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Sustainability Analysis of Marine Ecotourism Management for Preserving Natural Resources and Coastal Ecosystem Functions

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Ecotourism very support for conservation. Ecotourism may assist with preservation of natural resources and ecotourism functions in comparison to other alternatives, such as mass tourism. This study aims to analyze the sustainability status of ecotourism management for preserving natural resources and ecosystem functions. This study is a survey on ecotourism destinations Clungup Mangrove Conservation (CMC). To analyze the level of sustainability, 9 dimensions were analyzed based on theoretical and empirical studies. The dimensions consisted of (1) conservation, (2) participation, (3) recreation and education, (4) economy, (5) control, (6) government, (7) ecotourism center, (8) academics/researchers, and (9) social media. This study employed quantitative analysis using Rapfish application with Multi-Dimensional Scaling (MDS) to assess the status and sustainability index of marine tourism management (CMC). The result revealed that the sustainability status of marine ecotourism management in CMC was categorized as "highly sustainable". The highest value was the conservation dimension and the lowest value was in the government dimension. Therefore, government support for improving the role of ecotourism regarding preservation of natural resources and ecosystem functions is required. The government can give its support through implementing regulations, facilitating ecotourism management, designing public policy for ecotourism, and planning government policies that benefit the development of ecotourism.

Keywords: Coastal ecosystems, ecotourism, mangrove conservation, principles, sustainability.

Introduction

Natural resources are the essential assets of a country in carrying out development in the economic sector. Besides fulfilling human needs, natural resources also contribute significantly to the wealth of a nation. Numerous countries in the world relies on the tourism sector to increase the economic growth and some fields (Alhowaish, 2016; Manzoor et al., 2019).

One of the strategic coastal natural resources affecting economic growth is beach tourism or marine tourism. The development of marine tourism based on masstourism poses a serious threat to coastal ecosystem functions. Changes in coastal land use and other anthropogenic factors affect the ecological balance on the coast. They cause major environmental damage due to loss of natural resources and ecosystem functions. Besides unplanned and uncontrolled tourism, distortion in urbanization process and inadequate infrastructure also damage the natural environment and wildlife, causing air and water pollution (Liu and Var, 1986; Milman and Pizam, 1988; Lankford and Howard, 1994; Lindberg and Johnson, 1997). Excessive use or abuse of fragile archeological and historical sites can damage the environment and natural tourism (Gee and Makens; Inskeep, 1991).

Tourism is an activity involving direct contact with the local society. Thus, it gives some impacts on social and economic aspects. In this case, tourism can be a catalyst for social and economic changes in various aspects of society. The social and economic changes can be either positive or negative. Negative changes resulting from tourism activities are caused by the development and management of tourism which is solely economically oriented, neglect social and environmental aspects or conservation perspective. Tourism development based on mass tourism that does not follow conservation perspective will cause environmental problems (StoianandIsbăşescu, 2013; Ayachi and Jaouadi, 2017). In addition, tourism can give negative impact on migration activity; increase in new employment opportunities attracts people to move to tourist resort areas which then creates other social and cultural problems (morals, behavior, and culture) (Ross, 1992; McCool and Martin, 1994; Lindberg and Johnson, 1997).

Ecotourism is a form of sustainable tourism that is based on natural resources and encourages ecological awareness (Ceballos-Lascuráin, 1991; Cheia, 2013; Jamrozy and Lawonk, 2017; Çetinkaya et al., 2018). Ecotourism pays attention to conservation goals that preserves the environment and improves the welfare of the society (David A Fennell and Malloy, 1999; Tisdell and Wilson, 2005; Cater, 2006; Correya andJacob, 2011; Singh et al., 2016). Ecotourism is one of the developments of tourism that supports conservation. Conservation does not inhibit a development, instead it will trigger the establishment of sustainable development. The economic development of tourism industry, especially the management of ecotourism, must obey and comply with the ecotourism principles, besides applying those principles, significant supports from the government, private sector, universities/researchers, and social media are required to establish an excellent ecotourism management. A sustainable ecotourism management will ensure the preservation of natural resources and ecosystem functions. This study aims to analyze the sustainability status of ecotourism management for preserving natural resources and ecosystem functions.

Methods

Study area

This research was conducted in September - November 2019. The location was at the southern coast of Malang Regency, Indonesia, namely "Clungup Mangrove Conservation" (CMC) marine tourism area (figure 1). CMC is a conservation area of 117 Ha (71 ha of mangrove, 10 ha of coral reef, 36 protected forest) managed by the local community of Sendangbiru as an Ecotourism destination. CMC consists of 6 beaches offering unique and magnificent views. Those beaches are Clungup Beach, Gatra Beach, Sapana Beach, Mini Beach, Batu Pecah Beach, and Tiga Warna Beach. Some of them perform additional functions related to conservation. Clungup and Gatra Beach become mangrove conservation area and Tiga Warna Beach becomes coral reef conservation area. CMC Ecotourism is a destination that has the best coastal management system according to the Indonesian Ministry of Maritime Affairs and Fisheries.

Determination of the dimensions of sustainability

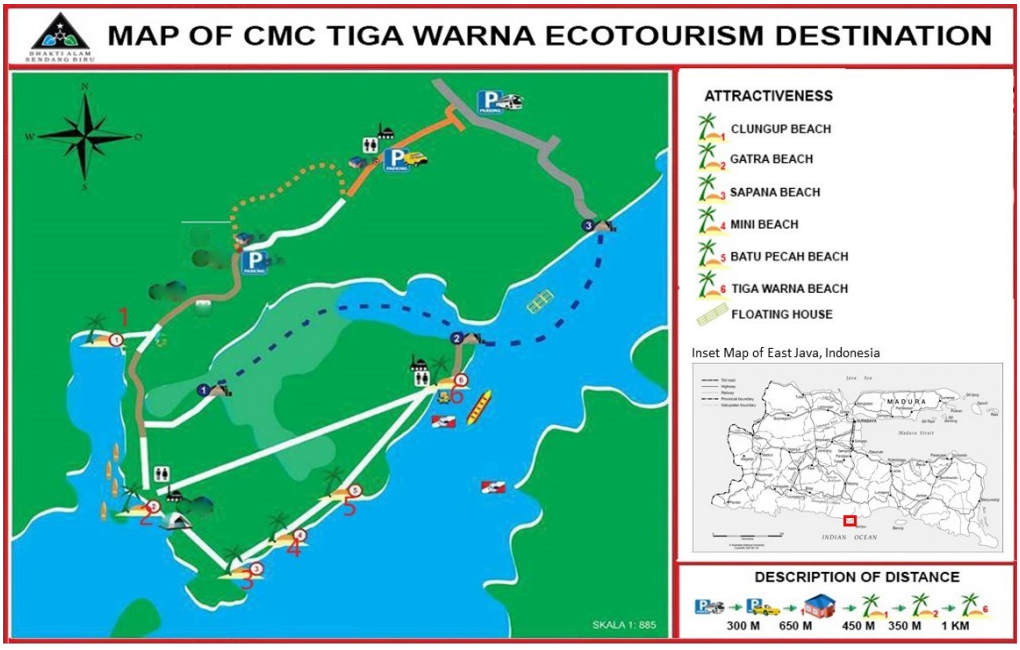
Sustainable development is a development process in which the exploitation of resources in a harmonious process to guarantee the potential of the present and future to meet the needs of human aspirations, therefore the minimum balance and resilience needs must be maintained. Rapid Appraisal for Fisheries (Rapfish) a method for measuring and describing the condition of sustainable resources.

derived from several research references on ecotourism management and principles, *presented in Table 1*.

Sample Determination and Data Collection

The samples of this research consisted of the local community who was familiar with the research area or experts and the tour managers in the site. The method of determining the sample using purposive sampling. The numbers of research respondents were 36 people. The data were collected through structured interviews with

Fig. 1. *Research location*



Rapfish with multidisciplinary science to evaluate the sustainability of resources comparatively based on a number of dimensions and scoring attributes. The attributes of each dimension to be evaluated can be chosen to reflect sustainability, and can be improved or replaced when the latest information is obtained. Ordination of the set of attributes described using multi-dimensional scaling (MDS).

This study employed quantitative analysis using Rapfish application with Multi-Dimensional Scaling (MDS) to assess the status and sustainability index of marine tourism management. The sustainability indicators were determined by using the nine dimensions. These nine dimensions were

questionnaires. The respondents were asked to provide answers to their perceptions about questions related to the dimensions and attributes of the study, with ordinal scale. The questionnaire about the dimensions and attributes used in this study as can be seen in *Table 2*.

Data Analysis

The sustainability analysis using the Rapfish technique began with reviewing attributes and defining the fisheries attributes that would be used, identifying, and scoring. Then, MDS analysis with SPSS software was performed to determine the ordination and stress value through the

Table 1. *Several articles as references determine the nine dimensions in this study*

Topic in the article	References
Ecotourism as a journey that is responsible for the natural environment to enjoy and appreciate nature	McIntosh et al., 1995; Martha Honey, 1999
Ecotourism as a journey to natural destinations with the specific purpose of gaining knowledge, appreciating, and enjoying the natural settings and diverse wildlife in the ecosystem, all of which contribute to environmental conservation	David A Fennell, 2001; Lee, 2007
Ecotourism is adopted in various countries and protected areas that are looking for sustainable development	David Weaver, 1998
Ecotourism must provide experience for the purposes of environmental education, and economic, sociocultural, and environmental sustainability	D. B. Weaver and Lawton, 2007; Powell and Ham, 2008
Ecotourism is a form of tourism that encourages learning experiences and appreciation of the natural environment, or some of its components	Hunter and Green, 1995; McNamara and Gibson, 2008; David Weaver, 2010
Ecotourism must be managed in accordance with best practices for achieving environmental, socio-cultural, and financial viability	David Weaver, 2011
Ecotourism development must have a positive relationship between environmental, economic, and social cultural sustainability on the one hand and financial stability on the other	Buckley et al., 2003; Spenceley, 2006; Reichel et al., 2008; Dwyer et al., 2010; Gössling, 2010.
Sustainability of natural resource-based ecotourism depends also on social, economic and environmental dimensions and the importance of making a balance between economic development and environmental conservation	Shanklin, 1993; Grenier et al., 1993; Allcock and Evans-Smith, 1994; Krüger, 2005; Nurhayati et al., 2019
The value benefits of ecotourism are not measured by profits such as money, but a value that cannot be replaced by money	Loomis, 2002; Mitchell and Carson, 2013
The benefits of ecotourism are not for short-term period and not economic oriented. However, they are for long-term period and respect social, environmental and sustainability principle	Majid et al., 1983; Garrod and Willis, 1999; Champ, 2003; Carson, 2012
The benefits of developing ecotourism for local community are often claimed to promote the conservation of natural and cultural heritage of an area and improve the living standards of local community	Boo, 1990; Lindberg and Hawkins, 1993; Eraqi, 2008
Three main principles must exist for ecotourism that are based on nature, education and sustainable management including economic and social issues	Beaumont, 1998; Diamantis, 1999; Blamey, 2001
True ecotourism discusses five principles: Contributing to conservation, generating economic and other benefits, minimizing negative impacts on the environment, increasing awareness and understanding of nature and cultural systems, increasing community participation	Wallace and Pierce, 1996
there are six principles of ecotourism, namely: Conservation, Education, Ethics, Sustainable development, Impacts, and local benefits	McIntosh et al., 1995

Based on table 1, the dimensions of the CMC marine ecotourism management in this research included; (1) Conservation; (2) Participation; (3) Recreation and education; (4) Economy; (5) Control; (6) Government; (7) Academics / Researchers; (8) Ecotourism center; and (9) Social media.

Table 2. *Attributes and measurement scale of ecotourism sustainability dimensions*

Dimension	Attributes	Scale	Score
Conservation	Changes in landscape	Changes occurred by 50% Changes occurred by 30 – 50% Changes occurred by 15 – 30% Changes occurred less than 15%	1 2 3 4
	Identification of social-economic and cultural values	Unidentified Identified only Identified and application planned Identified and applied	1 2 3 4
	Utilization of balanced resources according to carrying capacity	Free and unbalanced use There is discrimination and unbalanced No discrimination and unbalanced Balanced and appropriate with the carrying capacity	1 2 3 4
	Nature-based facilities and infra-structure	Built inappropriately more than 50% Built inappropriately between 30 – 50% Built inappropriately between 15 – 30 % Built inappropriately less than15%	1 2 3 4
	Direct use of ecological processes that are running in nature is avoided. (Maintained ecological process)	Inevitable Inevitable but still in the plan Sometimes inevitable Inevitable and does not damage the ecology	1 2 3 4
	Economic benefits are partly given back to nature	Nothing Planned Existed with very low proportion Existed with very fair proportion	1 2 3 4
Participation	Developing tourism according to community's decision	Not involving the community Less involving the community Involving certain people Involving all elements of community	1 2 3 4
	Identifying community involvement	Unidentified Will be identified Being identified Already identified	1 2 3 4
	Formulating engagement and incentive patterns	Not formulated Will be formulated Being formulated Already formulated	1 2 3 4
	Increasing empowerment and business opportunities	Fail to increase empowerment Empowerment will be increased Empowerment being increased Empowerment already increased	1 2 3 4
	Gaining competence to fill employment	Not formed Will be formed Being formed Formed and increased	1 2 3 4

Table 2. (continued)

Dimension	Attributes	Scale	Score
Participation	Hiring local labor	No recruitment Recruited in not strategic position Recruited in some strategic positions All recruited in all positions	1 2 3 4
Participation	Raising income and welfare	No impact on welfare Slightly impactful on welfare Less impactful on welfare Highly impactful on welfare	1 2 3 4
Recreation and Education	Natural and cultural values are explored	Not conveyed Less conveyed Not all conveyed Already conveyed	1 2 3 4
	The values of nature and culture are lifted	Not lifted Less lifted Adequately lifted Highly lifted	1 2 3 4
	Natural and cultural values are presented and promoted	Not presented Presented but not promoted Presented but less promoted Well-presented and promoted	1 2 3 4
	Interpretation of natural and cultural values are available	Unavailable Planned Partially available Completely available	1 2 3 4
	Tourism activities are programmed to enjoy	Not enjoyable Enjoyable Enjoyable but consumers are not satisfied Enjoyable and consumers are satisfied	1 2 3 4
	Satisfaction, safety and comfort standards are met	Not fulfilled Less fulfilled Fulfilled Completely fulfilled	1 2 3 4
Economy	Increased Original Local Government Revenue	No contribution Less contribute Contribute Highly contribute	1 2 3 4
	Expansion of employment,	No employment opportunity Opportunity not for the community Less opportunity for the community All opportunities for the community	1 2 3 4

Table 2. (continued)

Dimension	Attributes	Scale	Score
Economy	Increasing the number and quality of facilities and infrastructure	Nothing Slight improvement Adequate improvement Significant improvement	1 2 3 4
	Increasing trade of local products	Nothing Begin to increase Developing Developed	1 2 3 4
	Improving tourism services	Nothing Begin to increase Developing Developed	1 2 3 4
Control	Facilities and infrastructure development are controlled	Unplanned Will be planned Planned but not executed Planned and executed	1 2 3 4
	Ethics of activities are controlled	Unplanned Will be planned Planned but not executed Planned, executed, and controlled	1 2 3 4
	Plans and designs are available.	Unplanned Will be planned Being planned Planned	1 2 3 4
	Institution of supervision control is established	Unplanned Will be planned Being planned Planned and working	1 2 3 4
Government	Ecotourism management according to Government Regulations	Inappropriate Little appropriate Quite appropriate Very appropriate	1 2 3 4
	The existence of reward and punishment	Zero reward Sometimes Always Always and more than enough	1 2 3 4
	Government facilitation support	Zero support Little support Sufficient support Always and more than enough	1 2 3 4
	Adequacy of existing regulations	Zero regulation Less regulation Enough regulation Always and more than enough	1 2 3 4

Table 2. (continued)

Dimension	Attributes	Scale	Score
Ecotourism Centre (EC)	Contribute to the development of an ecotourism	Zero contribution Little contribution Quite contributing Very contributing	1 2 3 4
	Help the process of publication of ecotourism	Zero help Little helpful Quite helpful Very helpful	1 2 3 4
	Acting as a center of knowledge and information	Zero act Little act Adequate act Having big act	1 2 3 4
Academics/ Researchers	The role of academics for ecotourism managers	Zero role Little role Adequate role Having big role	1 2 3 4
	Research results support the development of ecotourism.	Zero support Little support Adequate support Giving big support	1 2 3 4
	Provide inspiration in ecotourism management	Giving zero inspiration Giving little inspiration Giving adequate inspiration Giving big inspiration	1 2 3 4
Social Media	As a means of information and promotion	Unproven Less proven Quite proven Very proven	1 2 3 4
	Ease of Use	Not easy Little easy Quite easy Very easy	1 2 3 4
	Function in Branding to attract tourists.	Non exist Little functional Quite functioning Very functioning	1 2 3 4
	Success builds awareness	Zero awareness development Little awareness development Enough awareness development Very developing awareness	1 2 3 4

Alternating Least squares SCALing (ALSCAL). Next, a rotation to determine the position on the bad and good ordination and Leverage analysis or sensitivity analysis were conducted (Tony J Pitcher, 1999).

The scoring of each indicator in each dimension had the basis of logical thinking that was true and clear. Score was given based on the worst and the best score qualitatively and quantitatively from indicators reflecting perceptions of the dimensions; 1 = very low; 2 = low; 3 = high; 4 = very high. Therefore, determining the score was very dependent on the perception of the analyzed dimensions. The dimensions and attributes specified in this study can be seen in *Table 3*.

Table 3. *Summary of the goodness-of-fit of the Multidimensional Scaling (MDS)-Rapfish Analysis*

Dimension	Stress (S)	R-Square (R)
Conservation	0.17	0.97
Participation	0.23	0.94
Recreation and education	0.22	0.94
Economy	0.24	0.93
Control	0.23	0.945
Governmental (Regulation)	0.24	0.93
Ecotourism Center	0.247	0.92
Researcher/Academic	0.24	0.93
Social Media	0.24	0.94

Feasibility of Sustainability Analysis

The feasibility of sustainability analysis was determined by measuring the level of goodness or goodness-of-fit between the distance between the point of estimation and the original point. This was done by employing the calculation of S-stress. The technique used to determine the goodness-of-fit was the least-squares method based on the root of the Euclidian distance (squared distance) or the algorithm of scale method. This algorithm of scale method optimized the squared distance to the squared data of the origin. The S-stress value was calculated by the following formula.

$$S-stress=\sqrt{\frac{1}{m}\sum_{k=1}^{m}\frac{\sum_i\sum_j\left(d_{ijk}^2-O_{ijk}^2\right)^2}{\sum_i\sum_j O_{ijk}^4}} \quad (1)$$

Where: d_{ijk} – Euclidean distance of point i and j in k-th attribute; O_{ijk} – Estimated Euclidean distance of pint I and j in k-th attribute; m – number of attribute.

A low S-stress value indicates high accuracy (good fit), while a high S-stress value reveals poor accuracy (poor fit). Commonly, an S-Stress value of less than 0.25 is deemed to represent a good fit for the analysis of sustainability. However, a value more than 0.25 indicates that the analysis was poor fit.

Assessment of the sustainability Index

The calculation method in determining the sustainability index category was analyzed manually using the Microsoft Excel application program. The result assessment referred to Pitcher and Preikshot (Tony J Pitcher and Preikshot, 2001) in which the value of 0.00 – 24.99 = Not Sustainable; 25.00 – 49.99 = Less Sustainable; 50.00 – 74.99 = Quite Sustainable; and 75.00 – 100.00 = Highly Sustainable.

Results and Discussion

Summary of the goodness-of-fit of the MDS-Rapfish Sustainability Analysis of Marine Ecotourism is presented in *Table 4.* The reference used as a basis for determining the goodness of the analysis results (Goodness-of-fit) in MDS was a Stress value of less than 0.25 and an R-square of more than 0.90. Based on *Table 3,* the stress value of the three dimensions used was smaller than 0.25. Likewise, for R-Square which showed values above 0.90. Thus, it could be said that this MDS analysis fulfilled the Goodness-of-fit criteria. Thus, further discussion or analysis could be performed.

The Sustainability Index of ecotourism and Sensitivity

The results of the study are briefly shown in summarized results of the MDS analysis in *Table 4*, where the average index value is 77.86 which means Highly Sustainable. The table shown that the sustainability index and the attribute sensitivity for the whole dimension respectively.

Table 4. *Summarized results of the MDS analysis*

Dimension and Attribute	Dimension Index	Attribute Sensitivity
Conservation	**85.57**	
Changes in landscape		2.66
Identification of social-economic and cultural values		3.47
Utilization of balanced resources according to carrying capacity		3.15
Nature-based facilities and infrastructure		4.44
Direct use of ecological processes that are running in nature is avoided (Maintained ecological process)		3.73
Economic benefits are partly given back to nature		2.17
Participation	**74.24**	
Developing tourism according to community's decision		1.43
Identifying community involvement		2.56
Formulating engagement and incentive patterns		3.06
Increasing empowerment and business opportunities		3.60
Gaining competence to fill employment		2.52
Hiring local labor		2.74
Raising income and welfare		1.99
Recreation and Education	**78.4**	
Natural and cultural values are explored,		2.28
The values of nature and culture are lifted,		3.88
Natural and cultural values are presented and promoted		3.84
Interpretation of natural and cultural values are available,		4.48
Tourism activities are programmed to enjoy		3.48
Satisfaction, safety and comfort standards are met.		2.60
Economy	**71.14**	
Increased Original Local Government Revenue		3.05
Expansion of employment,		3.39
Increasing the number and quality of facilities and infrastructure		3.89
Increasing trade of local products		4.22
Improving tourism services		2.32

Table 4. (continued)

Dimension and Attribute	Dimension Index	Attribute Sensitivity
Control	**80.76**	
Facilities and infrastructure development are controlled		3.16
Ethics of activities are controlled		5.76
Plans and designs are available.		5.40
Institution of supervision control is established		3.83
Government	**70.93**	
Ecotourism management according to Government Regulations		4.46
The existence of reward and punishment		4.19
Government facilitation support		4.06
Adequacy of existing regulations		3.90
Ecotourism Centre (EC)	**76.72**	
Contribute to the development of an ecotourism		5.70
Help the process of publication of ecotourism		7.74
Become center of knowledge and information		5.71
Academics/ Researchers	**82.4**	
The role of academics for ecotourism managers		6.91
Research results support the development of ecotourism.		5.79
Provide inspiration in ecotourism management		6.89
Social media	**80.58**	
As a means of information and promotion		5.08
Ease of Use		6.28
Function in Branding to attract tourists.		4.31
Success builds awareness		4.72
Overall Sustainability Index (The Average of the Dimension Index)	**77.86**	

Multidimension Sustainability Index

Based on *table 4*, the results of the multidimensional analysis, the sustainability index of the conservation had a value of 85.57% (highly sustainable). This is followed by the researcher dimension with a value of 82.4%, the control dimension with a value of 80.76%, the social media dimension with a value of 80.58%, the recreation and education dimension with a value of 78.4% (highly sustainable), and

the ecotourism center dimension with an index value of 76.72% (highly sustainable). Among the nine dimension, there were 6 dimensions with highly sustainable status, and the rest of them were in Quite Sustainable status.

Discussion

Discussion of the results of this research is explained for each dimension and attribute, which has a high influence on the sustainability and coastal ecosystem functions.

Conservation dimension

The sustainability dimension index of conservation dimension was 85.57. This value was in the range of 75-100 which meant it was very sustainable. The attributes of the conservation dimension that greatly affected the sustainability of this dimension were shown by the value of the leverage of those attributes which were greater than the other attributes, namely the attribute Nature-based facilities and infrastructure, meaning that facilities and infrastructure were in harmony with nature. This shows that ecotourism must respect ecologically sustainable nature, so that the development of tourism infrastructure and facilities must be in harmony with nature (Ziffer, 1989; Martha Honey, 2008). In addition, the values of vulnerability of natural resources and ecology in a tourist attraction must be managed properly, because something that is vulnerable to causing ecological damage will definitely disrupt conservation goals (Harahab *et al*., 2018; Riniwati et al., 2019).

Participation dimension

The sustainability dimension index of the participation dimension was 74.24. This value was in the range of 50-75, which meant it was quite sustainable. The attributes of the participation dimension that greatly affected the sustainability of this dimension were shown by the value of the leverage of those attributes which were greater than the other attributes, namely increasing empowerment and business opportunities, and formulating engagement and incentive patterns. This is in accordance with the opinion of the experts (Boo, 1990; Lindberg and Hawkins, 1993) that the management of ecotourism must have a positive impact on people's living standards.

Recreation and education dimension

Sustainability status index for recreation and education dimension was 78.40. This value was in the range of 75-100 which meant it was very sustainable. The attribute of recreation and education dimension that greatly affected the sustainability of this dimension was "the interpretation of environmental and cultural values is available, the values of nature and culture are lifted, and natural and cultural values are presented and promoted". This is consistent with the opinion of experts that the journey is responsible for the natural environment to enjoy and appreciate nature (McIntosh *et al*., 1995; Martha Honey, 1999) and of course not just recreation but must acquire knowledge and enjoy nature with its diversity (David A Fennell, 2001; Lee, 2007).

Economic dimension

The economic dimension of the sustainability status index was 71.14. This value was in the range of 50-75, which meant it was quite sustainable. The attributes of the economic dimension that greatly affected the sustainability of this dimension are increasing trade of local products and increasing the number and quality of infrastructure. This is consistent with the opinion that ecotourism must provide economic sustainability (Buckley *et al*., 2003; D. B. Weaver and Lawton, 2007; Powell and Ham, 2008; Reichel *et al*., 2008). In addition, the development of ecotourism must be financially feasible (David Weaver, 2011) which means that ecotourism management must bring clear economic incentives, for example the increase in trade in local products, or increase in the number and quality of infrastructure.

Control dimension

The control dimension of the sustainability status index was 80.76. This value was in the range of 75-100 which meant it was very sustainable. The attributes of the control dimension that greatly affected the sustainability of this dimension were "the ethics of natural and social activities are available and regional plans and designs are available". This means that the development of ecotourism must be controlled and remain in harmony with the natural, social and cultural environment. In accordance with expert opinion (Hunter and Green, 1995; McNamara and Gibson, 2008; David Weaver, 2010) that

Ecotourism must encourage learning, experience, and appreciation of the natural environment and some of its components. Thus, ecotourism management must be planned and designed properly so that its development does not damage the environment.

Governmental dimension

The governmental dimension of the sustainability status index was 70.93. This value was in the range of 50-75, which meant it was quite sustainable. The attribute of the governmental dimension that greatly affected the sustainability of this dimension was ecotourism management according to government regulations. This means that the management of ecotourism in Indonesia must follow laws and government regulations. Regulations related to tourism in Indonesia include Law of the Republic Indonesia No.10 of 2009, concerning Tourism; Minister of Home Affairs Regulation Number 33 of 2009, concerning Guidelines for the Development of Ecotourism in the Regions; and Regulation of the Minister of Tourism of the Republic of Indonesia Number 14 of 2016 concerning Guidelines for Sustainable Tourism Destinations. The government's important role in ecotourism development is regulation and facilitation

Ecotourism center dimension

The sustainability status index of the ecotourism center dimension was 76.72. This value is in the range of 75-100 which means it is very sustainable. The attribute of the ecotourism center dimension which greatly affected the sustainability of this dimension was "the ecotourism center helps publication process". Ecotourism center as an autonomous institution consisting of ecotourism managers establishes communication and good relations with stakeholders and the wider community. therefore, the role of this Institution is very helpful in the promotion and publication for local and foreign communities.

Academics/researchers dimension

Academics/researchers dimension of sustainability status index was 82.4. This value was in the range of 75-100 which meant it was very sustainable. The attribute dimension of academics / researchers that greatly affected the sustainability of this dimension was the role of researchers in ecotourism management. This shows that the synergy of universities or researchers is needed in the management of ecotourism, the role of researchers to give advice based on the results of research and to provide assistance is very important. This is consistent with what is expected by experts (Collins, 2008; Smith, 2009; Buckley, 2009; Fleischer, 2010) that managing ecotourism needs several strategies to realize the principles in ecotourism.

Social media dimension

The sustainability status index of the social media dimension was 80.58. This value was in the range of 75-100 which meant it was very sustainable. The attribute of the social media dimension that greatly affected the sustainability of this dimension was the ease of use. Nowadays, the role of social media cannot be avoided anymore. All human activities especially for business interests will always be greatly helped by the role of social media. However, careful consideration is needed when using social media. The disadvantages and weaknesses of the business must not be widely published.

Multidimension Sustainability Index

The average value of the sustainability index of all these dimensions was 77.86. This value indicated that the marine ecotourism lever factor was sustainable (75-100). Based on appendix 3, if the index approaches 100, it shows a better sustainability status. On the contrary, if it gets closer to 0, then the status of sustainability is getting worse. Of the 9 dimensions, the dimension that had a poor sustainability index value was the governmental dimension, followed by the economic dimension. This shows that the role of government regulation and facilitation is still not significant enough. The design of public policies for ecotourism and related government policy planning must benefit tourism development (Collins, 2008; Smith, 2009; Buckley, 2009; Fleischer, 2010). While from the economic dimension, there has not been an increase in tourist services. Thus, the role of the government in the regulation and facilitation of ecotourism must be improved. It is expected that ecotourism will continue to exist and be the most favorable tourism for local and international tourists. The condition is in accordance with what is stated in the principles of ecotourism, which is a direct impact in the economic aspects(Grenier *et al.*, 1993; Buckley *et al.*,

2003; Spenceley, 2006; D. B. Weaver and Lawton, 2007; Powell and Ham, 2008; Dwyer *et al*., 2010).

Of the 9 sustainability dimensions analyzed, there were 5 dimensions included in the principles of ecotourism, namely the dimensions of conservation, participation, recreation and education, and control. Managing ecotourism by applying these principles is believed to be able to preserve natural resources and ecosystem functions. From these 5 dimensions, the conservation dimension indicated a very high sustainability status. Meanwhile, the average value of the 5 dimensions was 78.02 indicating a highly sustainable status. Thus, CMC ecotourism in Malang Regency of Indonesia is declared able to preserve natural resources and ecosystem functions.

Conclusions

The results of this study concluded that the management of marine ecotourism in mangrove conservation is declared excellent with a very high sustainability status (highly sustainable), with an average value of 77.8. The highest value was in the conservation dimension indicating 85.57, while the lowest value was in the government dimension indicating 70.93. Judging from the principle of ecotourism, namely the dimension (1) conservation, (2) participation, (3) recreation and education, (4) economy, (5) control, showing highly sustainable status with a value of 78.02. Based on the results of sensitivity analysis or leverage analysis, sensitive factors must be managed properly. Thus, government support for improving the role of ecotourism regarding preservation of natural resources and ecosystem functions is required. The government can give its support through implementing regulations, facilitating ecotourism management, designing public policy for ecotourism, and planning government policies that benefit the development of ecotourism. It is expected that there will be an increase in tourism service business.

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