

Development of Generator Set Product Services Using Quality Function Deployment at PT X

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Abstract. In the service industry, service quality has a significant effect on customer satisfaction. The manufacturing industry and the service industry have different characters, as well as the measurement of the quality of the services produced. The company's ignorance of customer desires and expectations of the services provided causes services far from the expectations desired by the company which can result in moving consumers to competitors who will provide services in accordance with their expectations. Therefore, this research was conducted with the aim of developing services in generator rental using Quality Function Deployment (QFD) method with the hope of providing an overview of the desires and expectations desired by consumers for services owned by PT X. The results of the Quality Function Deployment analysis of the highest scale factor value in the analysis using the QFD method the top order is on the characteristics of "Adding Genset Stock That Does Not Exist" with a score of 185.

Keyword: Quality Function Deployment, Voice of Customer, Service Development, Genset

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1. Introduction

Advances in technology and information have changed the lifestyle of many people [1]. From this changing lifestyle, the industrial world is always required to make the latest innovations in products or services using appropriate technology in improving and developing a product both functionally, economically, efficiently, and effectively [2]. In the industrial world, it is divided into 2 industrial fields, namely the service industry and the manufacturing industry.

The differences in the characteristics of the service industry and the manufacturing industry are very different, as well as the measurement of the quality of services produced [3]. In the service industry, service quality has a significant effect on customer satisfaction [4]. Therefore, creating service quality is important so that companies can win competition in the industrial world and can provide benefits, namely customer loyalty with providers of goods or services. Service is a performance of appearance, intangible, and customers are more able to actively participate in the

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process of consuming these services [5]. Commitment to customer-oriented service quality is one of the main factors in supporting the success of a business, especially in the service industry [6].

PT X is a business that operates as a distributor or supplier or dealer that sells generators and panel makers. Some of the products sold by PT X include open type generators, silent, silent trailer all brand AMF ATS panels, genset synchronal panels, MDP panels, and so on. Therefore, PT X sells and rents generators by looking at its target market, namely new businesses and an old business with specifications requiring generators to support additional electricity needs for activities within the company.

So, PT X needs to know what factors are desired and expected by consumers of its products and see from the service factors provided to its consumers in order to provide satisfaction and will also retain customers to remain loyal. The decline in interest in renting generators by PT X consumers which caused a decrease in income and the amount of competition from similar companies made PT X need service quality measurements. One of the quality measurement methods that can translate the needs and desires of consumers and to improve products or services that have not and do not meet customer desires and expectations is the QFD (Quality Function Deployment) method [3]- [7].

Quality Function Deployment (QFD) is a methodology used to fulfill the needs and desires of consumers into product design in a structured manner, namely the right technical attributes in product development [8]-[9]. Voice of Customer is the main input for the HOQ creation process and has an important role and is the first step in compiling the customer requirements matrix and the basic input of the QFD method [10] and [11]-[12]. In order to develop more attractive products, the link between QFD and marketing needs to be developed, and new methods to do so need to be developed [13].

The purpose of the QFD method itself is to increase customer satisfaction, improve communication, increase competition with continuous quality and productivity improvements by increasing product reliability, increasing company profits and reducing design costs, and improving performance through improving the current system [14] and [15]-[16].

Through the processing of the QFD method, we will know what are the priorities of service quality in order to meet the needs and desires of consumers [17]. The purpose of this research is needed because it can provide recommendations for improving service quality based on the level of consumer desires, so that there is no decline in interest in renting generators by consumers at PT X and in order to compete with similar competitors.

2. Research Methodology

Development research (Research and Development) was the method adopted in this research. Data collection is done by making a questionnaire regarding statements in accordance with consumer expectations and needs, and in distributing research questionnaires addressed to respondents, namely organizations or people who own or use generators in the East Java region. The sample used as respondents as many as 30 with purposive sampling method. The measurement scale used is using a Likert scale, with research intervals for each answer, namely the scale has 5 levels [18].

Table 1 Likert Scale

Score	Description
1	Not Very Important
2	Not Important
3	undecided
4	Important
5	Very Important

QFD is a quantitative method that uses a quality matrix to translate customer requirements into engineering features [19]. Processing this QFD method will determine the development of quality in projecting with the aim of satisfying consumers [17]. In this study, the data collected is quantitative data which uses the Quality Function Deployment (QFD) method to analyze the improvement of service quality in accordance with the wants and needs of consumers which will be translated using the House of Quality (HOQ) matrix [20].

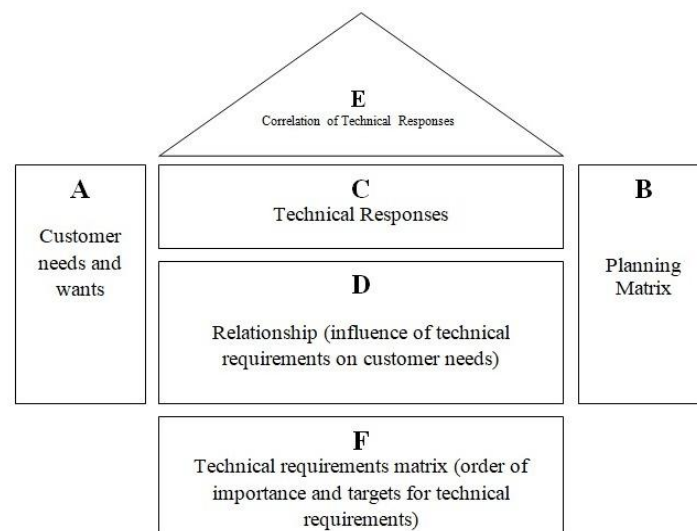


Figure 1 House Of Quality

In this research, QFD analysis only focuses on phase 1. The priority of attributes that become customer expectations and technical responses from the company will then be translated using improvement projects or development projects.

3. Results and Discussions

At the stage of data processing using Quality Function Deployment begins with data collection to explore the information used as a basis for solving problems in terms of service in the rental of generator products at PT X, the data obtained will then be tested for reliability and validation first. In calculating the validity test and reliability test using IBM SPSS Statistic 21 software to determine the results of distributing questionnaires.

Table 2 Validity Result

No	Statement	R-Calculated Value	R Table Value	Description
1	Company location	0,825	0,361	Valid
2	Road access to the company location	0,727	0,361	Valid
3	Speed of delivery of generators to consumers	0,771	0,361	Valid
4	Customer service friendliness in serving consumers	0,787	0,361	Valid
5	Fast service, responsive, and able to understand consumers	0,752	0,361	Valid
6	Ease of ordering generators	0,750	0,361	Valid
7	The function of the generator product	0,511	0,361	Valid
8	Quality of the generator set product	0,578	0,361	Valid
9	The ability of help desk personnel to guide and identify generator disturbances	0,541	0,361	Valid
10	Speed of handling generator disturbances	0,485	0,361	Valid
11	Ready availability of generator set products in rental	0,486	0,361	Valid
12	Quality assurance of generator set products in generator set rentals	0,613	0,361	Valid
13	Warranty for the generator set	0,653	0,361	Valid
14	Economic life of the generator set	0,624	0,361	Valid
15	Online service information	0,524	0,361	Valid
16	Company web provides information for customers	0,413	0,361	Valid
17	Promotion in print, electronic media, internet, etc.	0,541	0,361	Valid
18	Quality assurance of generator set products	0,415	0,361	Valid
19	Fulfillment of generator set product quality for consumers	0,551	0,361	Valid
20	Completeness of generator product specifications	0,468	0,361	Valid
21	Always provide new goods or products that have buyer appeal	0,609	0,361	Valid
22	Promotion offered in the rental of generators	0,689	0,361	Valid
23	Ease of operation in using generators	0,669	0,361	Valid
24	Flexible (easy to move) affects you in using generators	0,606	0,361	Valid
25	The price of generator rental according to you	0,663	0,361	Valid
26	The size of the generator affects the needs of the activity	0,574	0,361	Valid
27	The noise of the generator set affects the activity needs	0,622	0,361	Valid
28	The weight of the generator affects the use of the generator	0,585	0,361	Valid
29	Generator set design	0,640	0,361	Valid
30	Accessories (wheels) for generator products	0,694	0,361	Valid
31	Engine type on generator set products	0,664	0,361	Valid
32	Type of fuel in generator products	0,720	0,361	Valid
33	A product is able to meet consumer needs	0,422	0,361	Valid

Table 3 Reliability Result

Reliability Statistics	
Cronbach's Alpha	N of Items
.723	34

To find out that the questionnaire is said to be valid or not if the r_{count} value is greater than r_{table} ($r_{count} > r_{table}$), then the instrument item is valid, but on the other hand, if r_{table} is smaller than r_{count} ($r_{count} < r_{table}$), the instrument is invalid and is not used in research [7]. In this study, it was found that $n = 30$, the confidence level of (Degree of Freedom) $df = n - 2 = 30 - 2 = 28$ and a significant value of 5%, a value of 0.361 was obtained. Table 2 shows that all questions are said to be valid because the r count value is greater than the r table ($r_h > r_t$). From table 3 the results of the reliability with the value that Cronbach's Alpha is higher than the value of $\alpha = 0.700$ which has been determined, namely $0.723 > 0.700$ these results prove that the questions in the questionnaire are declared reliable.

3.1. Quality Function Deployment

The flow of applying the QFD method is based on the quality assurance dimensions used in accordance with the opinions of PT X consumers who need appropriate service quality. The service process will be assessed by consumers through 3 variables, namely Tangibles, Responsive, and Product Deployment. Where the Tangibles variable is used to assess the appearance and ability of PT X facilities and infrastructure in providing services, the responsive variable is used to assess policies in helping and providing services to customers, and the product development variable is used to determine the value of the level of importance in providing products at PT X whether it is good and in accordance with the needs and desires of consumers.

Then these service quality variables will be entered into the House of Quality (HOQ) matrix for analysis. Through the House of Quality matrix, information such as consumer needs, technical characteristics of the product or service objectives developed and so on can be obtained which can be used for continuous quality improvement. All of this information is very useful for companies to determine what actions to take, and what innovations must be developed so that the products or services developed can be better than before. In the preparation of HOQ, there are several components, namely the preparation of HOQ Technical Relationships, the preparation of HOQ Technical Correlations, the preparation of technical priorities.

A. *Compilation of HOQ Technical Relationships*

The relationship (influence of the influence of technical requirements on customer needs) (D) contains an assessment of the correlation between the elements of the technical response in the technical response (C) with each customer's needs and desires (A). Correlation filling there is a symbol used as table 4 below [9]:

Table 4 Correlation Value Table for HOQ

Symbol	Relationship	Value
•	Strong	9
○	Medium	5
△	Weak	1

In Figure 2 below, it shows the assessment of the strength of the correlation between the elements of the technical response in the technical response (C) with each customer's needs and desires (A).

B. Compilation of HOQ Technical Correlations

Technical characteristics or technical requirements are translators of consumer needs in technical form so that a product can be formed directly. In this section there are specific targets that will be set based on the company's capabilities that have been determined through Customer Needs, the technical requirements of each consumer need can be seen in Table 5.

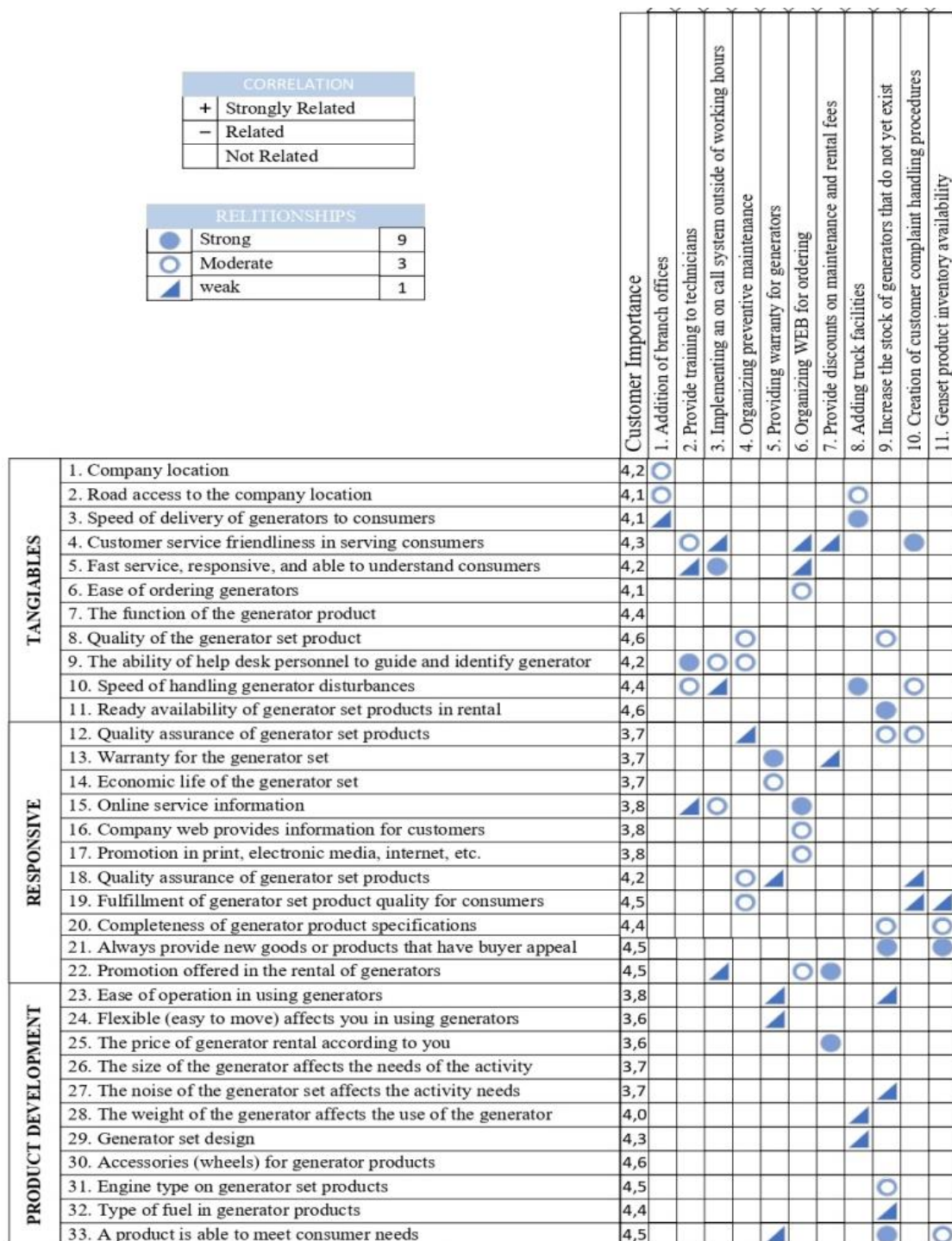


Figure 2 HOQ Technical Relationships

Table 5 Technical characteristics

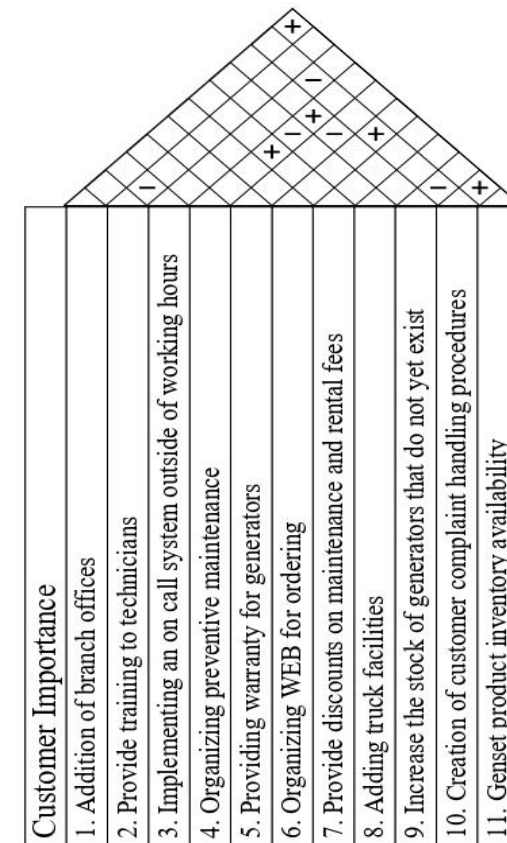
Score	Description
1	Addition of branch offices
2	Provide training to technicians
3	Implementing an on call system outside of working hours
4	Organizing preventive maintenance
5	Providing warranty for generators
6	Organizing WEB for ordering
7	Provide discounts on maintenance and rental fees
8	Adding truck facilities
9	Increase the stock of generators that do not yet exist
10	Creation of customer complaint handling procedures
11	Genset product inventory availability

Technical correlations or called technical correlations (E) show the relationship between one technical response and another. The aim is to be able to facilitate in determining the policy to be taken regarding the technical response to be implemented. The correlation between the technical responses is seen with the following symbols:

Table 6 Technical Correlations

Correlations	
+	Strongly Related
-	Related
	Not Related

It is known that the correlation of each technical response has a positive and negative relationship. Figure 3 below shows the relationship between technical responses as follows:

**Figure 3** HOQ Technical Correlations

C. Preparation of Technical Priority

Technical priority (F), useful for showing the score of each attribute multiplication between technical relationships with customer importance and after that it is summed up, that way it can get the value of the interaction matrix which will then be ranked so that the priority development of each technical parameter is obtained. Technical Priority is in Figure 4.

The HOQ matrix (B) consists of a planning matrix, which contains the relative importance of customer needs, Importance to Customer, Target value, Improvement Ratio, sales point, raw weight, normalized raw weight and comparison between PT X with competitors PT Y and PT Z.

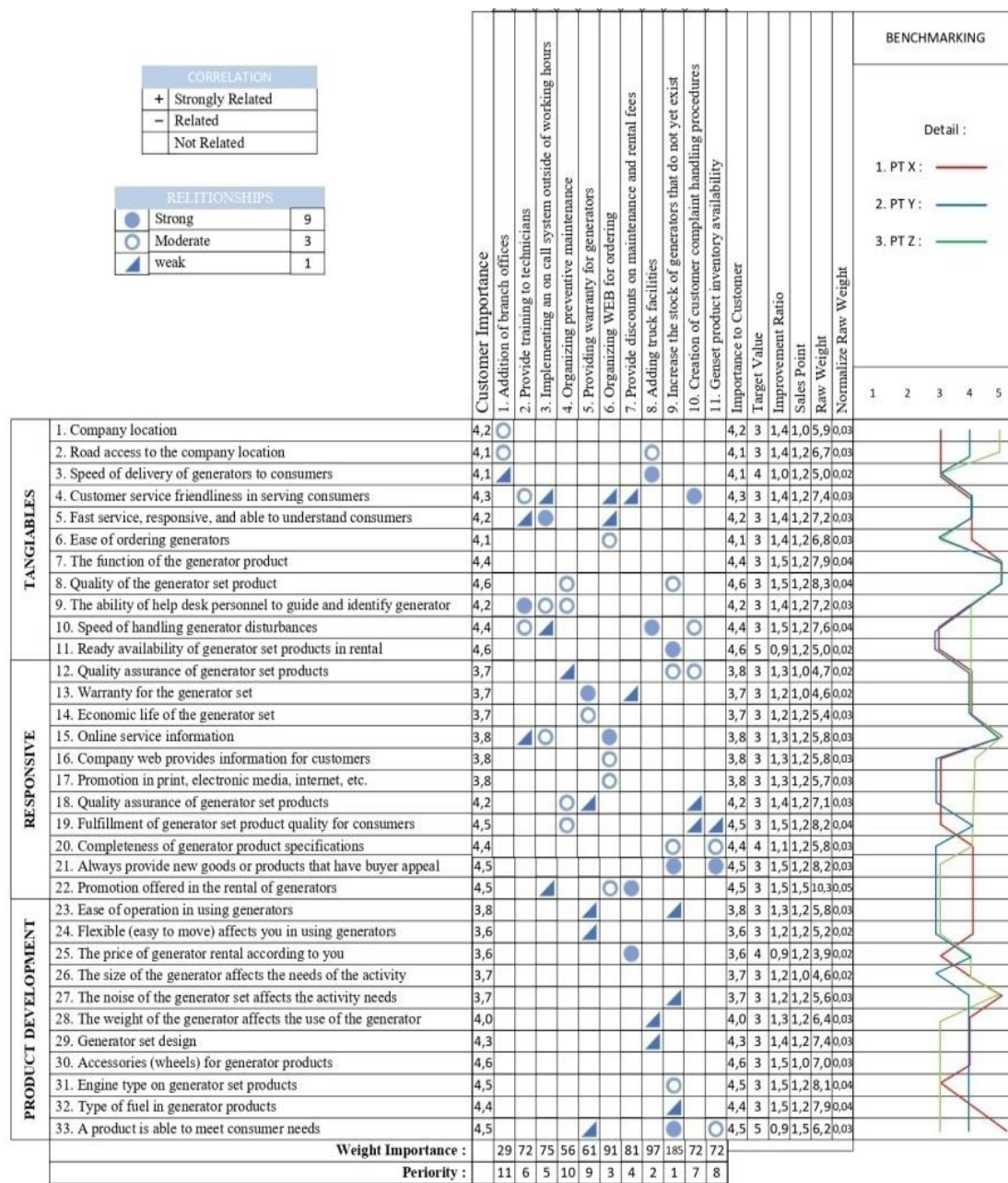


Figure 4 Technical Priority

Table 7 Normalized Raw Weight Data

No	Statement	ITC	TV	IR	SP	RW	NRW
1	Company location	4,2	3,0	1,4	1	5,9	0,03
2	Road access to the company location	4,1	3,0	1,4	1,2	6,7	0,03
3	Speed of delivery of generators to consumers	4,1	4,0	1	1,2	5	0,02
4	Customer service friendliness in serving consumers	4,3	3,0	1,4	1,2	7,4	0,03
5	Fast service, responsive, and able to understand consumers	4,2	3,0	1,4	1,2	7,2	0,03
6	Ease of ordering generators	4,1	3,0	1,4	1,2	6,8	0,03
7	The function of the generator product	4,4	3,0	1,5	1,2	7,9	0,04
8	Quality of the generator set product	4,6	3,0	1,5	1,2	8,3	0,04
9	The ability of help desk personnel to guide and identify generator disturbances	4,2	3,0	1,4	1,2	7,2	0,03
10	Speed of handling generator disturbances	4,4	3,0	1,5	1,2	7,6	0,04
11	Ready availability of generator set products in rental	4,6	5,0	0,9	1,2	5	0,02
12	Quality assurance of generator set products in generator set rentals	3,8	3,0	1,3	1	4,7	0,02
13	Warranty for the generator set	3,7	3,0	1,2	1	4,6	0,02
14	Economic life of the generator set	3,7	3,0	1,2	1,2	5,4	0,03
15	Online service information	3,8	3,0	1,3	1,2	5,8	0,03
16	Company web provides information for customers	3,8	3,0	1,3	1,2	5,8	0,03
17	Promotion in print, electronic media, internet, etc.	3,8	3,0	1,3	1,2	5,7	0,03
18	Quality assurance of generator set products	4,2	3,0	1,4	1,2	7,1	0,03
19	Fulfillment of generator set product quality for consumers	4,5	3,0	1,5	1,2	8,2	0,04
20	Completeness of generator product specifications	4,4	4,0	1,1	1,2	5,8	0,03
21	Always provide new goods or products that have buyer appeal	4,5	3,0	1,5	1,2	8,2	0,04
22	Promotion offered in the rental of generators	4,5	3,0	1,5	1,5	10,3	0,05
23	Ease of operation in using generators	3,8	3,0	1,3	1,2	5,8	0,03
24	Flexible (easy to move) affects you in using generators	3,6	3,0	1,2	1,2	5,2	0,02
25	The price of generator rental according to you	3,6	4,0	0,9	1,2	3,9	0,02
26	The size of the generator affects the needs of the activity	3,7	3,0	1,2	1	4,6	0,02
27	The noise of the generator set affects the activity needs	3,7	3,0	1,2	1,2	5,6	0,03
28	The weight of the generator affects the use of the generator	4,0	3,0	1,3	1,2	6,4	0,03
29	Generator set design	4,3	3,0	1,4	1,2	7,4	0,03
30	Accessories (wheels) for generator products	4,6	3,0	1,5	1	7	0,03
31	Engine type on generator set products	4,5	3,0	1,5	1,2	8,1	0,04
32	Type of fuel in generator products	4,4	3,0	1,5	1,2	7,9	0,04
33	A product is able to meet consumer needs	4,5	5,0	0,9	1,5	6,2	0,03

The description for table 4 above is:

1. ITC = Importance to Customer, namely Determination of the level of importance of the weighting scale used in determining the level of importance.

$$Y_i = \frac{(E1 \times 1) + (E2 \times 2) + (E3 \times 3) + (E4 \times 4) + (E5 \times 5)}{n} \quad (1)$$

Where Y_i is described as score of respondents' expectations of service attribute I, E1 as total respondents who answered "very unimportant", E2 as total respondents who answered "not important", E3 as total respondents who answered "undecided", E4 as total respondents who answered "important", E5 as total respondents who answered "very important", and n as number of respondents.

2. TV = Target Value, namely the value given by the company management from the perception of performance appraisal by consumers.
3. IR = Improvement Ratio, which is to determine the value that must be achieved by the company to achieve the set target.

$$\text{Improvement Ratio} = \frac{\text{Goal}}{\text{Performance}} \quad (2)$$

4. SP = Sales Point, which is information about the benefits of customer needs if fulfilled and has an impact on company sales.
5. RW = Raw Weight, which is the amount of effort required to implement the improvement of the attribute and the potential value of the service [21].

$$\text{Raw Weight} = (\text{importance to customers}) \times (\text{improvement ratio}) \times (\text{sales point}) \quad (3)$$

6. NRW = Normalized raw weight is the amount of contribution of the attribute to the fulfillment of customer desires on a scale of 0-1.

$$\text{Normalized raw weight} = \frac{\text{raw weight}}{\sum \text{raw weight}} \quad (4)$$

The results of further processing will be compiled in the form of a House of Quality (HOQ). HOQ contains information such as consumer needs, technical characteristics of the purpose of the product or service being developed and so on. All of this information is very useful for companies to determine what actions to take, and what innovations must be developed so that the products or services developed can be better than before. So, the form of HOQ this research is in Figure 5 below.

Based on the results The application of the Quality Function Deployment (QFD) method in improving service quality provides a systematic and structured approach to understanding customer needs from PT X, integrating customer voices in service design, setting improvement priorities. It is known that the value of the highest scale factor is for the characteristic "Adding Stock Generators That Do Not Exist" with a score of 185. The addition of generator stock that does not yet exist is related to customer desires for PT X services, namely the quality of generator products, ready availability of generator products in rental, generator quality assurance,

completeness of generator specifications, always providing goods or products, easy to operate generators, generator noise levels, wheel accessories for generator products, engine types for generator products, fuel types for generator products, and products that meet consumer needs.

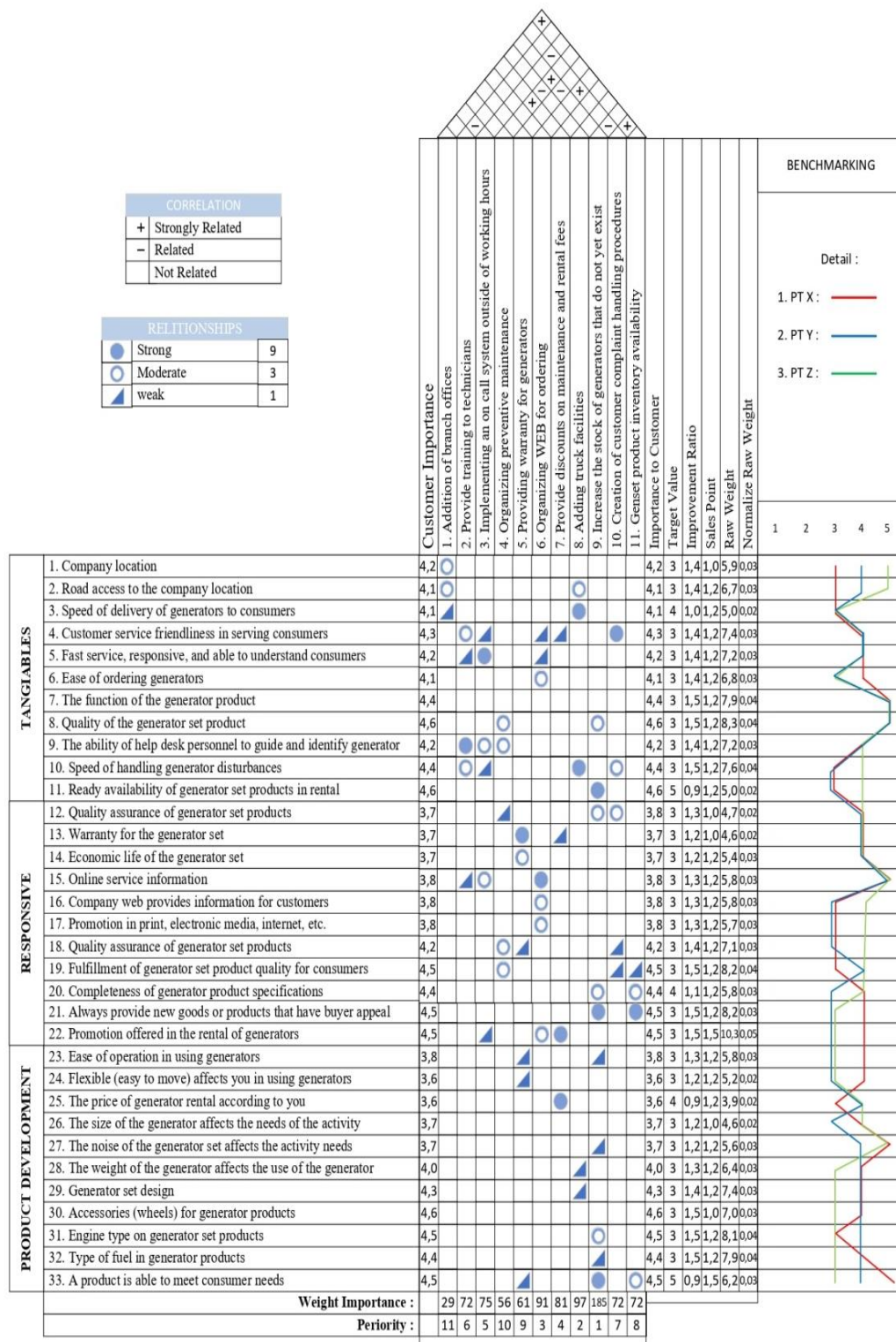


Figure 5 House of Quality Result

4. Conclusions And Suggestions

Based on the results of the discussion of this study, the conclusions of the results of this study are as follows: The level of importance of consumer desires in the first order is the quality of generator products, ready availability of generator products for rental, and the addition of accessories (wheels) to the generator with a score value of 4.6. From the Raw Weight data obtained attribute Promotion offered in the rental of generators occupies the top position with a score of 10.3 and a Normalized raw weight score of 0.05 where in this case it can be interpreted the amount of effort that must be done by the company to be able to meet consumers. The highest scale factor value in the analysis using the Quality Function Deployment method in the top order for the contribution of technical responses to consumer desires is on the characteristic "Increase the Stock of Generators That Do Not Exist" with a score of 185.

As a consideration of the research results to improve the development of generator services in the future it is recommended to using the Quality Function Deployment method up to phase four. It is also recommended to pay attention to customer expectations through the level of importance, namely the quality attributes of the generator product and always ready to provide generator products, because the quality of the generator product and always ready to provide generator products are the main priorities of customers when renting generators.

Increased satisfaction is also seen in the always ready availability of generator products where the project results suggest additional stock of products that do not yet exist. Increased customer satisfaction in terms of promotions offered in generator rentals will have an impact on price revisions for rentals.

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