The Analysis of Performance of Fery Boats Freight Transportation of Tarakan-Sebawang Route North Kalimantan

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| Submitted: July 02, 2025 | Revised: August 10, 2025 | Accepted: August 11, 2025 |

| Published: September 25, 2025 |

ABSTRACT

UPTD Juwata Tarakan Ferry Port has opened crossing services on the Tarakan-Sebawang route (Tana Tidung Regency) since 2021. This research aims to determine the level of crossing services for passengers carrying goods on their journey. The research aims to provide input to managers to improve the quality-of service performance. Data was collected through a questionnaire filled out by 70 selected respondents from a number of ferry passengers at the time the survey was conducted. Statistical analysis of questionnaire data using a validity test obtained $r_{count} > r_{table}$, and a reliability test obtained a Cronbach alpha value > 0.70, so the data obtained was valid and reliable. Further analysis using the Customer Service Index method obtained a CSI value of 86.66 with a very satisfactory service category. The results of the Importance Performance Analysis (IPA) method analysis of 19 measurement attributes show that there are two attributes whose performance needs to be improved. Then the results of the Quality Function Deployment (QFD) method analysis provide eight activities that must be carried out, including providing lifeboats, life jackets, marking evacuation routes on ships, qualified officers and sufficient numbers to carry out evacuations and provide services to the passenger.

Keywords: fery boats freight; CSI method; IPA method; QFD method.

INTRODUCTION

Tana Tidung Regency is the youngest autonomous region in North Kalimantan Province, which is the result of expansion from Bulungan Regency based on Law No. 34 of 2007 [1]. Currently, it is growing, marked by the opening of ferry transportation using Ferry Boats serving the Tarakan-Sebawang (Tana Tidung Regency) route. This ferry is managed by UPTD (Regional Technical Implementation Unit) Juata Ferry Port Tarakan, a work unit under the North Kalimantan Provincial Transportation Agency, sailing from a special ferry crossing port located in Juata Laut Tarakan to Sebawang Port, Tana Tidung Regency [2]. The ferries operated not only serve passenger transport, but also serve the transport of goods carried by passengers.

To improve the performance of ferries in providing reliable services and meeting customer expectations, especially users of freight transport services, it is necessary to conduct a study to determine the perceptions of service users regarding performance and satisfaction levels. Furthermore, the results were analysed to come up with strategy recommendations that can serve as feedback for the stakeholders of the ferry transport providers to improve their service quality.

The Importance Performance Analysis (IPA) method is used to determine user perceptions of the performance of this Ferry service, a method introduced by John A. Martilla and John C. James since 1977 [3]. Meanwhile, to determine the level of satisfaction, the Customer Satisfaction Index (CSI) method is used, which can produce an index of the level of customer satisfaction with the service or product from the manufacturer [4]. The results of the IPA method were then analysed with the Quality Function Deployment (QFD) method, which is commonly used to develop strategies to improve service quality [5].

This study uses research variables adapted from various performance appraisal studies that have been conducted. The research variables are arranged in the form of a questionnaire, which contains matters regarding; availability of safety information and facilities on ferries [6], availability of security facilities in the form of CCTV [7], operational implementation in accordance with system operating

pISSN 2302-4240
eISSN 2655-2086
Volume 14, Issue 3, September 2025, pp.01008-01019
DOI: http://dx.doi.org/10.32832/astonjadro.v14i3.20905 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

procedures [8], availability of security officers [9], lighting lamps [10], officer responsiveness to the administrative process or goods departure documents [11], incoming goods handling charges [12], time efficiency of queues [13], weather in loading and unloading process [14], conformity of loading and unloading schedules [15], availability of loading and unloading facilities and equipment [16], labour availability for loading and unloading goods [17], skills and proficiency of officers in service [18], officer's ability to respond to service user requests [19], problems with loading devices, and safety of luggage [20], conformity of departure and berthing schedules [21], and storage capacity of goods in ferry cabins [22].

RESEARCH METHODS

Materials

Location

The location of this research was centered at the Passenger Terminal of Juwata Ferry Port Tarakan, with the research respondents being users of ferry boat services on the Tarakan-Sebawang route (Tana Tidung Regency), North Kalimantan Province.

Data collecting

The data used in this study include primary data and secondary data. Primary data was obtained through questionnaires filled out by respondents, and secondary data in the form of data on ferry boats users on the Tarakan-Sebawang route from the UPTD of Juata Ferry Port Tarakan.

Based on the monthly average recapitulation data of the ferry on the Tarakan-Sebawang route in 2023 from the UPTD Juata Ferry Port Tarakan as many as 210 users. Furthermore, the calculation of the number of samples that will become respondents is carried out, using the Slovin formula as follows [23]:

$$n = \frac{N}{1+Ne^2} \quad (1)$$

Where **n** = sample size/number of respondents, **N** = population size, **e** = percentage of tolerable leeway in sampling accuracy, and **1** = constant. This study uses an *e* score of 10% (0.1), so that a sample of 70 respondents was obtained. Primary data was collected through surveys and direct interviews with a sample of respondents who used ferry boats at the Tarakan-Sebawang route using the stratified random sampling method [24].

Methods

Importance Performance Analysis (IPA) Method

The Importance Performance Analysis (IPA) method can be used to measure user perceptions of service providers for the resulting performance and user expectations/interests in these services. The level of assessment of entity performance and user expectations is interpreted from the IPA graph in the form of a cartesian diagram as shown in Figure 1 [25].

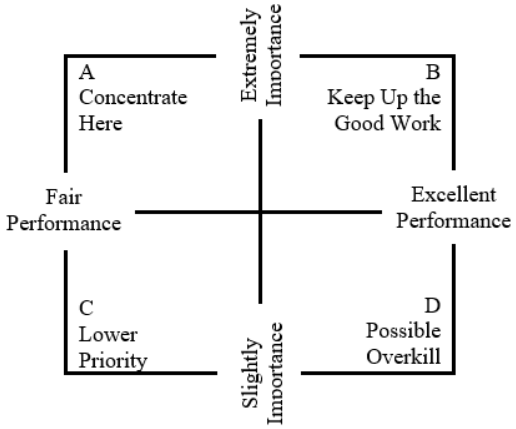

Figure 1. Diagram of IPA

The explanation of each quadrant is as follows [26]: (1) quadrant A: an area containing attributes that are considered important by users, but in reality do not match expectations, so this attribute is included in the quadrant that needs to be improved, (2) quadrant B: an area that contains attributes that are considered important and their performance is considered in accordance with user expectations, so their performance must be maintained, (3) quadrant C: contains attributes that are considered less important by users, where the facts on the ground show less than excellent performance, and (4) quadrant D: contains attributes that are considered less important, and their performance is overvalued.

Selected respondents as representatives of customers provide an assessment of the level of performance and the level of importance of service quality on the questionnaire submitted. Weighting using Likert scale with five categories of judgement as follows [27]: (a) weights 5, for answers very important (performance attributes)/very satisfied (importance attributes), (b) weights 4, important/satisfied answer, (c) weights 3, undecided answer, (d) weights 2, unimportant/unsatisfied, and (e) weights 1, very unimportant/very unsatisfied answer.

The results of weighting the level of performance and user interests are mapped in the IPA Cartesian diagram, so that the attributes that need to be prioritized to improve performance are known. Research attributes that refer to previous studies are arranged in a questionnaire as presented in Table 1 below.

Table 1. Research Attributes

Number of attributes	Description of attributes
1	Availability of safety information and facilities on the ferry
2	Availability of security facilities in the form of CCTV on ferry boats
3	Operational implementation in accordance with system operating procedures
4	Availability of security officers on ferry boats
5	Availability of lighting lamps on ferry boats
6	Officer responsiveness to the administrative process or goods departure documents
7	Cost for handling goods entering the ferry boats
8	Freight transportation rates per package to destination
9	Efficient queue time to entering the ferry boats
10	Weather in the process of loading and unloading goods on ferry boats
11	Compliance with loading and unloading schedules on ferry boats
12	Availability of loading and unloading facilities and equipment on ferry boats
13	Availability of labor for loading and unloading goods
14	Skills and abilities of officers providing services
15	The officer's ability to handle service user requests
16	Loading equipment problems can be resolved quickly and precisely by officers
17	Safety of luggage on ferry boats
18	Compliance with the departure and berthing schedule for ferry boats at the port
19	Luggage storage capacity in the ferry cabin

Customer Satisfaction Index (CSI) Method

To determine the overall level of satisfaction of service users by looking at the level of importance of product/service attributes. CSI is also an index for determining the overall level of customer satisfaction with an approach that considers the level of importance of the attributes being measured [4]. The process for determining the CSI value is as follows [22]:

- Mean Importance Score (MIS) and Mean Satisfaction Score (MSS).

$$MIS = \frac{\sum y_i}{n} \quad (2)$$

$$MSS = \frac{\sum x_i}{n} \quad (3)$$

Where **n** = number of respondents, $\mathbf{y_i}$ = value of importances attribute to-i, and $\mathbf{x_i}$ = value of performances attribute to-i

- Weighted Factor (WF)

$$WF_I = \frac{MIS}{Total\ MIS} \quad (4)$$

Where **MISi** = Mean Importance Score to-i

- Weighted Score (WS)

$$WS = MSS_i \,.\, WF_i \quad (5)$$

Where $\mathbf{MSS_i}$ = Mean Satisfaction Score to-i, and $\mathbf{WF_i}$ = Weighted Factor to-i

- Customer Satisfaction Index (CSI).

$$CSI = \frac{WA}{HS}\ 100\ \% \quad (6)$$

Where **WA** = Weighted Average, and **HS** = Highest Scale (maximum scale)

The results of the CSI calculation are correlated with criteria that describe the quality of customer satisfaction with the services received using the criteria values presented in Table 2 [18]:

Table 2. Criteria of CSI [18]

Value of CSI (%)	Criteria of CSI
81,00 – 100,00	Very satisfied
66,00 – 80,99	Satisfied
51,00 – 65,99	Relatively satisfied
35,00 – 50,99	Unsatisfied
0,00 – 34,99	Very unsatisfied

Quality Function Deployment (QFD) Method

The next step is to determine priorities for improving service performance as a result of analysis using the Importance Performance Analysis (IPA) method, using the Quality Function Deployment (QFD) method [28]. Analysis of QFD Method uses a graph called the House of Quality (HoQ) [5], with a schematic chart shown in Figure 2 [29]:

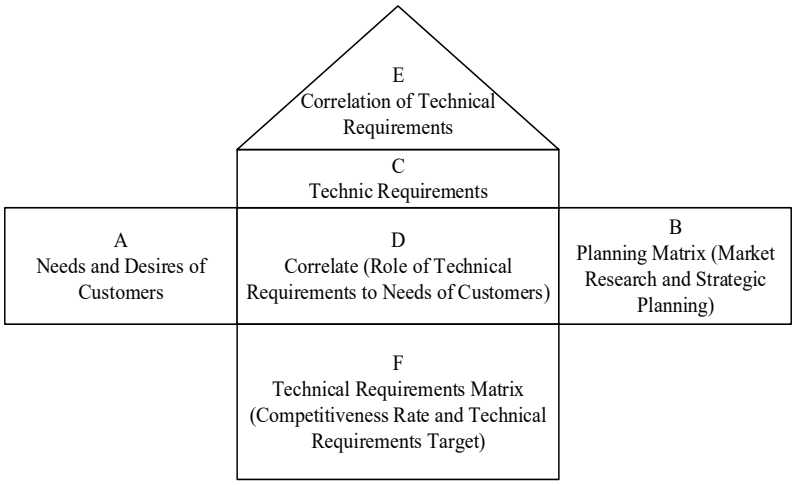

Figure 2. House of Quality (HoQ) Matrix [29]

The stages of QFD analysis are carried out as follows [30][31]:

- Customer satisfaction performance; Assessment of the quality of service that provides satisfaction to users can be calculated using the equation explained as follows:

$$WAP = \frac{\sum PW}{N} = \frac{\sum (TP)\ x\ n}{N} \quad (7)$$

Where **WAP** = Weight average performance, **PW** = Performance weight, **TP** = Scale of satisfaction levels, **n** = respondent to-n, and **N** = number of respondents.

- User expected performance; assessment of user expectations, calculated by formula:

$$EPW = \frac{\sum EPW}{N} = \frac{\sum (TH)\ x\ n}{N} \quad (8)$$

Where **EPW** = Expected performance weight, **TH** = Scale of expectation levels, **n** = respondent to-n, and **N** = number of respondents.

- Goal; The level of performance satisfaction that the manager hopes can be achieved to fulfill the wishes of each user.
- Improvement Ratio (IR); A measure that shows how much effort a service provider makes to improve service quality, calculated using a formula:

$$IR \rightarrow IR = \frac{Goal}{WAP} \quad (9)$$

- Determining the Raw Weight (RW) value which is the result of calculating the Goal value multiplied by the IR value.
- Normalized Raw Height (NRW) is expressed as a percentage, the calculation result of the RW item divided by the total RW.
- The technical response is the result of discussions between researchers and service providers to formulate improvement steps based on consumer input.
- The relationship and priority matrix describes the influence of technical responses in managing performance to meet user needs. Analysis of the relationship between priority items and handling strategies using the notation as in Table 3.

pISSN 2302-4240
eISSN 2655-2086
Volume 14, Issue 3, September 2025, pp.01008-01019
DOI: http://dx.doi.org/10.32832/astonjadro.v14i3.20905 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

Table 3. Notation of relationship matrix [30]

Notation	Value of Numerical	Definition
Empty	0	Unrelationship
△	1	Relationship
○	3	Moderat relationship
◎	9	Strong relationship

- Determining Contribution by adding up the relationship values between priority items and strategy items.
- The contribution value or Normalized Contribution (NC) is calculated using a formula:

$$NC = contribution \times NRW \quad (10)$$

The analysis stages carried out will produce a priority sequence for handling performance improvements. The attributes included in quadrant A of the IPA method analysis results are a list of user desires or customer needs that require an improvement response, which in this research is called *"what items"* [32]. Then a handling strategy was prepared in the form of a series of programs obtained from the results of discussions with authorities of the UPTD of Juwata Ferry Port Tarakan. The program that is compiled is called *"what items"* [32]. An then by analyzing the "how items" and "what items" we will obtain a priority order for performance improvement programs to meet user needs.

RESULT AND DISCUSSION

Performance of Freight Transportation

A questionnaire containing an assessment of the level of importance (in this study given the notation I) and level of performance (P), after being filled in by the respondent, needs to be tested for validity and reliability, before further analysis is carried out. Validity testing is needed to ensure that the instrument has validity to measure what you want to research [33]. Validity test using the SPSS 24 program with the pearson method, with n = 70, confidence interval = 95% (r_{table} = 0,195), value obtained $r_{count} > r_{table}$, which shows that all questionnaire instruments are categorized as valid. The validity test results are displayed in Table 4 and Table 5.

Table 4. Results of the validity test of the level of importance (I)

Attribute	Value of r_{count}	Attribute	Value of r_{count}	Attribute	Value of r_{count}
1	0,387	8	0,532	15	0,634
2	0,642	9	0,728	16	0,628
3	0,732	10	0,481	17	0,626
4	0,649	11	0,688	18	0,706
5	0,469	12	0,524		
6	0,617	13	0,563	19	0,671
7	0,493	14	0,618		

Table 5. Results of the validity test of the level of performance (P)

Attribute	Value of r_{count}	Attribute	Value of r_{count}	Attribute	Value of r_{count}
1	0,641	8	0,704	15	0,841
2	0,605	9	0,636	16	0,671
3	0,581	10	0,597	17	0,611
4	0,725	11	0,742	18	0,667
5	0,624	12	0,660	19	0,717
6	0,708	13	0,655		

7	0,635		14	0,679	

Reliability testing is to determine the reliability of an instrument as a good data collection tool by showing the consistency of the results obtained even though testing is carried out repeatedly [34]. Reliability testing can be carried out using the *Cronbach's Alpha* method to measure the lower limit of the reliability value and the *Composite Reliability* method to measure the actual value of the reliability of the questionnaire instrument. In this research, the reliability test uses the Cronbach's Alpha method, because the internal consistency test (composite reliability method) is not absolutely necessary if the validity of the instrument meets the requirements, because a valid instrument will meet the reliability requirements, and conversely a reliable instrument is not necessarily valid [35]. In another section it is stated that an instrument is considered reliable if a value is obtained of Cronbach's Alpha > 0,70, although a value of 0.60 is still acceptable [33].

The results of the reliability test for measuring the level of importance (I) and level of performance (P) are presented in Table 6. The results show a reliability value above 0.70 so the analysis can be continued to the next stage.

Table 6. Results of Reliability Test

Instrument Groups	Value of Cronbach's Alpha	Description
I	0,721	Reliable
P	0,769	Reliable

The next stage is analysis of the average values to assess the level of importance and level of performance, the results of which are presented in Table 7. The average level of importance (I) is 4.33 and the average level of performance (P) is 4.02 according to the x-y axis plotted on the Cartesian IPA diagram as presented in Figure 3.

Tabel 6. Average value of importance level (I) and performance level (P)

the Service attribute number	Average values (mean)		the Service attribute number	Average values (mean)	
	Level of importance (I)	Level of performance (P)		Level of importance (I)	Level of performance (P)
1	4.557	3.971	11	4.271	4.029
2	4.329	3.886	12	4.229	4.014
3	4.200	4.014	13	4.257	3.900
4	4.457	4.014	14	4.343	4.129
5	4.486	4.143	15	4.500	3.914
6	4.357	4.057	16	4.329	3.986
7	4.200	3.914	17	4.514	4.200
8	4.257	4.029	18	4.357	4.114
9	4.329	3.714	19	4.257	4.200
10	4.071	3.800			

pISSN 2302-4240
eISSN 2655-2086
Volume 14, Issue 3, September 2025, pp.01008-01019
DOI: http://dx.doi.org/10.32832/astonjadro.v14i3.20905 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

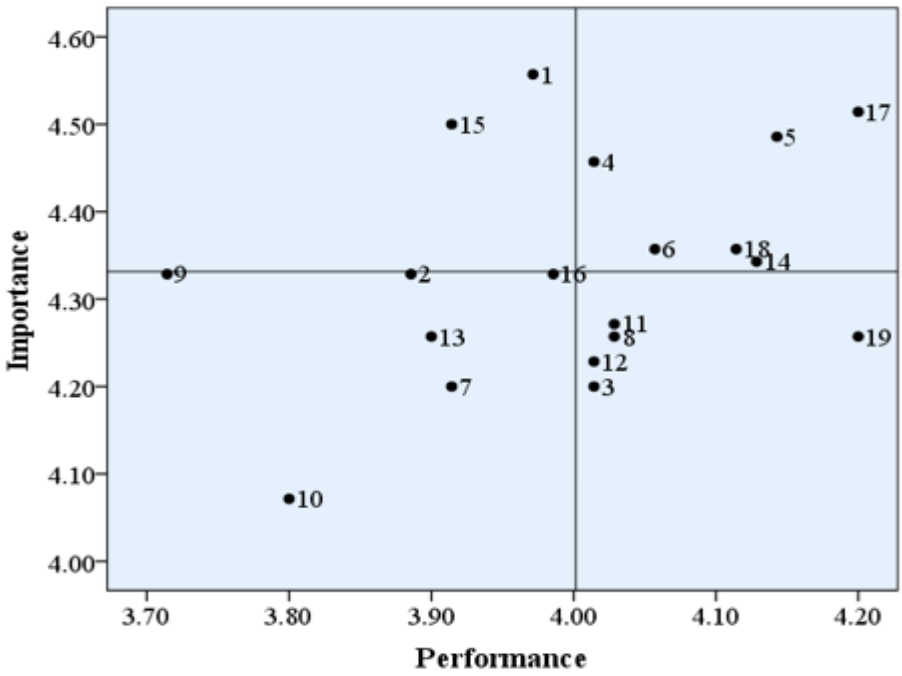

Figure 3. The Cartesian diagram of IPA

The results of the cartesian diagram plot as in Figure 3 show that there are two attributes included in quadrant A, namely attributes number 1 and 15. These two attributes are considered by customers to require attention for improvement, identified as falling into the management aspect category, namely the availability of information and safety facilities on ferry boats, and the ability of officers to respond to service user requests. In quadrant B there are six attributes whose performance is assessed as being in line with user expectations, so their performance needs to be maintained. Aspects that are considered to have met performance standards relate to the competency of officers, security of passenger goods, lighting facilities, as well as the accuracy of arrival and departure schedules for ferry boats.

There are six attributes included in quadrant C, whose performance is considered less special, and these attributes are considered unimportant by users. These attributes relate to CCTV equipment on ferry boats (attribute number 2), incoming goods handling costs (7), queue time efficiency (9), weather (10) and availability of loading and unloading officers (13), as well as the officers' abilities. response to passenger needs. There are five attributes included in quadrant D whose performance is considered very good, exceeding user expectations. These attributes relate to the implementation of good standard operating procedures in ferry boats operations (attribute number 3), ideal freight transportation rates (8), schedules (11) and the availability of adequate loading and unloading equipment (12), as well as the availability of passenger baggage storage in the cabin on ferry boats

Customer Satisfaction Index (CSI)

The results of filling out the questionnaire can be analyzed to determine the level of user satisfaction with the performance of goods transportation of ferry boats on the Tarakan-Sebawang (Tana Tidung Regency) route by first calculating the CSI variable using equations (1), (2), (3), and (4). The calculation results are presented in Table 7.

Tabel 7. Value of MIS, MSS, WF, and WS

The Service attribute number	Mean Importance Score (MIS)	Mean Satisfaction Score (MSS)	Weighted Factor (WF)	Weighted Score (WS)	Customer Satisfaction Index (CSI)
1	3.971	4.557	5,22	23,80	**86.66**
2	3.886	4.329	5,11	22,12	

The Service attribute number	Mean Importance Score (MIS)	Mean Satisfaction Score (MSS)	Weighted Factor (WF)	Weighted Score (WS)	Customer Satisfaction Index (CSI)
3	4.014	4.200	5,28	22,18	
4	4.014	4.457	5,28	23,53	
5	4.143	4.486	5,45	24,44	
6	4.057	4.357	5,34	23,25	
7	3.914	4.200	5,15	21,62	
8	4.029	4.257	5,30	22,56	
9	3.714	4.329	4,89	21,15	
10	3.800	4.071	5,00	20,35	
11	4.029	4.271	5,30	22,63	
12	4.014	4.229	5,28	22,33	
13	3.900	4.257	5,13	21,84	
14	4.129	4.343	5,43	23,58	
15	3.914	4.500	5,15	23,17	
16	3.986	4.329	5,24	22,69	
17	4.200	4.514	5,52	24,94	
18	4.114	4.357	5,41	23,58	
19	4.200	4.257	5,52	23,52	
Total	**76.028**			**433.28**	

Based on the results of the analysis as shown in Table 7, obtained a CSI score of 86.66. This value is in the range 0.81-1.00 with the criteria of Very Satisfied. So it can be said that service users/passengers are very satisfied with the performance of goods transportation of ferry boats on the Tarakan-Sebawang (Tana Tidung Regency) route. The results of this CSI analysis are relevant to the results of the IPA analysis, where there are only two attributes whose performance is rated less so that the quality of service needs to be improved. The number of attributes rated as unsatisfactory is 10% of all questionnaire attributes asked to respondents.

Quality Function Deployment (QFD)

Based on IPA analysis obtained attributes in quadrant A that require immediate improvement or handling, namely attributes number 1 and 15. To develop a performance improvement/handling strategy, discussions were held with the UPTD of Juata Ferry Port Tarakan. The outcome of this discussion is referred to as a technical response that contains measures to improve the performance of ferry boats on the Tarakan-Sebawang (Tana Tidung Regency) route. The results of the discussion from the service providers are outlined in the "items How" which can be seen in Table 8.

It is then identified how strong the relationship between "What items" and "How how" is by using symbols and weight values as presented in Table 3. Next, analyse the strength of the relationship between the "How items", which is depicted with the symbol "-" to indicate a negative or weak relationship. The symbol " + " to indicate a positive or strong relationship. The final result of the analysis is to obtain a priority order for handling user needs that have been voiced and need to be implemented by the UPTD Juata Ferry Port Tarakan to be able to improve service quality in ferry boats freight transport activities on the Tarakan-Sebawang (Tana Tidung Regency) route.

Table 8. How to handle technical responses/"How Items"

Attribute number	Item what	Item How / technical response
1	Availability of safety information and facilities on the ferry	1. signaling a gathering place in case of an emergency 2. clearly marking the evacuation route on the floor and hatch wall. 3. preparing life jackets that are placed in a safe and easily accessible place 4. preparing lifeboats that are placed in a safe and easily accessible place
15	The officer's ability to handle	5. preparing a lifeboat complete with a driving machine that is easy to operate 6. preparing competent officers related to the ferry's operational system

Attribute number	Item what	Item How / technical response
	service user requests	7. equipping officers with communication tools that are ready to serve 24 hours in the event of an emergency 8. increasing crew proportionally as needed.

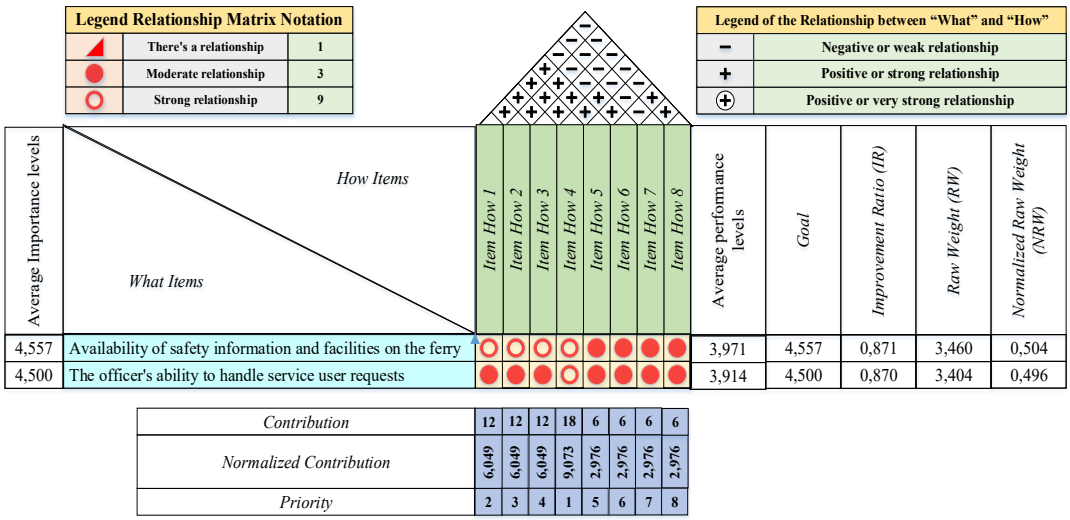

Figure 4. The House of Quality (HoQ)

The results of handling with the Quality Function Deployment (QFD) method found that the priority order was: (1) prepare a lifeboat that is placed in a safe and easily accessible place, (2) provide signs indicating the gathering place in the event of a state of alarm/danger/emergency on board installed in every strategic place, (3) clearly mark evacuation routes on the floor and hatch walls, (4) prepare life jackets that are placed in a safe and easily accessible place, (5) prepare a lifeboat equipped with a driving engine that is easy to operate, (6) Preparing officers who have a high knowledge of operational systems on ferry boats, (7) equip officers with communication tools that are ready to serve 24 hours if something happens, and (8) increase the number of officers proportionally (sufficient number as needed).

The results of this analysis can be used by UPTD Juata Ferry Port Tarakan to improve the performance of goods transportation of ferry boats on the Tarakan-Sebawang (Tana Tidung Regency) route.

CONCLUSION

The results of the IPA analysis provide two out of nineteen measurement attributes whose performance needs to be improved, namely the attribute of the availability of information and safety facilities on ferry boats, and the attribute of the officer's ability to respond to requests from service users. The results of this IPA analysis are relevant to the results of the CSI analysis which provides a satisfaction score for ferry boats service users in the very satisfied category. The results of the analysis of the QFD and House of Quality methods provide a series of technical responses and a priority order for improving the performance of ferry boats services that can be given to the UPTD Juata Ferry Port Tarakan as a service provider. Further research that needs to be done is to increase the number of respondents and increase the number of measurement attributes.

ACKNOWLEDGEMENT

Thank you for the Head of the UPTD of Juata Ferry Port Tarakan and his staff and the forwarders who have provided assistance, cooperation and participation during the data collection of this research.

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