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CULTURAL HERITAGE CONSERVATION OF "THE UNITED STATE ARMY TRANSPORT (USAT) LIBERTY" SHIPWRECK SITE AS A SUSTAINABLE SCUBA DIVING ECOTOURISM

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Abstract

The "USAT LIBERTY" shipwreck site is a US warship which sank due to a torpedo hit from a Japanese submarine. Presently, the cultural heritage of the shipwreck site is a scuba diving eco-tourism area, with an average of 150 visitors per day. This study therefore aims to examine the sustainability status of scuba diving ecotourism conservation at the USAT Liberty shipwreck site by analyzing the ecology, economics, socio-cultural, legal and institutional, infrastructure and technology using the Multi-Dimensional Scaling (MDS) method. The results showed that the ecological dimension was in an almost unsustainable status at 48.01, while the economic, legal and institutional dimensions were in a quite sustainable status at 74.93 and 68.78, respectively. The socio-cultural dimension of infrastructure and technology is in a very sustainable status at 80.23 and 76.66. Therefore, to solve this problem, a sustainable strategic steps are needed, such as (1) rehabilitation of coral reef ecosystems, (2) Establishment of small and medium businesses (SME) for local communities, (3) improvement of the planning and management system, (4) Establishment of environmental and law enforcement systems, and (5) Establishment of a legislative system for ecotourism planning.

Keywords: *Conservation; USAT Liberty shipwreck; Sustainable ecotourism, Scuba diving*

Introduction

The coastal area is a tourism asset supported by prospective geological features such as coral reefs particularly the hard corals which are suitable for diving and snorkeling. It contributes immensely to the maintenance of biodiversity and the ecosystem [1]. One of such areas, is the Tulamben waters, which is a prospective tourist site, with various types of coral fish and reefs, however, due to the richness of its biota, it is the best place for snorkeling and diving tours on the Bali Island [2].

The US ship was sunk after being hit by a Japanese submarine torpedo on the 11th of January, 1942 while on a cruise across the Lombok Strait [3]. This site is visited by an average of 150 divers daily and the ship is 30 meters beneath the sea. Subsequently, during the holiday season, there are approximately 200-250 divers per day. The ecological community of the coral reef has a limit or carrying capacity of 5,000 dives per year (100 divers per week - 15 per day), and when its values are above, it causes the ecosystem to deteriorate [4]. The damages to underwater archaeological sites by humans are minimal compared to natural disasters [5].

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Additionally, the pressure exerted by human activities on the natural resources in the coastal and small islands tends to have an impact on ecological sustainability [6, 7].

The underwater archaeology is a national asset that needs to be appropriately and reasonable managed. Its existence is not only a historical record that is evident in Indonesia's journey towards civilization, rather it also needs to be developed and utilized, because it is beneficial to the development of science. In accordance with the high potential and activities at the site, it is necessary to research on the conservation of sustainable scuba diving ecotourism. This study therefore is aimed at determining the sustainability status of scuba diving ecotourism at the USAT Liberty shipwreck site, and it was observed that the preservation of underwater archaeological resources tends to support these activities and also aids the local communities to become prosperous. This study employed a multidimensional scaling method to assess the sustainability status of scuba diving ecotourism at the site by interpreting/describing the proximity of all the variables [8].

Experimental

Area of study

This research was conducted at the "USAT Liberty" shipwreck site located in Tulamben Village, Kubu District, Karangasem Regency, Bali, with coordinates at 8°16'24" South latitude and 115°35'33.1" East longitude and 8°16'27.8". The "USAT Liberty" shipwreck was at a depth of 7 - 30 meters on the water surface. The study area is shown in figure 1.

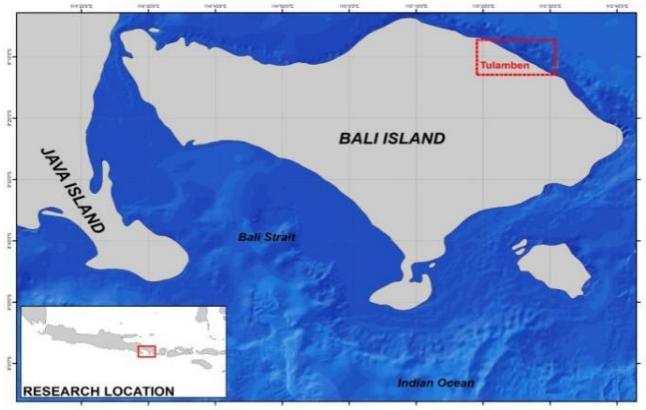

Fig. 1. Site location

The data used acquired from various sources

Primary data were obtained through in situ samplings and analyzed in the laboratory, while interviews were conducted using structured questionnaires which were distributed to the respondents including government officials, divers, tourism entrepreneurs, Tulamben tourism managers and dive guides, labor workers, local and foreign tourists. Secondary data were obtained from government agencies and results from previous relevant researches.

Sustainability analysis

The sustainability status of the scuba diving ecotourism conservation at the "USAT Liberty" shipwreck site was analyzed with the Multidimensional Scaling (MDS) approach using the RapFish (Rapid Appraisal for Fisheries). The software consists of 5 dimensions, such as ecology, economics, social and culture, law and institutions, infrastructure and technology. Sustainability status is determined following the index value generated by assigning a score to each dimension which consists of several attributes measured both qualitatively and quantitatively according to the basic needs. Furthermore, each attribute is given a score in

accordance with the field observations and literature. The dimensions and attributes used in assessing sustainability status are shown in Table 1.

Table 1. Dimensions and attributes of scuba diving ecotourism sustainability [9, 10]

No	Attribute	Score	Score Criteria
Ecological Dimension			
1	The suitability of scuba diving ecotourism	0; 1; 2; 3	Ecotourism suitability index (IKW): (0 = Not suitable (N): IKW <25%); (1 = Conditional Suitable (S3): IKW 25-50%); (2 = Suitable (S2): IKW> 50-75%); (3 = Conditional Suitable (S3): IKW 25-50%)
2	Physical carrying capacity of ecotourism during scuba diving	0; 1; 2	Optimum number of visitors (PCC): (0 = above PCC); (1 = according to PCC); (2 = under PCC)
3	Status of water pollution	0; 1; 2; 3	Based on pollutant status: (0 = heavily polluted); (1 = medium polluted); (2 = mildly polluted); (3 = good condition)
4	Percentage of live coral coverage	0; 1; 2; 3	Percentage of live coral coverage: (0 = 0-24.9%); (1 = 25-49.9%); (2 = 50-74.9%; (3 = 75-100%)
5	Number of life form types	0; 1; 2; 3	Based on the suitability matrix of scuba diving ecotourism: (0 = <4); (1 = 4-7); (2 = <7-12); (3 => 12)
6	Number of reef fish species	0; 1; 2; 3	Based on the suitability matrix of scuba diving ecotourism: (0 = <20); (1 = 20-<50); (2 = 50-100); (3 => 100)
7	Diversity index of coral fish	0; 1; 2	Based on diversity index (H): (0 = low); (1 = medium); (2 = high)
8	Uniformity index of coral fish	0; 1; 2	Based on the uniformity index (E) :(0 = small uniformity); (1 = medium uniformity); (2 = high uniformity)
9	Dominance index of coral fish	0; 1; 2	Based on dominance index (D): (0 = high dominance); (1 = medium dominance); (2 = low dominance)
10	Brightness of waters	0; 1; 2; 3	Based on the suitability matrix of scuba diving ecotourism: (0 = <20); (1 = 20-<50); (2 = 50-80); (3 => 80)
11	Current speed	0; 1; 2; 3	Based on the suitability matrix of scuba diving ecotourism: (0 => 50); (1 => 30-50); (2 = 15-30); (3 = 0-15)
12	Water depth	0; 1; 2; 3	Based on the suitability matrix of scuba diving ecotourism: (0 => 30); (1 => 20-30); (2 => 15-20); (3 = 6-15)
Economic Dimension			
1	Number of tourist visits	0; 1; 2	Optimum number of visitors (PCC): (0 = above PCC); (1 = in accordance with PCC); (2 = under PCC)
2	Local own revenue (PAD)	0; 1; 2	Increased local own revenue (PAD) (0 = decreased); (1 = constant); (2 = increasing)
3	Age of labor	0; 1; 2	The composition of the labor in the field of ecotourism business (0 = dominated by parents); (1 = parents and youth balanced); (2 = dominated by youth)
4	Job opportunities	0; 1; 2	Trend of local employment opportunities (0 = decreasing); (1 = constant); (2 = increasing)
5	Increasing the local people's income	0; 1; 2	Local community income level from ecotourism business (0 = < average of minimum wage); (1 = same as minimum wage); (2 = > average of minimum wage)
6	Advantages of ecotourism business	0; 1; 2	Comparison between capital and profits (0 = loss); (1 = no profit); (2 = profit)
7	Ecotourism business profit trends	0; 1; 2	Profit from the ecotourism business per year (0 = down); (1 = stable); (2 = increasing)
8	Business supporting ecotourism	0; 1; 2	The existence of a business supporting ecotourism in scuba diving (0 = none); (1 = exist and little contribute); (2 = exist and greatly contribute)
9	Conservation funds allocation	0; 1; 2	Funds provided for conservation (0 = not available) (1 = available, insufficient); (2 = available and sufficient)
10	Corporate social responsibility	0; 1; 2	Frequency of CSR funds provided by entrepreneurs (0 = not getting CSR); (1 = incidental); (2 = available regularly)
Socio Cultural Dimension			
1	Underwater beauty	0; 1; 2; 3	Tourist perception of underwater beauty (0 = bad); (1 = Medium); (2 = Good); (3 = Very good)
2	Rehabilitation activities	0; 1; 2	Frequency of rehabilitation activities in a year (0 = never done); (1 = done irregularly); (2 = done regularly)
3	Security	0; 1; 2; 3	Tourist and community perception (0 = poor); (1 = Medium); (2 = Good); (3 = Very good)
4	Cleanliness	0; 1; 2; 3	Tourist and community perception (0 = poor); (1 = Medium); (2 = Good); (3 = Very good)
5	Harmony of society and tourists	0; 1; 2; 3	Comfort of local people and tourists (0 = uncomfortable); (1 = medium); (2 = comfortable); (3 = very comfortable)
6	The role of indigenous peoples	0; 1; 2; 3	The role of indigenous peoples in scuba diving ecotourism conservation (0 = have no role); (1 = have a low role); (2 = have a role); (3 = have a significant role)
7	Stakeholder participation	0; 1; 2; 3	The role of stakeholders in development (0 = have no role); (1 = have a low role); (2 = have a role); (3 = have a significant role)
8	Social conflict	0; 1; 2	Frequency of other utilization conflicts, for example fishing tourism (0 = often); (1

No	Attribute	Score	Score Criteria
			= sometimes); (2 = never)
9	Local knowledge	0; 1; 2	Local community knowledge about scuba diving ecotourism (0 = low); (1 = medium); (2 = height)
10	The role of government in supervision	0; 1; 2	The role of the government in guiding the community to preserve the environment (0 = none); (1 = through counseling); (2 = through counseling and joint action)
11	The role of local community leaders	0; 1; 2	The role of local community leaders in supporting government programs (0 = have no role); (1 = have a role during the program); (2 = play an active role after the program and continue independently)
12	Community empowerment program	0; 1; 2	Benefits of community empowerment programs (0 = none); (1 = available but not effectively used); (2 = available and continues effectively)
13	Change in quality of life	0; 1; 2	Changes in the quality of life on local community (0 = decreased); (1 = constant); (2 = increasing)
Legal and Institutional Dimensions			
1	Enforcement	0; 1; 2	The role of Pokmaswas in supervising violations (0 = have no role); (1 = the role is only supervising); (2 = play a role until reporting to the authorities)
2	Law and regulation	0; 1; 2	The level of compliance in carrying out the rules in the management document (0 = provisions in the document are not implemented); (1 = violation); (2 = there is no violations)
3	Compliance in carrying out ecotourism management documents	0; 1; 2	Conformity of regional policies with the provisions in the community (0 = contradictory); (1 = not contradictory); (2 = not contradictory and running well)
4	Policy synergy	0; 1; 2	Regional regulations supporting coastal management (0 = none); (1 = available but not working); (2 = available and running well)
5	Local government regulations	0; 1; 2	Customary law governing ecotourism management (0 = none); (1 = available but not working); (2 = available and running well)
6	Customary law	0; 1; 2; 3	The existence and role of ecotourism groups (0 = none); (1 = exist, have no role); (2 = exist, have an incidental role); (3 = exist and have a very good role)
7	Ecotourism group	0; 1; 2; 3	The existence and role of Pokmaswas (0 = none); (1 = exist, have no role); (2 = exist, have an incidental role); (3 = exist and plays a role in supervision)
8	Monitoring community group (Pokmaswas)	0; 1; 2; 3	The role of local government institutions (0 = none); (1 = exist, have no role); (2 = exist, have an incidental role); (3 = exists and have a good role)
9	The role of the government	0; 1; 2; 3	The role of indigenous peoples in ecotourism management (0 = none); (1 = exist, have no role); (2 = exist, have an incidental role); (3 = exists and have a good role)
10	The role of indigenous peoples	0; 1; 2; 3	The role of NGOs in ecotourism management (0 = none); (1 = exist, have no role); (2 = exist, have an incidental role); (3 = exists and have a good role)
11	The Role of Non-Government Organizations (NGOs)	0; 1; 2	Availability of scuba diving ecotourism guides (0 = not yet available); (1 = available but still limited); (2 = sufficient available)
Infrastructure and Technology Dimensions			
1	The number of ecotourism diving spots	0; 1; 2	Number of dive spots (0 = 1-2); (1 = 3-5); (2 => 5)
2	Medical facility	0; 1; 2	Health Facilities and Infrastructure (0 = not yet available); (1 = available but still limited); (2 = sufficient available)
3	Restaurant	0; 1; 2	Availability of restaurants / stalls (0 = not yet available); (1 = available but still limited); (2 = sufficient available)
4	Lodging	0; 1; 2	Availability of lodging, inns, hotels (0 = not yet available); (1 = available but still limited); (2 = sufficient available)
5	Worship place	0; 1; 2	Availability of places of worship (0 = not yet available); (1 = available but still limited); (2 = sufficient available)
6	Diving equipment rental	0; 1; 2	Availability of diving equipment rental (0 = not available); (1 = available but still limited); (2 = sufficient available)
7	Supporting boat for scuba diving ecotourism	0; 1; 2	Availability of scuba diving ecotourism boat (0 = not yet available); (1 = available but still limited); (2 = sufficient available)
8	Availability of fresh water	0; 1; 2	Availability of fresh water (0 = not yet available); (1 = available but still limited); (2 = sufficient available)
9	Access to dive sites	0; 1; 2; 3	Ease of access to the dive sites (0 = very difficult); (1 = difficult); (2 = easy); (3 = very easy)
10	Transport to the location of ecotourism	0; 1; 2	Transportation to the location of ecotourism (0 = not yet available); (1 = available but still limited); (2 = sufficient available)
11	Marketing of scuba diving site ecotourism (online)	0; 1; 2;	Marketing of scuba diving ecotourism sites (online) (0 = not yet available); (1 = available but still limited); (2 = sufficient available)
12	Ease of accessing ecotourism information	0; 1; 2; 3	Ease of accessing ecotourism information (0 = very difficult); (1 = difficult); (2 = easy); (3 = very easy)
13	Increased HR for technology mastery	0; 1; 2	Availability of facilities to improve the quality of human resources in technological mastery (0 = none) (1 = available but not utilized) (2 = available and useful)

Multidimensional scaling (MDS) analysis

MDS analysis using the RapFish was chosen because it is proved to be more stable than other multivariate evaluation methods, such as factor analysis and multi-attribute utility theory (MAUT) [11].

The object observed during MDS analysis is mapped in two or three-dimensional space, thereby existing close to its origin. The ordination technique (distance determination) in MDS is in accordance with the euclidian distance where the dimensional space is stated in equation (1) [12]:

$$d = \sqrt{([x_1 - x_2]^2 + [y_1 - y_2]^2 [z_1 - z_2] + \ldots\ldots)} \quad (1)$$

The point is then rounded off by regressing the euclidean distance (dij) from point i to j with its origin (dij), as stated in equation (2):

$$d_{ij} = \alpha + \beta\, \delta ij + \varepsilon \quad (2)$$

The regression equation employed the least squared technique which is alternately derived from the root of euclidian distance (s*quared distance*) often referred to as the ALSCAL algorithm, and the iteration principle, thereby making it capable of generating the smallest possible error value. According to *P. Kavanagh* [13], the ALSCAL algorithm increases the squared distance (*dijk*) to quadratic data (*origin point = 0ijk)*, in three dimensions (i, j, k) and this is expressed using a formula called S-Stress, as stated in equation (3):

$$S = \sqrt{\frac{1}{m}} \sum_{k=1}^{m} \left[\frac{\sum_i \sum_j (d_{ijk}^2 - o_{2IJK}^2)^2}{\sum_i \sum_j o_{ijk}^4} \right] \quad (3)$$

The squared distance is the weighted euclidean distance, which is stated in equation (4):

$$d_{ijk}^2 = \sum_{a=1}^{i} W_{ka} (X_{ia} - X_{ja})^2 \quad (4)$$

The position of the sustainability point is visualized through the horizontal and vertical axis. In addition to the rotation process, the position of the point is observed on the horizontal axis with a sustainability index value of 0% (Bad) and 100% (Good). Furthermore, the value of the sustainability index for each dimension is represented in the form of a kite diagram as shown in Table 2.

Table 2. Category index and status of sustainability for dive tourism [14]

Index Value	Category		
0 – 25	Bad	:	not sustainable
26 – 50	Low	:	almost unsustainable
51 – 75	Sufficient	:	simply sustainable
76– 100	Good	:	very sustainable

Leverage analysis

This is used to determine the sensitive attributes and interventions conducted. The results from the leverage analysis are stated in terms of percentage (%) changes in the root mean square (RMS) of each attribute omitted in the ordination. Leverage analysis is conducted by observing the effect of each attribute which occurs in the RMS value, particularly on the x-axis or on the accountability scale. The attributes with the highest percentage are the most sensitive and tend to affect sustainability, therefore the greater the change in the root mean square (RMS), the more the sensitivity towards the improvement of the sustainability status [15].

Monte Carlo analysis

This analysis is used to verify the confidence level of the index value of each dimension and 95% was obtained. The Monte Carlo analysis aids in evaluating sustainability in order to discover the effect of scoring errors on each attribute. This is caused by procedural errors or when the attributes and variations are not properly understood [16]. These errors occur due to different scores awarded by the researcher, mistakes when entering data or missing information, and high-stress values [17].

Stress and Coefficient of Determination Value (R^2)

The Stress and Coefficient of Determination (R2) values are aimed at validating the attributes studied in the MDS analysis and also to ensure that they are quite accurate and are accounted for scientifically. The results from this analysis are considered precise and detailed when the stress value is smaller than 0.25 (25%) and the coefficient of determination (R) approaches the value of 1.0 (100%) [17].

Results and Discussion

Index value of sustainability status in scuba diving ecotourism based on ecological dimensions

The sustainability status for scuba diving ecotourism on the ecological dimension is measured using 12 attributes, selected in accordance with the availability and utilization of resources that describe the condition of the marine ecosystem. The results from the RapFish analysis of the ecological dimension have a sustainability index of 48.01 with an almost unsustainable status, as stated in figure 2. The leverage analysis of the ecological dimension shows three attributes that are sensitive to the sustainability index value, namely the dominance index of coral fish (2.43), the physical carrying capacity of scuba diving ecotourism (1.62) and the percentage of live coral coverage (1.44), as stated in figure 3. This dimension is the basis for managing coastal resources. The condition of a coastal area is observed from the dependence of the community on its ecosystems and the impact it has on the environment [18].

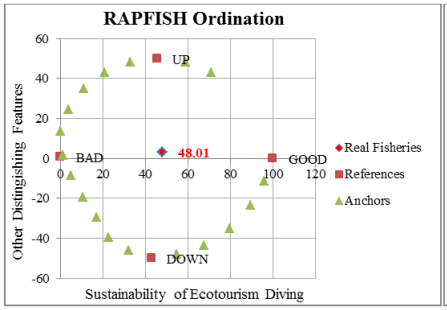

Fig. 2. RapFish ordination of the ecological dimension

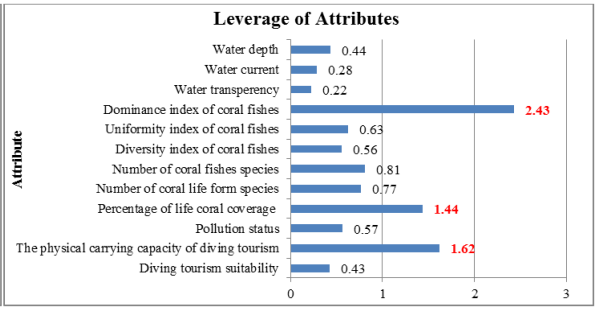

Fig. 3. Leverage of elements of the ecological dimension of dive tourism on a sustainability scale of 0 to 100

Index value of sustainability status in scuba diving ecotourism based on economic dimensions

This is measured using 10 attributes which are chosen in accordance with the parameters that tend to affect the people's welfare [19]. The results from scuba diving ecotourism at the USAT Liberty shipwreck site following the economic dimension obtained a score of 74.93 with a fairly sustainable status as shown in figure 4. The leverage analysis show that some attributes are sensitive and significantly influences the sustainability status derived from the economic dimension, such as supporting businesses (5.48), conservation of fund allocation (5.03) and

availability of corporate social responsibility funds derived from tourism entrepreneurs (4.09) as shown in figure 5.

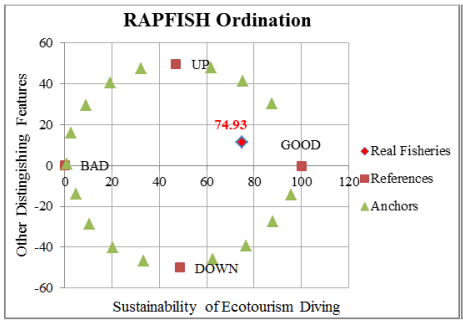

Fig. 4. RapFish ordination of the economic dimension

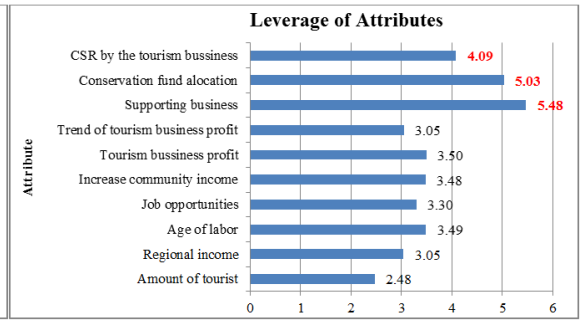

Fig. 5. Leverage of elements of the economic dimension of dive tourism on a sustainability scale of 0 to 100

Index value of sustainability status in scuba diving ecotourism based on social culture dimensions

The analysis of the sustainability status for scuba diving ecotourism in accordance with the socio-cultural dimension is carried out by evaluating 13 attributes that refer to numerous social factors that are considered important and affects the societal life of the community. The results from the RapFish evaluation on the socio-cultural dimension obtained a score of 80.23 with a very sustainable status as shown in figure 6. However, the results from the laverage analysis had a significant influence on sustainability under the socio-cultural dimension namely the knowledge of ecotourism by the local communities (4.78), stakeholder's participation (3.19), community empowerment program (3.18) as shown in figure 7.

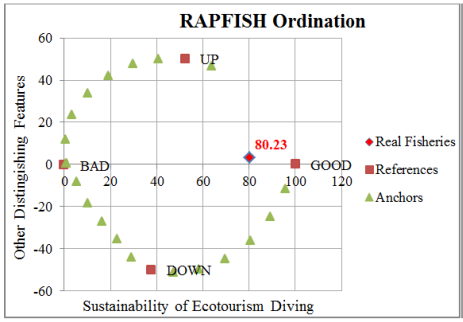

Fig. 6. RapFish ordination of the socio-culture dimension

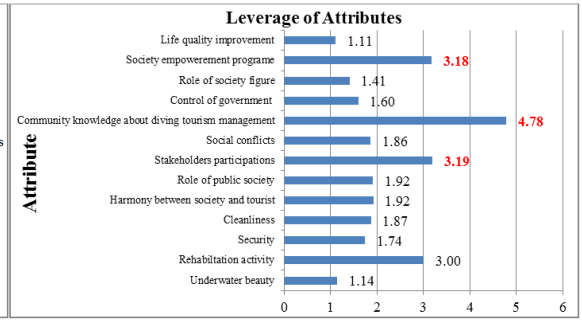

Fig. 7. Leverage of elements of the socio-culture dimension of dive tourism on a sustainability scale of 0 to 100

Index value of sustainability status in scuba diving ecotourism based on legal and institutional dimension

This analysis is carried out by analyzing 11 attributes, with the legal and institutional dimension of society created to improve the welfare of the community. The results from the RapFish evaluation in accordance with this dimension obtained a score of 68.78 with a fairly sustainable status. Meanwhile, the results from the laverage analysis on this dimension are customary law (3.79), policy synergy (3.69), and local government regulations on scuba diving ecotourism conservation (3.56) as shown in figures 8 and 9 respectively.

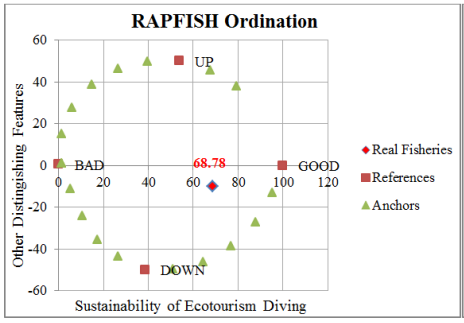

Fig. 8. RapFish ordination of the legal and institutional

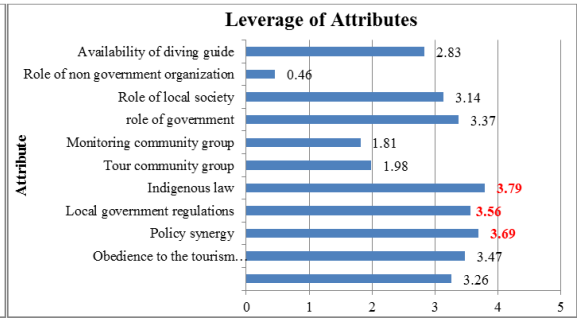

Fig. 9. Leverage of elements of the legal and institutional dimension of diving tourism on a sustainability scale of 0 to 100

Index value of sustainability status in scuba diving ecotourism based on infrastructure and technology dimensions

Indicators of infrastructure and technology dimensions consist of 13 attributes. The sustainability of scuba diving ecotourism obtained a score of 76.66 with a very sustainable status. Following the results from the leverage analysis, several attributes serve as the lever factor in this dimensions, such as places of worship or religious house (4.33), public transportation to locations (3.97), and health facilities (2.66). The lack of supporting ecotourism facilities such as places of worship, public transportation and health facilities inconveniences the tourists. These facilities need to be beneficial to and managed by the local community [20]. The results from the ordination and leverage analysis are shown in figures 10 and 11 respectively.

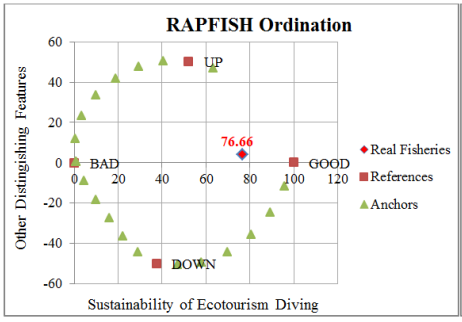

Fig. 10. RapFish ordination of the infrastructure and technology dimension

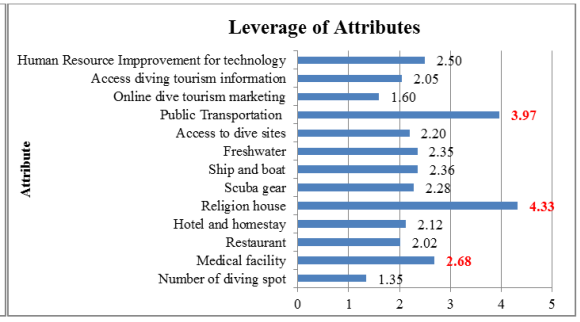

Fig. 11. Leverage of elements of the infrastructure and technology dimension of diving tourism on a sustainability scale of 0 to 100

Analysis of multidimensional sustainability status

The analysis of the 5-dimensional RapFish showed several results with an almost unsustainable status, while the economic, legal and institutional dimensions are quite sustainable. The socio-cultural and infrastructure-technology had a very sustainable status. The Montecarlo analysis is displayed in the form of Stress (S) values, while the results from the RapFish and Monte Carlo analysis obtained minute differences, below 5%. These results are also supported by the coefficient of determination (R^2) for each dimension at 95%, which show the confidence level of the index value. Also, the stability of the sustainability score is illustrated by the value of *goodness of fit* or stress < 0.25 [21]. The results from the analysis of the total dimensions are shown in table 3 and figure 12.

Table 3. The results of the sustainability analysis of scuba diving ecotourism conservation in Tulamben-Bali

Dimensions of Sustainability	Sustainability Index				Status	Parameter	
	Score RapFish	Monte Carlo	Variation	Variation (%)		R2 (%)	Stress (%)
Ecology	48.01	47.72	0.29	0.6	almost unsustainable	95.25	13.69
Economy	74.93	72.49	2.44	3.26	simply sustainable	95.36	13.44
Socio-culture	80.23	77.31	2.92	3.64	very sustainable	95.88	12.52
Legal and Institutional	68.78	66.88	1.90	2.76	simply sustainable	95.41	13.36
Infrastructure and Technology	76.66	76.46	0.20	0.26	very sustainable	95.82	12.57

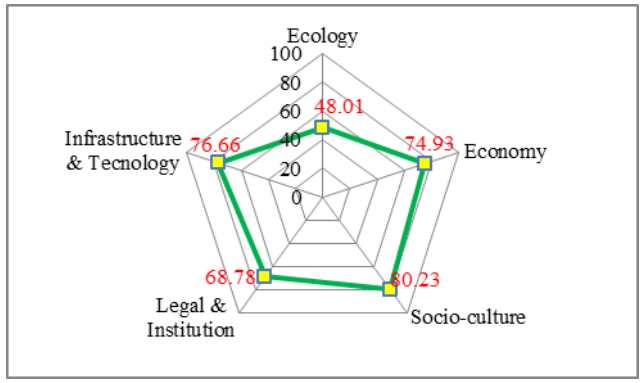

Fig. 12. Kite Diagram of the sustainability status in scuba diving ecotourism conservation at USAT Liberty Tulamben

Sustainability is an important factor for the improvement of ecotourism in developing countries, this is because sustainable management is the key to the competitiveness of tourism destinations [22]. The results from the analysis of the sustainability are selected in accordance with the sensitive attributes on the ecological, economic, legal and institutional dimensions which had unsustainable and quite sustainable status. These sensitive attributes tend to affect the sustainability status of the fisheries resources, therefore it is used as a reference in the selection of management strategies [21]. The sensitive attributes for the three dimensions are shown in table 4 and figure 13.

Table 4. The RMS value of each dimension based on sensitive attributes in leverage analysis

Dimension	Attribute	Root Mean Square (RMS)
Ecology	Dominance index of coral fishes	2.43
	The physical carrying capacity of diving tourism	1.62
	Percentage of life coral coverage	1.44
Economy	Supporting business	5.48
	Conservation fund allocation	5.03
	CSR by the tourism business	4.09
legal and institutional	Indigenous law	3.79
	Policy synergy	3.69
	Local government regulations	3.56

The sensitive attributes are required in order to improve the sustainability status of scuba diving ecotourism in the "USAT Liberty" shipwreck site. The priority to improve it is carried out on the ecological dimensions, such as the dominance index of coral fish, the physical carrying capacity of scuba diving ecotourism, and the percentage of live coral coverage. In addition, the economic dimension consists of the type of supporting business, the conservation fund allocation, the availability of CSR funds while the legal and institutional dimensions

involve the customary law in ecotourism management, the synergy of local government policies and regulations.

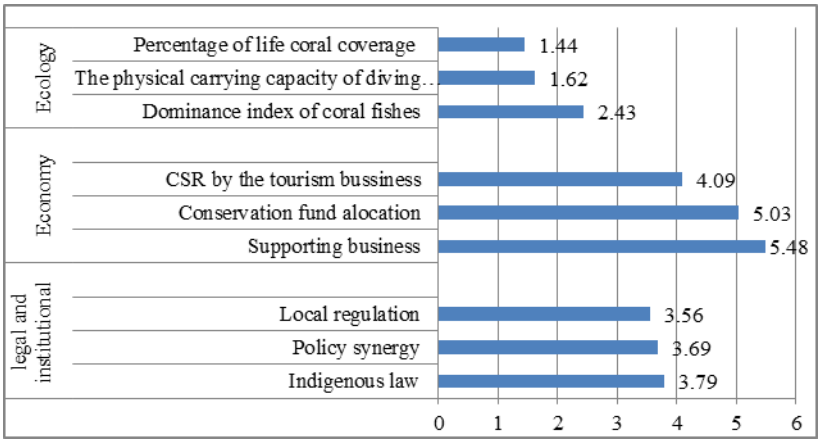

Fig. 13. Sensitive attributes of each dimension from the results of leverage analysis

The results from the evaluation of the dominance index of coral fish at Tulamben waters are high. Due to this condition, the indicator tends to influence the sustainability analysis of the ecological dimension. The result from the dominance index of coral fish, which values from 0.6-1.0, indicates high dominance, and it is included in the high category. This means that the sea is dominated by several coral fish species with an increase in the sensitive attributes of the dominance due to the supportive maintenance of its health and growth [23]. Furthermore, the physical carrying capacity of "USAT Liberty" consists of 306 divers and in 2014, the number of divers increased to 173 people daily [24]. In accordance with the data on the carrying capacity, it is observed that the utilization of the coral reef ecosystem is still below its limit. The result from the analysis of the percentage of coral coverage at the study site is 24.50%, this condition is included in the category of moderate damage [25, 26], and with the highest sensitivity for coral reef vulnerability [27]. The Bali provincial government, Karangasem regency government, Tulamben village customary holders and Tulamben Dive Guide Organization (OPST) have made some rehabilitation efforts such as constructing hexadomes (artificial reefs) and coral reef transplants from 2015 till date. Furthermore, efforts to improve the condition of the coral reef ecosystem are continually being carried out.

The sensitive attributes on the businesses supporting scuba diving ecotourism need to be carried out by involving the local communities. The involvement of the community in Tulamben ecotourism is only a small part that acts as a dive tourism guide while the larger aspect acts as the carriers of the diving equipment. The development of marine tourism tends to support micro, small and medium businesses and the local community basically needs to be involved. Types of micro and small businesses in the secondary marine tourism sector are souvenir and food sellers, coconut traders and tour guides [28]. Rehabilitation and conservation efforts to improve the condition of the ecosystem need to be conducted. The results from the analysis of the percentage of coral coverage in the "USAT Liberty" shipwreck site is in the category of moderate damage (24.50%), therefore efforts to rehabilitate it need to be carried out, however, the attempt is constrained because of funds. The allocation of funds for rehabilitation and conservation of coral reefs on the site is available although it is not sufficient. Entrepreneurs in the tourism sector play a huge role in the local community because the presence of business owners offers economic and social benefits [29]. In accordance with the results from interviewing the local communities, the CSR received is incidental. The indigenes

receive CSR funds only at certain times and its allocation needs to be applied routinely. The CSR allocation funds derived from scuba diving ecotourism entrepreneurs tend to be in the form of training to hone the skills of the inhabitants as internationally certified dive guides.

The legal framework in managing marine and coastal resources needs to be prioritized by the government to maintain its sustainability. This is aimed at preventing damages caused by various community activities. In addition, it is used as a reference and evaluation guide for all activities involved in the utilization of the coastal and marine areas [30]. The results from interviewing the traditional leaders in Tulamben village stated that customary law was initiated to regulate ecotourism for scuba diving, such as the prohibition of fishing due to the fact that it is not environmentally friendly. Their involvement in the enforcement of this law is needed to maintain and sustain the preservation of ecotourism diving scuba environment.

Effective support for conservation programs and the enactment of strict laws is important to address the threat of loss of diversity [30]. In addition, the function of the customary law in the utilization of fisheries resources is not only to make the community comply rather it is for every human activity to be following the carrying capacity of the environment. This simply means that it has ecological, socio-economic and political functions. [31, 32]. The synergy of policies on the management of scuba diving ecotourism between the Provincial Government of Bali, the Regional Government of Karangasem Regency and the local village of Tulamben needs to be carried out to develop regulations and planning systems for its conservation. Efforts to improve environmental sustainability in the scuba diving tourism sector are carried out, in collaboration with local policymakers, scientists, governance, organizations and national authorities [33]. Furthermore, other attempts carried out by the government and related institutions are involving the community to participate in planning, implementing and evaluating coastal management programs [30]. Building a regulatory system is required to formulate a legal basis for tourism management [34].

The USAT Liberty shipwreck site which is the cultural heritage for scuba diving ecotourism is under pressure from ecological, economic, legal and institutional dimensions, with its coastal areas vulnerable to damage due to the activities of tourist [35]. Despite this fact, marine tourism remains the most developed attractive destinations [36, 37]. Tourism and environmental activities are interrelated because it involves numerous tourist exercises that have an impact on the environment, economy, physical, and social life [38, 39].

Conclusions

The USAT Liberty shipwreck site is the cultural heritage for a scuba diving ecotourism and this is proven by the RapFish score on ecological dimension which is 48.01 with an almost unsustainable status. The scores on the economic, legal and institutional dimensions are 74.93 and 68.78 respectively with quite a sustainable status. Furthermore, the scores on socio-culture, infrastructure and technology are 80.23 and 76.66, respectively with a very sustainable status.

The improvement of the sensitivity attribute is carried out on the dominance index of coral fish, physical carrying capacity of divers, percentage of live coral coverage (ecological dimension), type of supporting business, conservation fund allocation, availability of CSR funds by the entrepreneurs (economic dimension), customary law for the conservation of ecotourism, synergy of local government policies and regulations (legal and institutional dimension).

All three dimensions indicate adequate conditions that support the sustainability and conservation of the cultural heritage in the "USAT Liberty" shipwreck site. To solve the problem associated with the conservation of the cultural heritage certain strategic steps needs to be implemented, namely (1) rehabilitation of the coral reef ecosystems, (2) establishment of either small or medium businesses that support scuba diving ecotourism in the local communities, (3) improvement of the planning and management system, (4) establishment of

environmental legislation and law enforcement system, (5) implementation of a legislative system concerned with the practice of ecotourism.

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