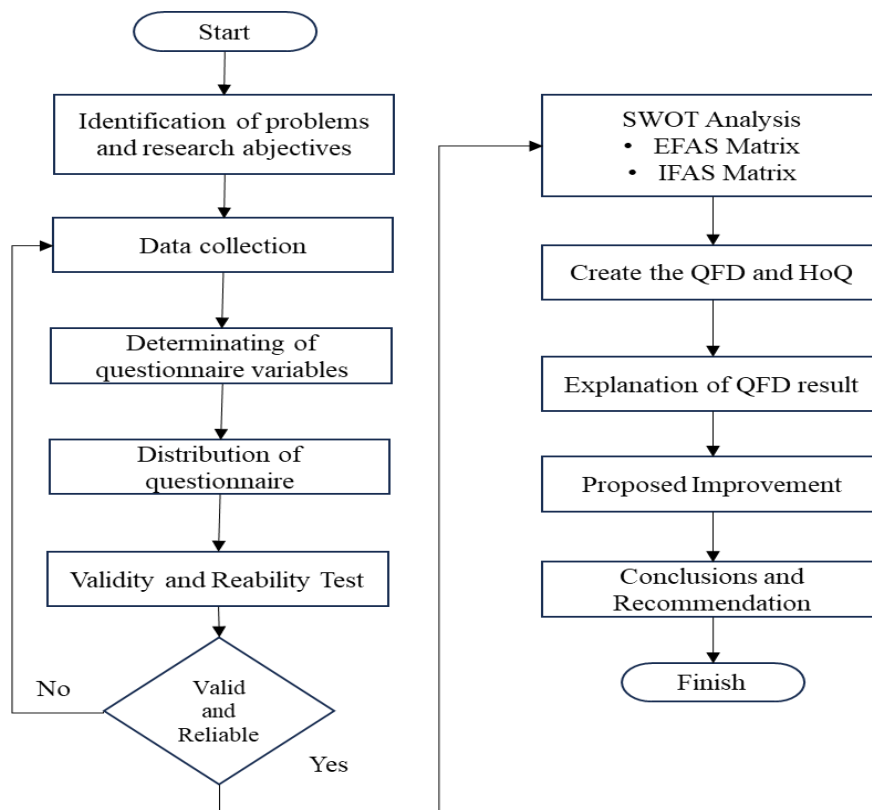


Figure 2. Flowchart diagram of research

This study takes data based on the response of consumers of Porang XYZ Rice products through the distribution of questionnaires,

observation and recording directly in the field. To determine the respondents of the questionnaire, the sample used in this study is

the number of consumers who bought xyz porang rice products between October and December 2022 as many as 6950 people. The number of sales is used as Population (N). So with the number of people who buy the product will be used as a benchmark in determining the right respondent in this study. The formula for determining respondents is as follows:

$$n = \frac{N}{1+N e^2}$$

$$= \frac{6950}{1+6950(0.1)^2}$$

$$= \frac{6950}{1+69.50} = 98,58$$

With the above calculations, the minimum number of respondents is 99 people. In this study we took 100 respondents whom we distributed questionnaires as samples. After the data is collected, the next step is to process the data and analyze the data as follows:

**a. SWOT**

**Table 1.** IFAS matrix

No	Strengths Factors	T	R	W	S
1	Has good product quality	14	0.14	4	0.56
2	Health benefits of the product	13	0.13	4	0.52
3	Little product competition	12	0.12	4	0.48
4	Ease of Consumers in managing it	12	0.12	3	0.36
5	Social media marketing strategy	10	0.1	3	0.3
<b>Total Strength</b>					<b>2.22</b>
<b>Weakness Factors</b>		<b>T</b>	<b>R</b>	<b>W</b>	<b>S</b>
1	Unaffordable price	14	0.14	2	0.28
2	Less Product Variety	13	0.13	2	0.26
3	Product marketing is not yet widely available in stores	12	0.12	2	0.24
<b>Total weakness</b>					<b>0.78</b>
total number of strengths + weaknesses		100	1.00	3.00	
<b>Total Difference Strengths - weaknesses</b>					<b>1.44</b>

Note :

T :Total R:Rating

W: Weight S: Score

From the IFAS matrix table above, the total

The research method carried out in this study is a qualitative and quantitative descriptive model in the form of calculations related to SWOT analysis which is assisted by using the IFAS and EFAS matrices. The IFE and EFE matrix consists of columns of weight, rating and total value which is the product of weight and rating. The weight and rating columns are filled in according to the value which is the result of grouping internal and external factors based on their level of importance.

**b. House of Quality (HOQ)**

HOQ itself is a supporting method of Quality Function development (QFD). Where this HOQ method describes the use of a matrix that connects customer desires with practitioners. So that later the resulting output will be able to concentrate on the desired customer needs that narrow down to the most important and valuable matrix.

**4. RESULT AND DISCUSSION**

Based on the research conducted, the respondents of XYZ Porang Rice obtained the strengths, weaknesses, opportunities and threats described in the Table 1.

value between strengths and weaknesses is 3.00 and the greatest weighting value on the strength factor is about good product quality, product benefits for health and little product competition. For the weakness factor, the price is not affordable to be the highest score of 0.28 compared to other factors.

**Table 2.** EFAS matrix

No	Opportunity Factors	T	R	W	S
1	High population growth	14	0.14	4	0.56
2	Public awareness and interest in living a healthier life	13	0.13	4	0.52
3	Government support as it relates to food production	12	0.12	3	0.36
4	Diabetic Consumer or Diet Consumer	10	0.1	2	0.2
<b>Total Opportunity</b>					<b>1.64</b>
<b>Threat Factors</b>		<b>T</b>	<b>R</b>	<b>W</b>	<b>S</b>
1	Emergence of competition from new entrants	14	0.14	4	0.56
2	Weather Factors affecting Porang Farmers	14	0.14	4	0.56
3	unstable raw material prices	13	0.13	3	0.39
4	Existence of substitute products	10	0.1	2	0.2
<b>Total threat</b>					<b>1.71</b>
<b>Total number of Opportunities + Threats</b>					<b>3.35</b>
Sum of the difference between opportunities - threats					<b>0.07</b>

In the data above, the total value in the EFAS Matrix is 3.35 with a total opportunity value of 1.64 and a threat value of 1.71. Referring to the data above, of course the threat factor in this business opportunity is large with the existing factors.

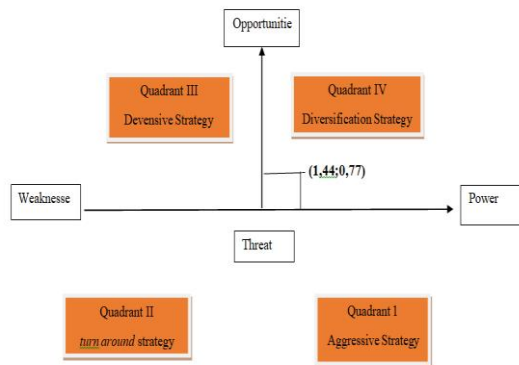


Figure 3. Quadrant position matrix of SWOT

Based on the results of data processing carried out using SWOT, XYZ brand Porang Rice is in Quadrant 1 position which is a very profitable position where XYZ Brand Porang Rice has opportunities and strengths so that it can take advantage of existing opportunities. The tactic recommendation given is Progressive, meaning that the organization is in prime and good condition. So it is really possible to continue to expand, enlarge growth and achieve maximum progress. To carry out expansion and enlarge growth, it is necessary to develop products with good quality. Where the product development is through the Quality Function Development (QFD) approach at the initial stage of QFD, namely by exploring what the customer needs so that it will help the company get the right recommendations according to customer needs. In the initial stages of the QFD approach, namely by identifying and collecting what consumers need and want. XYZ Brand Porang Rice products are analyzed in this study by comparing competing rice products, namely Brand K shirataki rice. Attributes in improving product quality are used as customer needs formulated in the Table 3.

Table 3. Customer needs

No.	Attributes
1	Good Taste
2	Good Rice Texture (Fluffy)
3	High Fiber

- 4 Good fragrance
- 5 Variety of types and flavors
- 6 Long Lasting within a day of cooking
- 7 Easy to find
- 8 Competitive price with similar products
- 9 Easy processing
- 10 Strong product packaging to protect the product
- 11 Transparent product packaging to make the product visible
- 12 White Color
- 13 Whole grain size of rice
- 14 Clean
- 15 Complete ingredient composition information
- 16 There is a BPOM license number and Halal certificate
- 17 Affordable price with various groups
- 18 Packaging models with various sizes
- 19 more creative and attractive product packaging models

After doing the description related to customer needs, to follow up it is necessary to make Customer Satisfaction Performance (CSP) data. The following is the Customer Satisfaction Performance (CSP) data between XYZ Brand Porang Rice Products and K brand Shirataki rice.

Table 4. Customer Satisfaction Performance (CSF)

No.	Attributes	CSP Value	
		XYZ Brand Porang Rice	K Brand Shirataki Rice
1	Good Taste	4.70	4.50
2	Good Rice Texture (Fluffy)	4.10	4.50
3	High Fiber	3.70	4.70
4	Good fragrance	3.75	3.95
5	Variety of types and flavors	2.80	2.50
6	Long Lasting within a day of cooking	4.75	4.60
7	Easy to find	2.55	4.50
8	Competitive price with similar products	4.60	4.60
9	Easy processing	3.30	3.55
10	Strong product packaging to protect the product	4.45	4.60
11	Transparent product packaging to make the product visible	3.55	3.40
12	White Color	3.45	3.75
13	Whole grain size of rice	4.60	4.70
14	Clean	4.60	4.35
15	Complete ingredient composition information	3.40	3.45
16	There is a BPOM license number and Halal certificate	3.55	3.45
17	Affordable price with various groups	4.45	4.45

18	Packaging models with various sizes	4.25	1.45	5	Use of packaging design	3.4	3.0
19	More creative and attractive product packaging models	2.35	2.65	6	Product processing	4.6	4.1
				7	Texture produced	4.3	4.6
				8	Marketing	3.6	4.4

From Table 4 related to determining the CSP value, the CSP value for XYZ Brand Porang Rice is 4.75 with a durable attribute within a day and the lowest is on a more creative and attractive product packaging model with a value of 2.35 while for its competitors with Shirataki Rice with the K brand, the attribute that has the greatest value is the high fiber and the size of the intact rice grains with a value of 4.70 and the lowest is the attribute of the packaging model with a variety of sizes, namely 1.45. For the creation of the House of Quality (HOQ) in table 4, technical categories must be created that will be processed in the HOQ. The following is data processing for the use of QFD methods related to Technical Categories on XYZ Brand Porang Rice: (a) Porang quality (A), (b) Production Equipment (B), (c) Presentation Technique (C), (d) Use of Packaging Materials (D), (e) Use of packaging design (E), (f) Product processing (F), (g) Texture produced (G), and (h) Marketing (H). The technical category data above will be inputted in the questionnaire and used as Attributes consisting of Attributes A to Attributes H with a total of 8 Attributes. The following are the results of the level of satisfaction and the level of user importance (Table 5 and Table 6).

**Table 5.** Results satisfaction level and importance level

No	Atr	Satisfaction Level					Level of Importance				
		5	4	3	2	1	5	4	3	2	1
1	A	22	8	0	0	0	18	12	0	0	0
2	B	0	0	15	1	0	0	17	13	0	0
3	C	18	8	6	0	0	10	15	5	0	0
4	D	16	14	0	0	0	15	10	5	0	0
5	E	0	12	18	0	0	0	10	10	10	0
6	F	17	13	0	0	0	12	10	8	0	0
7	G	15	10	5	0	0	18	12	0	0	0
8	H	5	8	17	0	0	13	15	2	0	0

**Table 6.** Average satisfaction and importance level

No.	Attributes	Satisfaction Level	Level of Importance
		Average	Average
1	Porang quality	4.7	3.0
2	Production Tools	2.5	3.6
3	Presentation Technique	4.7	4.2
4	Use of Packaging Materials	4.5	4.3

From the above attribute values on all attributes the overall average value for the satisfaction level is 4.0 and the overall average value for the importance level is 3.9. So that the 8 attributes are used in making HOQ because they are valued above 3.5. The initial step in determining HOQ is starting with the following stages:

(i) Determining the level of absolute importance and relative importance based on Table 6, namely the average level of satisfaction and the level of importance. The absolute importance value is obtained from the average value of the level of importance while the relative importance is obtained from the results of the calculation as follows:(Wicaksono et al., 2021)

For example, attribute A, namely Porang quality, is calculated in terms of relative importance.

$$\text{Relative Importance Value} = \frac{30}{31.2} \times 100 = 9.61$$

**Table 7.** Absolute importance value and relative importance value

No.	Attributes	Absolute Importance	Relative Importance
1	Porang quality	3.0	9.63
2	Production Tools	3.6	11.55
3	Presentation Technique	4.2	13.48
4	Use of Packaging Materials	4.3	13.80
5	Use of packaging design	3.0	9.63
6	Product processing	4.1	13.16
7	Texture produced	4.6	14.76
8	Marketing	4.4	14.12

(ii). Determination of goal or target in product development Goals and targets in the development of xyz brand poran rice products depend on existing attributes where product development goals and targets are related to the level of satisfaction with the product. Goal or target value The average product quality indicator is 4 and 5 where it shows that the product development team has a positive target, of course this is a must that must be supported and considered to provide comprehensive improvements so that customer desires can be fulfilled.(Pengembangan et al., 2023).

(iii). Improvement Ratio. Ratio is one of the parameters that describe the quality of a product so that it is a benchmark in the success of product development. The calculation of the development ratio value is exemplified as follows for the Porang Quality Attribute (A) as follows:

$$Development\ Rasio = \frac{4}{4.7} = 0.85$$

**Table 8.** Improvement Ratio (IR) values

No.	Attributes	IR
1	Porang quality	0.845
2	Production Tools	1.600
3	Presentation Technique	0.857
4	Use of Packaging Materials	0.882
5	Use of packaging design	1.176
6	Product processing	0.876
7	Texture produced	0.923
8	Marketing	1.111

(iv) Determining Sales Points. The sales point value shows how much influence the fulfillment of consumer needs has on the product. The determination of the Sales Point value is based on the ItC value: (a) For consumer needs with an ItC value > 3, a Sales Point value of 1.5 (Strong Sales Point) is set if these needs are met, there will be an increase in sales. (b) For consumer needs with a value of  $2 < ItC \leq 3$ , a Sales Point value of 1.2 (Medium Sales Point) is set if these needs are met, there will be an increase in sales, although not too large. (c) For consumer needs with an ItC value  $\leq 2$ , a Sales Point value of 1 (No Sales Point) is set if these needs are met, there will be no increase in sales.

In general, the sales point that is most often used is Point sales 1.2. For Point sales value

1,2 this will be used on all 8 attributes (Li et al., 2022; Setyabudi et al., 2022).

(v). Determining importance weight (row weight). Row Weight is a model of the overall interest of the product development team that bridges the needs of consumers.

Value calculation formula (Row Weight) = (Importance to Customer) x (Improvement Ratio) x (Sales Point). For example Attribute A  $RW = 10 \times 0.845 \times 1.2 = 10.14$

(vi). Determining Normalized Row Weight (NRW)

NRW shows the importance of the Row Weight value compared to the Total Row Weight value.

NRW Formula as follow= $RW/(RW\ Total)$

**Table 9.** Calculation results of RW and NRW values

No	Attributes	Raw Weight (RW)	Normalized Raw Weight (NRW)
1	Porang quality	10.140	0.079365576
2	Production Tools	23.040	0.180333617
3	Presentation Technique	14.398	0.112689902
4	Use of Packaging Materials	15.170	0.118738602
5	Use of packaging design	14.112	0.110454513
6	Product processing	14.366	0.1124457
7	Texture produced	16.983	0.132927373
8	Marketing	19.554	0.15304587

From the calculation results for RW and NRW values, the average value is above 10% and the largest value is at the Production Equipment Attribute of 18%, then the Marketing Attribute of 15% and the resulting Texture Attribute has a value of 13%. So that these three attributes become priorities that need to be improved to improve quality and customer desires.(Siwec et al., 2023).

(vii). House of Quality (HOQ)

HOQ functions to describe and connect the voice of the customer with the voice of the company. In this study, the form of proposed improvements is described in the form of a house of quality (HOQ).(Sales et al., 2021).

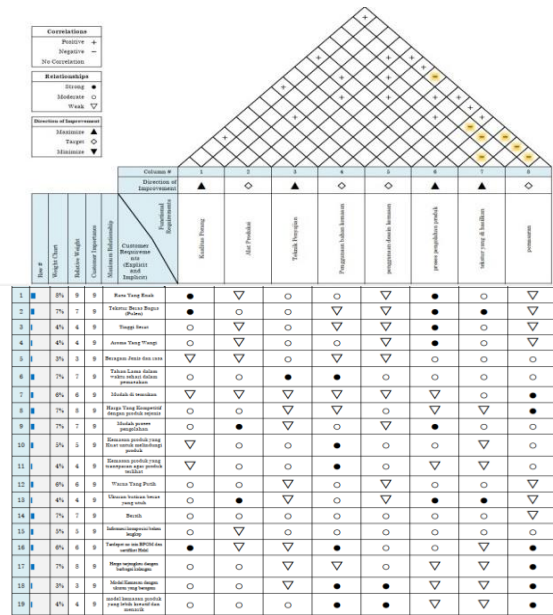


Figure 4. House of quality

### 5. CONCLUSION

Porang rice is rice made from porang tubers, where porang rice will be an alternative as a staple in the future. Currently in the community itself there are still many who do not recognize porang rice as an alternative raw material for rice substitutes. For this reason, improving product quality is one of the things that companies must do to introduce products with the research obtained from the HOQ results that the 3rd largest value of priority improvements is in the production tool, then followed by marketing, and the third is in the texture produced. Suggestions that can be given to companies are to continue to innovate product development according to the needs of consumers. Focus on product introduction in the community that staple foods such as rice can be replaced with porang rice.

### REFERENCES

Fonseca, L., Fernandes, J., & Delgado, C. (2020). QFD as a tool to improve negotiation process, product quality, and market success, in an automotive industry battery components supplier. *Procedia Manufacturing*, 51(2019), 1403–1409. <https://doi.org/10.1016/j.promfg.2020.10.195>

Hadi, H. A., Purba, H. H., Indarto, K. S., Simarmata, R. G. P., Putra, G. P., Dabith Ghazali, D., and Aisyah, S. (2017). The implementation of quality function deployment (QFD) in tire industry. *ComTech: computer, mathematics and engineering applications*, 8(4), 223-228. <https://research.binus.ac.id/publication/57FBA517-3939-4FA7-A173-02BFEF41489A/the-implementation-of-quality-function-deployment-qfd-in-tire-industry/>.

Li, W., Yüksel, S., & Dinçer, H. (2022). Understanding the financial innovation priorities for renewable energy investors via QFD-based picture fuzzy and rough numbers. *Financial Innovation*, 8(1). <https://doi.org/10.1186/s40854-022-00372-3>

Mubarak, A. A., & Sasongko, R. M. (2023). Menerjemahkan Voices of the Customer (VoC) Kedalam Inovasi Produk Melalui Quality Function Deployment (QFD) pada UMKM KULINER. *Journal of Economic, Business and Engineering (JEBE)*, 4(2).

Nalhadi, A., Subentar, B., & Supriyadi, S. (2022). Perancangan Kemasan Produk Kue Gipang Pangrih Menggunakan Metode Quality Function Deployment. *JiTEKH*, 10(2), 52–59. <https://doi.org/10.35447/jitekh.v10i2.560>

Nurchaya, S. B., Mantri, Y. M., Hatimatunnisani, H. (2022). Analisis Potensi Porang sebagai Pengganti Beras untuk Ketahanan Pangan di Kabupaten Pangandaran. *Jurnal Pendidikan, Humaniora, Linguistik dan Sosial (JAGADDHITA)*, 1(1), 22-32. <https://doi.org/10.58268/jagaddhita.v1i1.18>

Purba, H. H., Sunadi, S., Suhendra, S., & Paulina, E. (2020). The Application of Quality Function Deployment in Car Seat Industry. *ComTech: Computer, Mathematics and Engineering Applications*, 11(1), 35-42. <https://doi.org/10.21512/comtech.v11i1.6329>



- Sales, J. P. De, Salvador, J., Bastos, B., Araujo, A. H. De, Almeida, G. De, & Santos, G. (2021). *Barbosa Quality Management in the Contours of Continuous*. 16(3), 689–702.
- Setyabudi, M. F., Kurniawan, M. D., & Jufriyanto, M. (2022). USULAN Pemasaran Produk Gawang Baju Menggunakan Metode SWOT dan QFD (Studi Kasus: UKM Avandi Teknik). *JISI: Jurnal Integrasi Sistem Industri*, 9(1), 25. <https://doi.org/10.24853/jisi.9.1.25-35>
- Siwiec, D., Pacana, A., & Gazda, A. (2023). A New QFD-CE Method for Considering the Concept of Sustainable Development and Circular Economy. *Energies*, 16(5), 1–21. <https://doi.org/10.3390/en16052474>
- Wahyunawati, S. (2023). Penggunaan Matriks SWOT dan QSPM dalam Menentukan Strategi Pengembangan Kompetensi Karyawan PT.Ketapang Subur Lestari. *MAMEN (Jurnal Manajemen)* 2(1), 44–59. <https://doi.org/10.55123/mamen.v2i1.1365>
- Wicaksono, T., Hossain, M. B., & Illés, C. B. (2021). Prioritizing business quality improvement of fresh agri-food smes through open innovation to survive the pandemic: A qfd-based model. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2), 156. <https://doi.org/10.3390/joitmc7020156>