



Original research article

Assessment and Evaluation of Madiredo Telaga Tourism Service Factors

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ABSTRACT

This study introduces the "FIPIA with information entropy" method as an evolution of previous models (IPA, IPIA, FIPA) to evaluate the quality of tourism services at Telaga Madiredo. The aim is to identify priority areas for improvement, providing actionable recommendations for optimal resource allocation to enhance customer service and satisfaction. The integration of fuzzy rules and expert assessments reduces subjectivity in evaluation. Despite its rich potential as a nature-based tourism destination, Madiredo Agrotourism faces challenges due to insufficient prioritization and evaluation of services, leading to a gap between tourist expectations and actual service quality. The primary goal is to develop a comprehensive plan for improving tourism services aligned with on-ground realities and critical priorities. This is achieved through three parameters: comparing importance and performance of service attributes, assessing their impact on business objectives, and evaluating their importance for tourist satisfaction. The study involved field testing by distributing a questionnaire with 18 items to Madiredo Lake tourists and analyzing responses using Importance-Performance-Impact Analysis (IPIA), fuzzy logic, and information entropy. The findings revealed five key dimensions of service quality: reliability, assurance, tangibles, empathy, and responsiveness. The FIPIA method with information entropy proved effective for prioritizing service improvements and is adaptable for evaluating service quality across various industries where attributes significantly influence outcomes.

1. Introduction

The development of the tourism sector in Indonesia continues to undergo a revolution and transformation into one of the leading sectors, as can be seen from the emergence of many new tourist attractions, both natural and artificial, which have a direct beneficial impact [1]. However, after the COVID-19 pandemic, the tourism sector experienced a development transition to sustainably attract tourist visits where previously there were restrictions on public activities and travel bans [2]. In line with the continued development of tourism, improvement efforts need to be made to ensure the sustainability of tourist destination areas [3]. An efficient recommendation is to carry out a structured evaluation of tourism services. This evaluation must also be carried out by the industrial sector to prepare for the challenges it will face in the future. As well as implementing an integrated strategic plan to respond to the pandemic transition period [4].

Starting in early 2022, the new normal lifestyle has become a new social lifestyle for humans. This is a new challenge for industrial sector players to respond to changes in consumer behavior and preferences, including for managers of the Telaga Madiredo Natural Tourism Object where service

fulfillment must also be improved. Madiredo Lake Tourism is located in Madiredo Village which is included in the administrative area of Pujon District, Malang Regency. This tour offers a unique experience for tourists to explore the outdoors, outbound programs and culinary experiences. Madiredo Lake was noted to have been affected during the pandemic, but in 2022 it will undergo massive restoration to attract local and foreign tourist visits [5]. Development is carried out with a tourism planning master plan which is the manager's dream, but in reality the development is not on target due to limited capabilities in tourism planning [6].

Inappropriate planning has an impact on the non-optimal service provided to tourists, causing the number of visits to tend to fluctuate. Ticket sales data from 2023 has the lowest value at 2000 visitors/month and the highest value at 9000 visitors/month. This is indicated by several factors, one of which is that the level of tourist satisfaction is still considered to have not met expectations with the reality obtained to support Madiredo Lake tourism being able to compete with other tourist attractions [7]. Moreover, the Telaga Madiredo tourist attraction is close to the Batu Tourism City as a competitor in providing excellent service and is able to give the impression of satisfaction to tourists.

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Based on the Madiredo Village Government Work Plan for 2022, the obstacle faced is the lack of service monitoring so that several research area subjects point of view that the competency of Madiredo Lake tourism services still needs to be improved. Lack of improvement in service quality has proven to be a lot of neglected development and a lack of preparedness in the management and internal management of tourism. This indicates the need for a structured evaluation, so that the development of the tourism environment at Telaga Madiredo is more efficient [8], [9]. Tourism evaluation is a systematic process carried out to evaluate the performance and impact of tourism management on services, the tourism environment and society. Tourism evaluation involves analysis of various indicators, including service dimensions, ease of access, facilities, and physical tourist attractions. The aim of tourism evaluation is to increase awareness and ability of human resources in managing sustainable and environmentally friendly tourism [10], [11], [12]

As a stage of increasing tourism sustainability, we have not been able to see priority development and planning for tourism services. Development that is not optimal will have an impact on decreasing the quantity of tourists. Meanwhile, priority is absolute to accommodate the most useful proposals with the greatest impact, taking into account the specifics of potential and tourist needs as well as other aspects. Tourism prioritization is carried out using the updated Fuzzy Importance Performance Impact Analysis (FIPIA) method for evaluating service attributes which uses fuzzy numbers to assess three main parameters: importance, performance and impact on business objectives [13]. Evaluation of importance and performance is based on tourist survey results, while impact on business objectives is assessed through expert opinion. By combining the opinions of tourists and experts, the FIPIA method provides a decision-making framework that is accurate and in line with business needs for service improvement [2].

2. Method

This research aims to examine the evaluation of tourism services based on two perspectives, namely tourists and experts. The following methods were applied in this research. Research on service quality at Telaga Madiredo is descriptive evaluative research, which describes data in the field using an evaluative approach. This research was carried out in nature to dissect the results of a quantitative assessment of a particular activity or object with the aim of measuring the success of an activity or object whether it is in accordance with factual expectations.

2.1. Population and Sample

This research uses two types of population, namely the tourist population and expert respondents. The sample of tourists was selected using purposive analysis techniques, namely using respondents who happened to be at the research location based on certain conditions according to the criteria [14]. The criteria referred to are Telaga Madiredo tourists with an age range of 20-50 years because they are considered to have the skills in terms of experience and understanding in providing objective assessments, and are not residents who live in the village. The number of samples uses time in data

collection, namely time linear sampling. Time limitations are also based on the proportion of data collection time that has been projected against the distribution of data collection for agency surveys, expert interviews and field visits. Apart from determining the sampling technique, this is due to population limitations, namely data on average tourists/year.

With a fixed research time of 7 (seven) days, the sample taking time is 6 hours and the questionnaire filling time is 0.25 hours so that the samples obtained

$$n = \frac{T - t_0}{t_t} \quad (1)$$

$$n = \frac{168 - 42}{1,75} \quad (2)$$

$$n = 72 \cong 100$$

Meanwhile, sampling expert respondents used stakeholder mapping, looking at the level of interest, resources, influence and actions that significantly helped in developing Madiredo Lake tourism. On this basis, the experts used stakeholder mapping with non-probability sampling, where the respondents were determined based on research criteria, not on the basis of chance. The criteria for determining expert respondents are as follows [15], (Figure 1)

1. Parties who can provide direction in the development and tourist activities of Madiredo Lake
2. Parties who can provide an objective assessment of the development and tourist activities of Madiredo Lake

Stakeholder mapping is a method that can be used to identify and assess the interests of key parties, groups or institutions that can influence the success of an activity [16]. Stakeholder mapping is carried out before conducting a primary survey by identifying stakeholders who take part in tourism development and then explaining each role from the level of activity in the development process, influence and actions taken by each stakeholder through an interview process with tourism managers [17]. The following is the stakeholder mapping for this research.

2.2 Study Location

Telaga Madiredo is a tourist attraction that is very rich in culture, this is proven by the legend attached to Javanese society, namely the incident of fighting over the Cupu Manik Astagina, so that to this day people still believe that the water in Telaga Madiredo brings its own blessings. , one of which can make you stay young. Apart from that, Madiredo Lake was also previously believed to be a haunted place that could only be visited by certain people or brave people. Then the following year it became a mass tourist attraction driven by local youth.

Madiredo Lake, with a diameter of approximately 200 meters and a depth of 1.5 meters, is easy to access because it is close to residential areas. The site offers a variety of tourist attractions, including the lake itself, conservation areas, campsites, playgrounds, rooftop facilities, guided tours, performing arts, auditoriums, cafes, places of worship, and surrounding access points. Additionally, the site has open green spaces, toilets and parking facilities, making it a comprehensive and welcoming destination for visitors [18] (Figure 2).

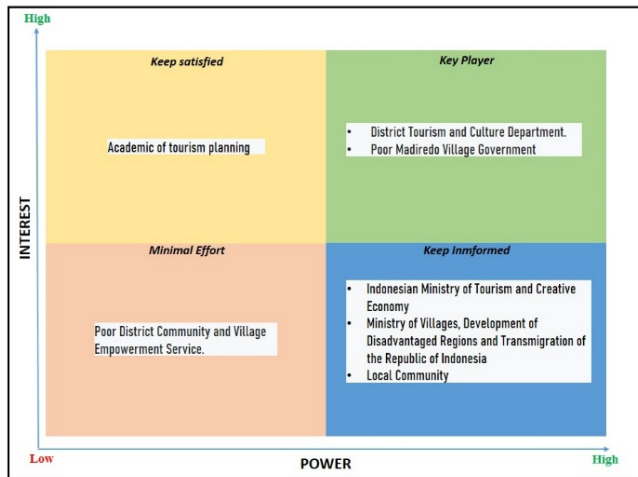


Figure 1. Stakeholder Mapping Telaga Madiredo

2.3 Research Variables

In quantitative research, the principle of service quality dimensions is used, sub-variables are modified according to field observations. The quality of service at a tourist attraction can be determined by looking at customers' perceptions of the service they receive from the managers or guides of the tourist attraction [19]. There are five dimensions in measuring the quality of tourism services as proposed by Zeithaml & Bitner (2009), namely tangible, reliability, responsiveness, assurance and empathy (Table 1)

2.4 FIPIA

The analytical method refers to the systematic approach used to process data in research [20]. Knowing the most critical service quality priorities for tourists using the Fuzzy Importance-Performance-Impact Analysis (FIPIA) method developed by Atalay, 2019. This analysis uses conventional Importance Performance Analysis (IPA) to determine critical service attributes that really need to be improved to achieve superior customer satisfaction [21]. Some of the weaknesses of IPA analysis include measurement, lack of control, differentiating IPA quadrant thresholds, and the relationship between performance and qualifications of interest [22].

On the other hand, FIPIA is a new combined method of the IPIA method by Lin and Vlachos, 2018 to determine the highest service quality priorities in the sector and optimize resource allocation accordingly. This method that uses fuzzy values functions to avoid uncertain values from the questionnaire values and the fuzzy results produce values that will be plotted into the Importance Performance Analysis method quadrants [23]. The analysis process first distributes questionnaires to respondents and experienced (competent) subjects with a specified Likert scale of 1-5. After that, the assessment results will undergo a fuzzification process (f_{ij}^{imp}) in accordance with TNF rules [13] (Table 2).

The translation of these values can be seen from equations (3) and (4), where the notation l, m, u is the interpretation of low, medium and upper values, while f_{ij} represents the i th respondent for the j th attribute. f_{ij}^{imp} is a triangular fuzzy number. Triangular Fuzzy Number (TFN) is Fuzzy sets, which are used for measurements related to subjective human judgment using linguistics, this research uses the TFN scale which has been determined referring to research by Atalay,

2019 [21], [24]. The goal of fuzzification is to map input values that can be true or false simultaneously with the membership that has been determined. where for example a tourist can answer 4 (good) which could be translated between the values 4 and 5 or 3 and 4

$$f_{ij}^{imp} = (l_{ij}, m_{ij}, u_{ij})^{imp} \tag{3}$$

$$f_{ij}^{perf} = (l_{ij}, m_{ij}, u_{ij})^{perf} \tag{4}$$

After fuzzification, the next stage is defuzzification, changing the TNF results in real numbers with equation (5) for the importance value and equation (6) for the performance value. Meanwhile, the aim of defuzzification is to change the fuzzy set (fuzzy output) into precise real numbers based on statistical calculations.

$$def f_{ij}^{imp} = \frac{l_{ij} + 2m_{ij} + u_{ij}}{4} = f_j \tag{5}$$

$$def f_{ij}^{perf} = \frac{l_{ij} + 2m_{ij} + u_{ij}}{4} = Perf_j \tag{6}$$

Where l, m and u are the lower, middle and upper limits of the performance level and importance values on the selected scale from 1 to 5 (triangular fuzzy number). For example, if the respondent feels that they are not very satisfied/good with their attention to the service, they will be given a value of 1 and the value fuzzyfication process will become (1,1,2). After that, the process changes to the real number to 1.25. Furthermore, after all the data processing of respondents (tourists), it is necessary to distribute questionnaires to experienced subjects using the same process through fuzzyfication.

The impact value of each service attribute is determined by calculating the information entropy value E_j of the selected expert subjects (staff) using equations (7) to (9). Equation (5) is used to normalize the scores given by expert subjects for certain service attributes (each service attribute is rated on a scale of 1 to 5). Equation (6) is used to calculate information entropy, while equation (7) is used to calculate the impact of a service attribute on achieving tourist objectives.

$$P_{kj} = \frac{x_{kj}}{\sum_{k=1}^t x_{kj}} \quad j = 1, \dots, m \quad k = 1, \dots, t \tag{7}$$

$$E_j = -\frac{1}{\ln(e)} \sum (P_{kj} \ln P_{kj}) \quad j = 1, \dots, m \tag{8}$$

$$Impact_j = -\frac{E_j}{\sum_{j=1}^m E_j} \quad j = 1, \dots, m \tag{9}$$

After obtaining the impact value from experienced (competent) subjects, the next step is to carry out mapping by comparing the values between performance and importance assessments and then looking at factors that are considered important and expected by customers, but the current performance or actual performance is still not satisfactory. And the next stage is mapping these values to see high and low influences or impacts [2]. After the service attribute receives an assessment from each expert through the defuzzification process, the final value of the service attribute used is the average of these values.

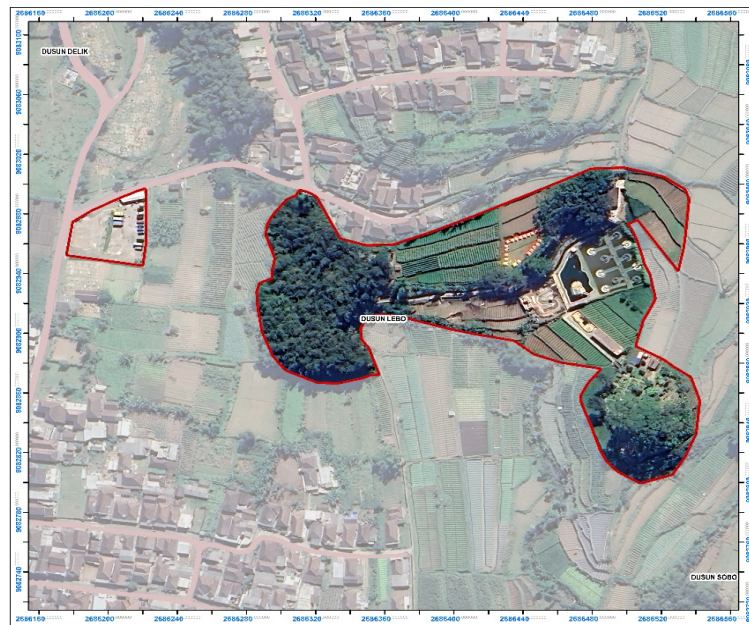


Figure 2. Research Sites



Figure 3. Physical condition of Telaga Madiredo tourism

Table 1. Research Variable

Variable	Sub Variable	Indicator	Source
Service Quality	Reliability	Employee attention to visitors who experience difficulties	[25], [26]
		Service activities are according to schedule or on time	
		Sincere management service towards tourists	
		Tourist attraction services are in accordance with what was promised	
	Tangible	Completeness of Physical Tourist Facilities	
		Tourist Views	
		Modern Equipment	
	Responsiveness	Fast service for customers	
		Willingness to help visitors	
		Readiness to respond to customer requests	
Assurance	Safety instructions in tourism		
	There is a safety and health guarantee provided by the tourism manager		
	Peace of mind while on tour		
Empathy	Expertise In The Field Of Tourism		
	Friendly service		
	There are services for children, disabilities and seniors		
		Staff show initiative to help visitors	

Table 2. Score Tringular Fuzzy Number FIPIA

Score	Lts Importance	Lts Perfomance	TFN
1	Very unimportant	Very less	(1,1,2)
2	Not important	Not enough	(1,2,3)
3	Quite important	Enough	(2,3,4)
4	Important	Good	(3,4,5)
5	Very important	Very Good	(4,5,5)

3. Result and Discussion

Results and discussion consist of research location, characteristics of respondents, implementation stage, and FIPIA analysis results process.

3.1. Tourist characteristics

Product and service quality has a significant impact on customer satisfaction [27]. The relationship between service quality and satisfaction is seen when tourists visit again and recommend to others. Of course, this can happen if the tourist destination has a tourist attraction. So, if there is a decrease in satisfaction, it could be one of the factors that tourists' expectations are not met [28]. The average suitability level of tourism service attributes is 79%, which indicates that the quality of the services provided is lacking or does not meet what is considered important by tourists so it can be said to be unsatisfactory (Table 3). From the aspect of service reliability, several visitors indicated that there were still challenges related to the lack of information in tourist areas and the lack of attention from tourist officers on weekends the purity percentage of 65% is below average. Apart from that, the significant increase in the number of tourists also has an impact on decreasing the responsiveness of tourism officers based on the results of primary surveys observing researchers and tourism managers, this is due to the limited space for tourists to move in tourist areas and the results of the level of conformity are at a percentage of 77% (Figure 3).

From the aspect of ensuring the ability of tourism officers in tourism management, however, this needs to be improved because the background of tourism officers does not yet have the general standards that should exist and the special standards implemented by tourist destinations. In providing friendly service is still not optimal. This is because child-friendly tourist destinations must have a security system that is based on children's needs, such as providing officers at several points is at a percentage below 60% so it is relevant if services still need to be improved.

Apart from that, tourism still requires improvisation in broader services and adapting to tourist needs. The physical evidence aspect of providing services from tourist staff to tourists must be improved. This phenomenon can occur due to several internal and external factors. And several tourist support facilities are still unfinished and not in use.

3.2. Data Instrument Test

Validity is carried out to show how well the instrument used measures what is being measured. Instrument data is validated by correlating the scores obtained on each questionnaire item with the individual's total score. The validity test was carried out with the help of a computer using the SPSS for Windows version 25 program. Decision making was based on the item-total correlation > table correction value of 0.195 and for an error significance level of $\alpha = 0.05$, the item/question was valid and vice versa. So the results of the reliability and validity of the data for interest and performance are obtained. (Figure 4) (Figure 5).

3.3. FIPIA

The initial stage of this analysis is to transform the values of tourists and experience subjects according to TNF rules.

The following are the transformation results in (Table 3.). After that, data inference from the fuzzyfication process is carried out by changing the variables from the fuzzy set into concrete values or numbers that have actual values (defuzzyfication). After that, the average calculation of the service attributes assessed is carried out

The FIPIA diagram shows the importance, performance and impact of each attribute investigated in the X-axis and Y-axis diagrams. The FIPIA diagram is divided into three diagrams that look at the performance and level of importance of all the service quality attributes studied, as shown in (Figure 6), the diagram looks at the influence or impact of the performance of Madiredo Lake tourism service quality on attributes that have a high level of importance as shown in (Figure 7), and a diagram looking at the influence or impact on performance for attributes that have a low level of importance shown in (Figure 8) Some tips for making a discussion on a manuscript:

The table above is the result of calculating the impact value from the assessment of 4 experts. This impact value is a reference for seeing the influence of the indicator on the object or attribute being studied. After obtaining the impact results, the next stage is to map the assessment results into a Cartesian diagram. The diagram will be interpreted into several quadrants. In general, the FIPIA diagram is almost the same as the previous IPA diagram, but only in this method, changes are applied to impact assessment. For decision making, the attributes in the quadrants of the Concentrate here classification are used. The following are the results of the FIPIA Diagram mapping of service quality attributes at Telaga Madiredo Tourism.

Based on the provisions of Atalay, et al (2019), the attributes that need to be evaluated or improved in service quality are attributes that have a high level of importance, high performance, and high impact or service quality attributes that have a high level of importance, performance is still low, and high impact or attributes that have a high level of importance, performance and impact are still low [21]. As in the FIPIA extraction table (Table 4). The results of the FIPIA mapping show that the level of influence or impact that is combined on attributes that have a low level of importance are prioritized on attributes 7,11,17,18, this is because they have low importance but have a high influence if improvements are made to these attributes. One example is the empathy dimension of service from tourism officers taking initiative.

The table above shows the selection of Madiredo tourism service factors which have carried out value comparisons between tourists and expert respondents and then mapped them by looking at low and high importance. The results show that there are 6 factors that are the main priority according to the impact felt in the future based on the calculations of expert respondents who are able to provide the best quality for Madiredo services.

Based on the results of the assessment carried out, there are 6 factors that have a high impact on importance and performance that must be paid attention (Table 5). This assessment will be the basis for seeing the right steps in evaluating tourism development for the services provided based on comparative assessments of tourists and expert respondents.

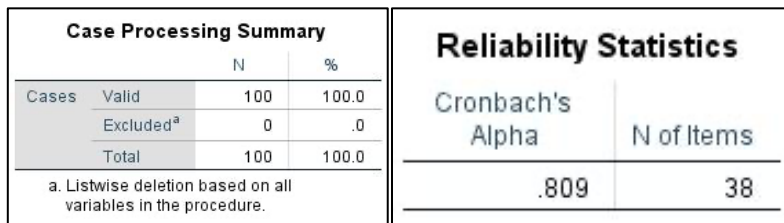


Figure 4. Summary of Interest Data Instrument Test Important

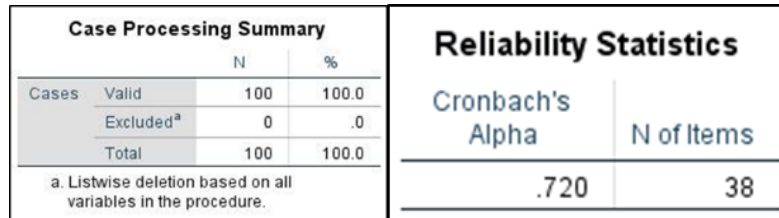


Figure 5. Summary of Performance Data Instrument Test Performance

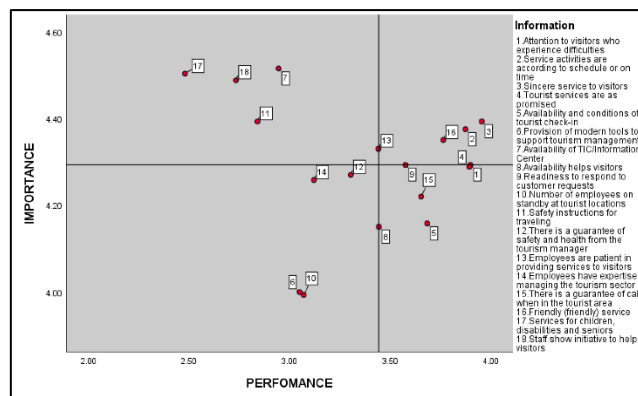


Figure 6. Importance Vs Performance

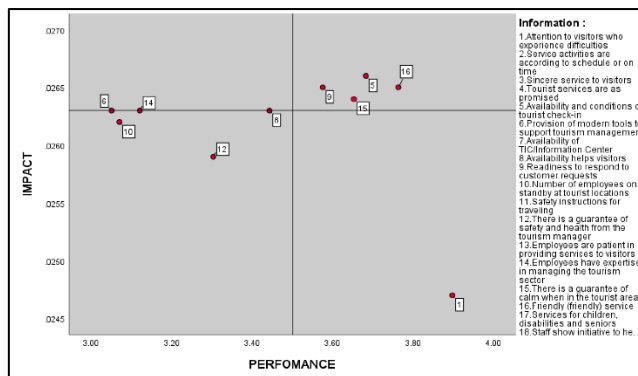


Figure 7. Impact Vs Performance with High Important

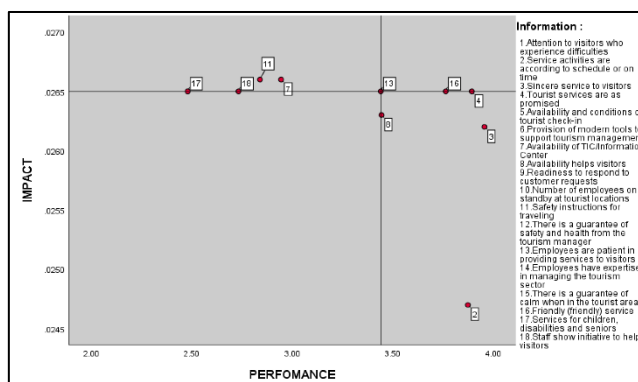


Figure 8. Impact Vs Performance with Low Impirtance

Table 3. FIPIA Service Level Factors

Code	Attribute	X	Y	Pkj	Ej	Impact	Tki
R1	Attention to visitors who experience difficulties	3.898	4.293	0.25	0.448	0.025	91%
R2	Service activities are according to schedule or on time	3.873	4.375	0.25	0.448	0.025	89%
R3	Sincere service to visitors	3.955	4.393	0.25	0.475	0.026	90%
R4	Tourist services are as promised	3.893	4.288	0.25	0.479	0.027	91%
T1	Tersedia dan kondisi check in wisata	3.683	4.158	0.25	0.481	0.027	89%
T2	Availability and conditions of tourist check-in	3.050	4.000	0.25	0.475	0.026	76%
T3	Availability of TIC/Information Center	2.945	4.515	0.25	0.481	0.027	65%
RP1	Ketersediaan membantu pengunjung	3.443	4.150	0.25	0.476	0.026	83%
RP2	Availability helps visitors	3.575	4.293	0.25	0.479	0.027	83%
RP3	Employees on standby at tourist locations	3.070	3.993	0.25	0.475	0.026	77%
A1	Safety instructions for traveling	2.840	4.393	0.25	0.481	0.027	65%
A2	Guarantee of safety and health from the tourism manager	3.303	4.270	0.25	0.469	0.026	77%
A3	Employees are patient in providing services to visitors	3.440	4.330	0.25	0.479	0.027	79%
A4	Employees have expertise in managing the tourism sector	3.120	4.258	0.25	0.476	0.026	73%
A5	Guarantee of calm when in the tourist area	3.653	4.220	0.25	0.478	0.026	87%
E1	Friendly service	3.763	4.350	0.25	0.479	0.027	86%
E2	Services for children, disabilities and seniors	2.480	4.503	0.25	0.479	0.027	55%
E3	Employees show initiative to help visitors	2.733	4.488	0.25	0.479	0.027	61%

Table 4. FIPIA Extraction Table

Code	Y	X	Impact	Information
R1	Low	High	Low	Overkill
R2	High	High	Low	Keep right balance
R3	High	High	Low	Keep right balance
R4	High	High	Low	Keep right balance
T1	Low	High	High	Overkill
T2	Low	Low	High	Low priority
T3	High	Low	High	Concentrate here
RP1	Low	High	Low	Overkill
RP2	Low	High	High	Overkill
RP3	Low	Low	Low	Low priority
A1	High	Low	High	Concentrate here
A2	Low	Low	Low	Low priority
A3	High	Low	High	Concentrate here
A4	Low	Low	High	Low priority
A5	Low	High	High	Overkill
E1	High	High	High	Keep right balance
E2	High	Low	High	Concentrate here
E3	High	Low	High	Concentrate here

Table 5. FIPIA Assement Evaluation

Code	Coordinat	Information
T3	(2,95;4,52)	Availability of TIC/Information Center
A1	(2,84;4,39)	Safety instructions for traveling
A3	(3,44;4,33)	Employees are patient in providing services to visitors
E1	(3,76;4,35)	Friendly service
E2	(2,48;4,50)	Services for children, disabilities and seniors
E3	(2,73;4,49)	Employees show initiative to help visitors

4. Conclusion

Evaluation of factors influencing tourist satisfaction at Telaga Madiredo is based on tourist assessments with a sample of 100 people which shows that there are gaps in excellent service from each service attribute. Overall, the obstacles to Madiredo Lake Tourism services still need to be improved. The variables studied show that performance is below the average, namely 3.373. The results of FIPIA

calculations found that there was a service performance attribute value below 2.50 and an importance value above 4.50. This indicates that performance in providing services to tourists still looks very poor.

The FIPIA diagram also shows attributes that need immediate treatment and have a very high impact or influence, namely 0.0266. Thus, if implemented, it can provide optimal service perception to tourists. However, excellent service needs to be updated to be better. One of the services

that still needs to be improved because tourist satisfaction/performance is considered to be still lacking is regarding information services, services in terms of safety when traveling, employee services that are less patient, friendly and inclusive and willingness to take employee initiative which is still lacking. Furthermore, based on the FIPIA calculation results, improvements still need to be made because the performance value is below 2.50 and the importance is above 4.50 and the FIPIA diagram mapping is included in the attributes that need immediate treatment with a very high impact, namely 0.0266. So, if it is realized, it will be able to provide the perception of excellent service to tourists.

Based on the conclusions above, in general the performance of Madiredo Lake object services is below the average assessment. This is relevant to attribute extraction during the FIPIA analysis process, priorities still need to be studied because there are still many services that are more urgent than the results of these calculations. So the next recommendation is to re-explore the service attributes and carry out data tests before determining the variable attributes to be studied.

This research in evaluating tourism services has not taken into account dynamic consumer behavior, such as consumer knowledge or lifestyle, which can change consumer perceptions about the importance and satisfaction of a service attribute and tourist attraction of two or more groups of tourists with their knowledge, lifestyle, and different reference groups. There needs to be further analysis after getting the factor extraction from the FIPIA analysis to see the right ranking for these factors according to the needs of the tourism manager

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Author Declaration

Authors' contributions and responsibilities

The authors made substantial contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation, and discussion of results. The authors read and approved the final manuscript.

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All data are available from the authors.

Competing interests

The authors declare no competing interest.

Additional information

No additional information from the authors.

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