Sustainable tourism performance based on tourist clusters: evidence from Madura, Indonesia

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Abstract. In recent years, there has been a notable progression in the development of Madura's tourism. In addition to its reputation as a salt-producing island, Madura possesses considerable potential in tourism. Tourism development should be in line with preserving the environment and improving the economy, society, and culture so that the sustainability of a tourist destination is maintained. However, tourism development is carried out partially and is short-term-oriented. The tourism industry must prioritize incorporating sustainability considerations. Performance measurement is needed based on tourist clusters for tourism development to be focused and sustainable. Performance measurement assesses whether sustainable tourism programs have been implemented as they should and what the benefits and impacts are for management and stakeholders. The integrated Importance-Performance Analysis (IPA) and Kano model will be employed to assess sustainable tourism performance by involving environmental, economic, social and cultural indicators. The findings indicate three clusters of tourists achieving the best and worst performance. The third cluster is chosen since most of the tourists are in this cluster. The primary keys of interest encompass local cultural information, job opportunities, tourism promotion, society participation and village tourism.

1 Introduction

Indonesia encompasses a total of 74,961 villages, which are distributed over its 34 provinces [1]. Rural communities in Indonesia, as well as several other countries, frequently encounter prevalent challenges such as adverse economic situations, elevated unemployment rates, substandard education systems, and inadequate basic infrastructure [2]. The government has implemented many rural economic development programs, such as the PNPM project (National Program for Community Empowerment) and Regional Innovation Systems Program (SIDa) [3]. However, the implementation and outcomes of these programs have yet to reach their objectives.

Dealing with the above condition, one of the options for development is the pursuit of tourism development, with a particular emphasis on rural tourism. The development of tourism villages can consider the potential of many economic sectors, including the local, government, private, formal, and informal sectors, as well as the interests of both internal and foreign stakeholders [4]. In addition, the utilization of tourism as a strategy for economic development has garnered heightened attention due to its potential to enhance the socio-economic well-being of local communities through tourism-derived business income, taxes, and jobs [5].

Based on data provided by the Ministry of Tourism and Creative Economy, there was a documented number of 3,613 tourist villages in 2022, which subsequently witnessed a rise to 4,714 tourist villages in 2023 [6]. In the region of Madura, specifically, there exist a total of seven tourist villages, six of them being in Sampang and one in Pamekasan [7]. A tourist village is a form of integration between tourist attractions, supporting facilities and accommodation that is formed based on traditional community life [8]. The endeavour to promote rural economic development through tourism is challenging, mostly due to the multifaceted nature of the resources and stakeholders associated with it.

Indonesian people still need to acquire knowledge regarding the tourist attractions situated on Madura Island, which distinguishes itself from the globally famous Bali Island. The Madura region in consideration is recognized not just for its adherence to normative religious principles but also for its wide variety of natural attractions, including small islands, hills, and beaches. Coastal and highland environments appeal to postmodern travellers and outdoor enthusiasts [9]. In addition to its abundant natural tourism resources, Madura offers an exciting variety of famous cultures, including cow racing (Karapan Sapi), Pecut dance (Tari pecut), long yard (Tanian lanjhen), and several other socio-cultural traditions. There are many kinds of potential, encompassing both natural and socio-cultural aspects, that possess significant commercial appeal.

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These potentials can enhance the local economy and increase the visibility of Madura among the general populace [10].

Rural tourism is reliant upon a diverse array of natural and cultural resources that are controlled by both village governments and private entities. Additionally, the presence of necessary infrastructure and interpretative facilities is crucial. Moreover, rural tourism necessitates the availability of accommodation, food, beverages, and various items. If adequately regulated, the quality of the physical environment, social structures, and cultures might be protected due to the nature and magnitude of development activities and the influx of tourists [9].

That is why sustainable tourism development is important to implement at a tourist destination. [11] argued that sustainable development entails the responsible utilization of natural, cultural, and other tourist resources by the present generation to preserve these resources for the benefit of future generations. Additionally, both natural and man-made attractions present in the region have a significant impact on the growth of tourism there. As a result, the implementation of sustainable development practices becomes increasingly crucial. However, one of the foremost issues confronting policymakers and destination managers is how to evaluate tourism to ascertain its effectiveness in achieving its intended goals.

Numerous frameworks and models have been proposed to assess the performance of tourism. In their study, [12] employed multiple models to examine the hierarchical structure of the SusTour Index. This method was achieved through the integration of weighting and aggregation techniques. In addition, [13] looked into the hierarchical relationships and found the important factors that affect how much people depend on the attributes, with the end goal of improving long-term performance. It will be achieved using a mixed approach involving fuzzy set theory, decision-making trial and evaluation, and interpretive structural modeling. Therefore, this study will employ the Important-Performance Analysis (IPA)-KANO integration model to assess performance and determine suitable strategies by categorizing sustainable tourism indicators.

The IPA-Kano model serves as a valuable tool in the classification and assessment of service quality attributes while also offering targeted recommendations for each attribute area. The IPA-Kano model fixes the problem with the Kano model by considering attribute performance and importance. It also fixes the problem with the IPA model, which only looks at one-dimensional attributes. The proposed IPA-Kano model allows for acquiring suitable action strategies for each service quality attribute [14]. Moreover, the significance of Importance-Performance analyses (IPA) has been extensively explored in the broader field of tourism literature due to the versatility of IPA and its adaptability to various destinations [14].

To enhance the precision and focus of the resultant strategy, it is important to categorize tourists who visit tourist destinations into clusters. Clustering is crucial in exploring data, predictive modeling, and addressing anomalies. Reiterative approaches organize clusters in a dataset that exhibit collateral, identical properties [15]. For example, promotional efforts should align with the characteristics of visiting tourists. The objective of clustering is to improve comprehension of diverse tourist geographic, demographic, socioeconomic, psychographic, behavioural traits, or a combination thereof [16].

The aim of this study is to design a measurement framework that assesses the performance of sustainable tourism practices in the tourist village based on tourist cluster using IPA-Kano model.

2 Method

The unit of analysis in this study is tourists who have visited or are currently visiting Bira Tengah Tourist Village, Sampang. This study utilizes a quantitative methodology to assess performance, categorize sustainable tourism indicators, and formulate specific suggestions for each indicator domain. Data collection was conducted through a questionnaire, which was distributed to a total of 120 respondents. The questionnaire is divided into two sections: the initial section serves to segment clustering tourists, while the subsequent section is designed to assess sustainable tourism's perceived performance and importance. The flow of this research is shown in the Fig. 1.

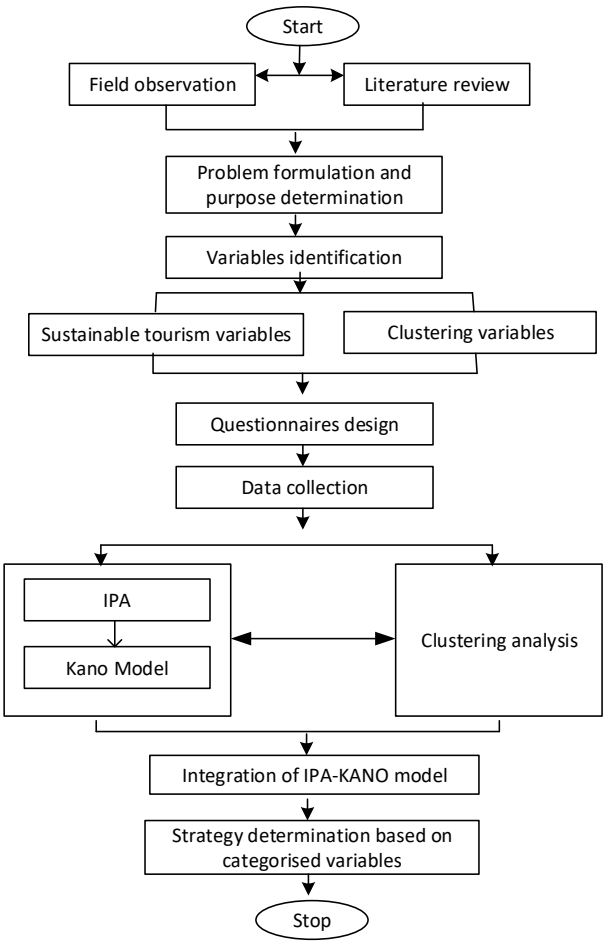

Fig. 1. Research flow.

The K-Means clustering algorithm is widely recognized as a prominent partitioning technique utilized in clustering. The K-means clustering method categorizes data points by their proximity, as determined by the Euclidean distance metric [15]. This method groups data into one or more clusters. This clustering combines data with the same characteristics and then combines data with different characteristics so that there is a trim level of variation between clusters and groups of data. This study will utilize the software SPSS 25 for generating clusters based on the tourist clustering variables acquired from the literature review. The tourist clusters are predicted by four variables: geographic, demographic, psychographic, and behavioral segmentations [17]. Many scholars have employed multiple segmentation bases to segment a market effectively [18].

According to [19], IPA has gained popularity as a managerial tool for assessing strengths and weaknesses. This technique is employed to get insights into the level of satisfaction experienced by tourists, which is influenced by their expectations regarding the performance of a particular service. A matrix is constructed to visually display the pairs of importance and performance for each indicator. The x-axis represents the level of performance, while the y-axis represents the level of importance and is partitioned into four quadrants, illustrated in Fig. 2.

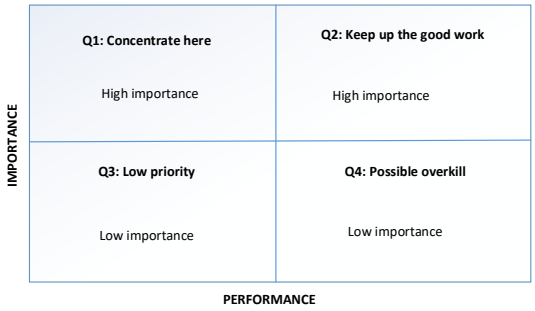

Fig. 2. Four quadrants for IPA analysis [20].

[21] formulated a two-dimensional model of quality based on customer requirements, as shown in Fig. 3. This model categorizes aspects of product or service quality into five distinct areas, each of which has a varying impact on customer satisfaction.

Fig. 3. Five distinct categories in Kano model [21].

The IPA-Kano model posits that performance and importance within a given context are contingent upon customer perceptions and that concerted efforts can enhance both aspects. There exist three distinct series, namely Hygiene, War, and Treasure, which are further categorized into twelve different categories based on the combination of levels of importance and performance. Ultimately, the objective is to generate prioritization strategies [22]. However, a crucial aspect of the approach is the identification and selection of indicators that are reflective of sustainable tourism. Table 1 presents a comprehensive compilation of sustainable tourism indicators derived from an extensive review of relevant literature.

Table 1. Sustainable tourism indicators.

Aspect	Code	Indicator	Literature
Environmental	X_1	Health and safety	[23]
	X_2	Availability of clean water sources	[24]
	X_3	Waste management	[23]
	X_4	Destination cleanliness	[24]
Culture	X_5	Local cultural information	[23]
	X_6	Access traditional culture	[23]
	X_7	Protection of artistic heritage	[23]
Economy	X_8	Job opportunities	[25]
	X_9	Tourism promotion	[23]
	X_{10}	Tourist activities	[25]
Social	X_{11}	Society participation	[25]
	X_{12}	Stakeholder role	[25]
	X_{13}	Village tourism	[26]

3 Result and discussion

3.1 Bira Tengah tourist village

The Bira Tengah tourist village is in the Sokobanah District of the Sampang Regency. Tourism management in Bira Tengah village has been delegated to BUMDes Mitra Mandiri. Village-owned enterprises (BUMDes) refer to business institutions in rural areas collectively managed by the local community and village government. The primary objective of establishing BUMDes is to enhance the village's economy, with its formation contingent upon identifying its specific needs and potential [27]. However, the development of BUMDes in driving the village economy still needs to improve its efficiency and effectiveness, specifically the inadequate establishment of networks and limited engagement of villagers [2].

The presence of Lon Malang Beach tourism may be attributed to the collective thoughts of the local village

community. This process encompassed various stages, including planning, implementation, and evaluation. Furthermore, the community was granted equal opportunities to participate in and benefit from the outcomes of tourism development. The tourism management framework in question is called community-based tourism [28].

Since its establishment in 2018, the Bira Tengah tourist village has undergone ongoing development, including the expansion of 49 small and medium-sized business units that contribute to the growth and sustainability of this destination. These business units engage in the sale of food and beverages, as well as the provision of horse and all-terrain vehicle (ATV) rentals. Additionally, they offer a range of souvenir items and photography services. Notably, this tourist village has effectively employed 200 workers, all residents. Therefore, the successful implementation of rural tourist development and entrepreneurship necessitates the active involvement and collaboration of individuals directly and indirectly engaged in the tourism industry [29]. Additionally, based on management information, the number of domestic tourist visits to Lon Malang Beach in 2019–2021 was 222,292 people. This growth indicates that there are great opportunities as well as challenges for future tourism development. Fig. 4 shows that Lon Malang Beach is a nature attraction of the Bira Tengah village.

Fig. 4. Nature attraction of the Bira Tengah village-Lon Malang Beach.

3.2 Clustering analysis

K-means clustering is a non-hierarchical data grouping method that divides data into one or more clusters. Table 2 represents the result of the ANOVA test for all tourist segment clustering indicators.

Based on Table 2, among the 24 indicators examined in the ANOVA test, it was observed that four of them did not exhibit statistically significant variations among the generated clusters. The four indicators encompass gender, family size, educational background, and culinary preferences, which is their sig-value (sig.) above the threshold of 0.05 (α). In simple terms, these four indicators lack the ability to distinguish between the three clusters and hence can be excluded from cluster analysis as they do not contribute meaningful information.

Table 2. Analysis of variance (ANOVA) on tourist clustering.

Indicators	Cluster		Error		F	Sig
	MS	df	MS	df		
Visiting_status	2.480	2	0.206	101	12.041	0
Age	2.629	2	0.284	101	9.243	0
Gender	0.255	2	0.234	101	1.092	0.34*
Marital_status	2.445	2	0.201	101	12.145	0
Family size	0.065	2	0.765	101	0.086	0.918*
Education	1.353	2	0.541	101	2.501	0.087*
Occupation	35.278	2	2.168	101	16.271	0
Income	1.885	2	0.404	101	4.661	0.012
Expenses	1.510	2	0.226	101	6.682	0.002
Visit with whom	35.364	2	0.366	101	96.729	0
Length of visit	20.264	2	0.478	101	42.434	0
Source of information	9.854	2	0.573	101	17.209	0
Origin	25.596	2	1.350	101	18.961	0
Modes of transportation	1.053	2	0.235	101	4.480	0.014
Accommodation type	25.949	2	1.282	101	20.241	0
Parking lot	0	2	0	101	.	.
Motivation	43.789	2	0.878	101	49.894	0
Attractiveness	2.102	2	0.17	101	12.382	0
Main objective	57.449	2	1.650	101	34.819	0
Leisure activity	11.878	2	1.656	101	7.171	0.001
Culinary	1.344	2	0.884	101	1.520	0.224*
Souvenir	16.717	2	0.91	101	18.370	0
Facility	5.557	2	0.868	101	6.404	0.002
Number of visits	28.575	2	0.955	101	29.907	0

MS: Mean Square; df: degree of freedom; F: F value; Sig: significance level.

The k-means clustering algorithm yields three distinct groupings. Out of the total 120 respondents, a total of 104 valid answered respondents were found to inhabit these clusters. All of the 120 respondents were national tourists. The initial cluster comprises nine individuals, while the subsequent cluster encompasses 25. Lastly, the third cluster consists of 70 individuals, as indicated in the Table 3. The third cluster exhibits the highest proportion of respondents (67.31%).

Table 3. Number of cases in each cluster.

Cluster 1	9	8.65%
Cluster 2	25	24.04%
Cluster 3	70	67.31%
Valid	104	

3.3 Important Performance Analysis (IPA) based on tourist clustering

The results give us helpful information about how tourists think about sustainable tourism. Studying Bira Tengah as a tourist village destination is a way to learn more about the factors that tourists believe are important for sustainable tourism. There are several essential things that tourist village places should think about when they are trying to make an appealing destination and sustainable.

The measurement employed by IPA is predicated on assessing the importance and performance of a service to ascertain its strengths and limitations. Table 4 shows the mean performance and perceived importance obtained from three distinct clusters of visitors visiting the Bira Tengah tourist village. The mean values for importance and performance in cluster one were 4.44 and 4.60, respectively. Similarly, in cluster two, the mean values for importance and performance were 4.52 and 4.58, while in cluster three, the mean values for importance and performance were also 4.56 and 4.55.

Table 4. Performance and importance average based on three cluster of tourists.

Code	Cluster #1		Cluster #2		Cluster #3	
	P	I	P	I	P	I
X_1	4.44	4.56	4.36	4.72	4.53	4.61
X_2	4.22	4.56	4.44	4.56	4.39	4.56
X_3	4.44	4.33	4.32	4.48	4.49	4.43
X_4	4.67	4.33	4.80	4.64	4.80	4.50
X_5	4.67	4.44	4.56	4.60	4.61	4.46
X_6	4.89	4.44	4.60	4.56	4.54	4.49
X_7	4.33	4.56	4.36	4.44	4.44	4.54
X_8	4.67	4.33	4.76	4.48	4.57	4.57
X_9	4.56	4.33	4.64	4.52	4.59	4.59
X_{10}	4.89	4.33	4.68	4.44	4.51	4.66
X_{11}	4.56	4.44	4.76	4.44	4.60	4.66
X_{12}	4.78	4.44	4.68	4.40	4.50	4.61
X_{13}	4.67	4.56	4.64	4.44	4.61	4.63
Avg	**4.60**	**4.44**	**4.58**	**4.52**	**4.55**	**4.56**

P: Performance average; I: Important average

The results of the analysis using IPA are provided in the following Fig.s. First, the performance average level for the three cluster is presented in Fig. 5. In general, the performance average of the three cluster is ranging from 4.22 to 4.89, the highest and lowest performance are in cluster 1.

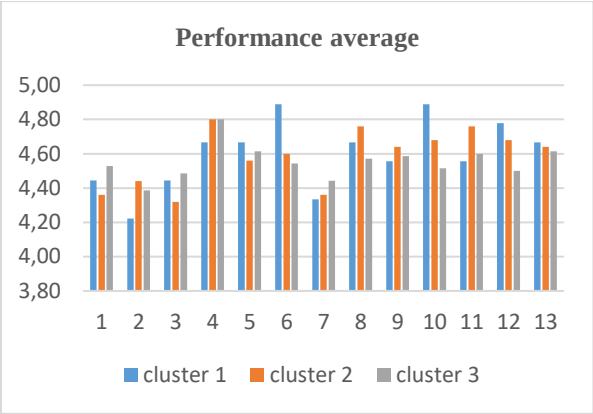

Fig. 5. Performance average for three clusters.

Fig. 6 depicts the information about average value of importance for three cluster. The importance average of the three cluster is ranging from 4.33 to 4.72, the highest and lowest importance are in cluster 1 and cluster 2.

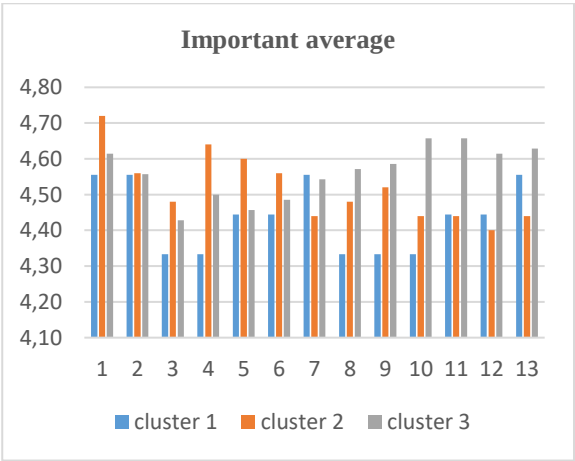

Fig. 6. Importance average for three clusters.

Fig. 7 illustrates three clusters on IPA quadrants. Quadrant 1 : concentrate here (high importance, low performance) [22]. Addressing this quadrant is the utmost priority for destination management since it signifies the aspects that tourists deem significant, yet their experience indicates a subpar performance by the place. Tourists within the first cluster have identified attributes such as health and safety, availability of clean water sources, protection of artistic heritage, and society participation as areas that need improvement. In contrast, the second cluster posits that attributes such as health and safety, availability of clean water sources, and local cultural information warrant significant consideration from managerial personnel. According to tourists belonging to the third cluster, there is a need for improvement in attributes such as health and safety, tourist activities, and stakeholder roles. The study's results are helpful for managers who want to improve the qualities that are most important to the three clusters that were found, especially health and safety and availability of clean water sources (environmental aspects).

Quadrant 2 : keep up the good work. The attributes that fall inside this quadrant are favorable and should be

maintained (high importance and high performance) [22]. In the first cluster, attributes such as local cultural information, access to traditional culture, stakeholder role, and village tourism exhibit high performance and importance. Attributes such as destination cleanliness, access to traditional culture, and tourism promotion are associated with the second cluster. In contrast, attributes of job opportunities, tourism promotion, society participation, and village tourism are associated with cluster 3 within this quadrant. Hence, the 'keep up the good work' attributes for all clusters are access to traditional culture, tourism promotion, and village tourism, respectively (culture, economy and social aspects).

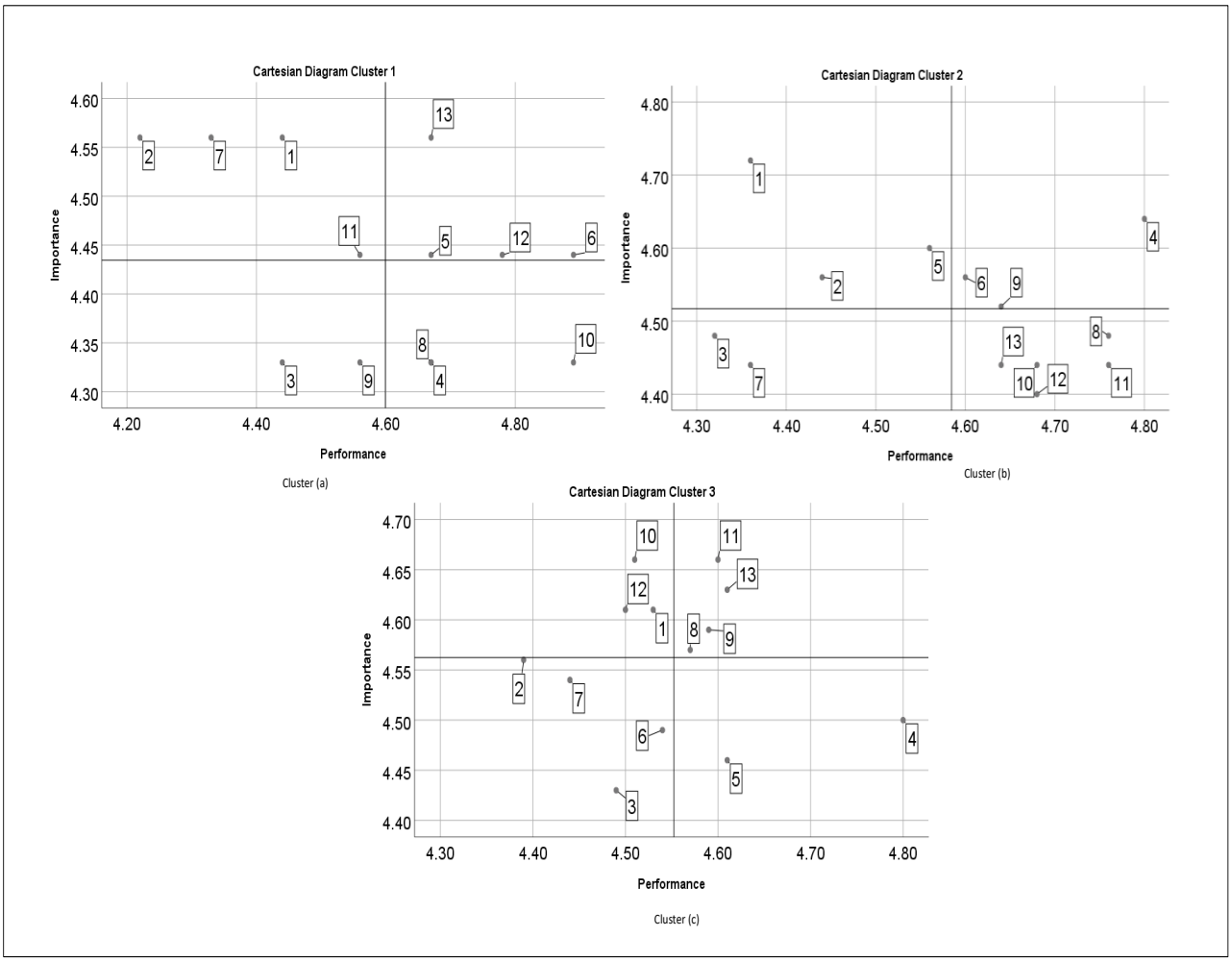

Fig. 7. IPA for three tourist clusters : (a) cluster 1, (b) cluster 2, and (c) Cluster 3.

Quadrant 3 : low priority, characterized by both low importance and low performance [22]. Enhancing attributes within this quadrant is deemed to have a relatively low priority level. The 'low priority' attributes for the first cluster are waste management and tourism promotion. Cluster 2 has attributes waste management and protection of artistic heritage. Finally, cluster 3 has attributes availability of clean water sources, waste management, access to traditional culture and protection of artistic heritage. It can be concluded that attributes waste management and protection of artistic heritage are 'low priority' attributes for the entire cluster.

Quadrant 4 : possible overkill refers to a scenario characterized by low priority and high performance [22]. Attributes falling inside this quadrant tend to receive an excessive allocation of resources, which could be more effectively utilized elsewhere. Cluster 1 possesses attributes destination cleanliness, job opportunities, and tourist activities, whereas cluster 2 exhibits attributes job opportunities, tourist activities, society participation, stakeholder role, and village tourism. The third cluster is characterized by attributes destination cleanliness and local cultural information. Hence, under the quadrant labeled as 'potential overkill', it is necessary to eliminate three attributes, specifically destination cleanliness, job opportunities, and tourist activities.

3.4 Kano model based on tourist clustering

The KANO model categorizes the quality-related features into five management quality categories based on the relationship between performance and the objective and subjective needs of consumers. The selection of the third cluster as the target cluster was based on its most significant representation of respondents, accounting for 67.31% of the total.

Table 5 presents the tourist characteristics of the specific target cluster, as identified in the analysis. It gives the geographic, demographic, psychographic, and behavioral information of the respondents in detail. Most respondents from Sampang, visited the destination by car and stayed at a relative's house who lived close to the tourist attraction. Most tourists are aged 17 - 24 years old, unmarried, visiting destinations with friends, and have a maximum income IDR. 3.000.000, the average expenditure for travelling is IDR. 100.000 and obtain information regarding destinations from social media. The motivation for tourists to visit Bira Tengah tourist villages is to looking for entertainment because of the natural beauty of beach, with the preferred activity of walking along the beach and preferring to rent facilities at tourist attractions. In contrast, many tourists have yet to experience the destination or are embarking on their first visit.

Table 5. Tourist characteristics based on third cluster.

Variable	Indicator	Characteristic
Geographic segmentation	Origin	Sampang
	Modes of transportation	Car
	Accommodation type	Relative's House
	Parking lot	Available
Demographic segmentation	Age	17-24 years old
	Marital status	Not married yet
	Occupation	Housewife
	Income	IDR 1,000,000-3,000,000
	Expenses	Under IDR 100,000
	Visit with whom	Friends
	length of visit	2 – 3 Hours
	Source of information	Social Media
Psychographic segmentation	Motivation	Looking for entertainment
	Attractiveness	Natural beauty
	Main objective	Enjoy nature
	Leisure activity	Walk along the beach
	Souvenir	Food/snacks/beverages
	Facility	Renting at tourist destination
Behavioral segmentation	Visiting status	Never visited
	Number of visits	1 time

The Kano category is derived from the grouping of tourists belonging to the third cluster. The initial stage in obtaining attribute categories using the Kano model involves performing calculations to determine whether the sum of the categories of Must-be, One-dimensional, and Attractive (M + O + A) exceeds or falls short of the sum of the categories of Indifferent, Reverse, and Questionable (I + R + Q). In this context, the letter M represents the must be, O denotes a one-dimensional, A signifies attractiveness, I refers to indifferent, R indicates reverse, and Q represents a questionable. In the first indicator, X_1, it can be observed that the sum of variables M, O, and A exceeds the sum of variables I, R, and Q, indicating a numerical disparity between the two sums. The value is derived from the highest, specifically, the one-dimensional value. The detailed findings are presented in Table 6. Category O contains eight attributes, while category I consists of two attributes, and category A encompasses three attributes.

Table 6. Kano category based on third cluster of tourists.

Code	A	M	O	I	M+O+A	I+R	Category
X_1	22	4	40	4	66	4	O
X_2	23	5	34	8	62	8	O
X_3	24	5	29	12	58	12	O
X_4	21	13	31	5	65	5	O
X_5	23	4	11	32	38	32	A
X_6	15	8	6	41	29	41	I
X_7	13	7	9	41	29	41	I
X_8	28	18	14	10	60	10	A
X_9	16	6	31	17	53	17	O
X_{10}	7	4	47	12	58	12	O
X_{11}	7	16	35	12	58	12	O
X_{12}	16	12	22	20	50	20	O
X_{13}	25	5	21	19	51	19	A

A: Attractive; M: must-be; O: one dimensional; I: indifferent; R: Reverse.

3.5 Integrated IPA-KANO model based on tourist clustering

The present study proposes an integrated approach that combines the IPA (Importance-Performance Analysis) and Kano model frameworks for decision-making, specifically focusing on the third cluster of tourists. The IPA-Kano category is derived from the pre-existing results in Fig. 6 and Table 6. Then, Table 7 presents the IPA-Kano integration. For instance, the utilization of health and safety attribute represents a strategy point that lacks adequate defensive measures and necessitates enhancements in health and safety indicators.

The attributes that require improvement are health and safety, availability of clean water sources, waste management, tourist activities and stakeholder role. Meanwhile, attributes local cultural information, job opportunities, tourism promotion, society participation and village tourism must be maintained.

Given the third cluster as a target segmentation that the predominant demographic of tourists consists of individuals between the ages of 17 and 24 who rely on social media platforms for getting tourist-related information, one potential solution to improve tourist activities attribute might be the implementation of information technology innovations. One approach to enhancing visitor experience is to offer facilities that

allow visitors and tour operators to make advance bookings and online payments. This arrangement would grant them preferred access to the site throughout the day, particularly during periods of peak visitor flow [30].

Table 7. Integrated IPA-Kano model for making decision based on third cluster of tourists.

Code	IPA Quadrant	KANO Category	Integrated IPA-KANO	Decision
X_1	1	O	Defenseless strategy point	Repaired
X_2	3	O	Defenseless zone	Repaired
X_3	3	O	Defenseless zone	Repaired
X_4	4	O	Supportive weapon	-
X_5	4	A	Beginning jewelry	Maintained
X_6	3	I	-	-
X_7	3	I	-	-
X_8	2	A	Precious treasure	Maintained
X_9	2	O	Major weapon	Maintained
X_{10}	1	O	Defenseless strategy point	Repaired
X_{11}	2	O	Major weapon	Maintained
X_{12}	1	O	Defenseless strategy point	Repaired
X_{13}	2	A	Precious treasure	Maintained

4 Conclusion

This study presents a comprehensive framework outlining the essential procedures for assessing the perceived performance of sustainable tourism based on segment clustering. It also identifies specific areas where sustainable tourism attributes require enhancement, hence highlighting the allocation of resources based on tourist feedback. The improvement needs and priorities may vary between tourist village. Based on tourist cluster, the attributes that require improvement are health and safety, availability of clean water sources, waste management, tourist activities and stakeholder role. Meanwhile, attributes such as local cultural information, job opportunities, tourism promotion, society participation and village tourism must be maintained. In addition, the suggested strategy for enhancing tourist activity attributes can be implemented through innovative information technology.

The present study exhibits certain shortcomings that warrant additional research. Future research endeavors may consider employing diverse research methodologies or sampling techniques, such as face-to-face interviews, to enhance the validity and deepen the understanding of tourists' perspectives. Additionally, collecting data from a more extensive pool of tourists visiting the village is advisable.

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