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Assessment of Kendari Bay reclamation areas status in Kendari City, Southeast Sulawesi, Indonesia

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Abstract: Kendari Bay is experiencing the degradation of environmental condition. In order to restore the coastal area environment, reclamation policies have been implemented in the area. This study aims to analyze the sustainability status of the Kendari Bay reclamation areas and to propose development strategies in order to improve the sustainability status of the Kendari Bay reclamation areas. Assessment of sustainability status in Kendari Bay Reclamation areas was carried out using the Rapid Appraisal for Fisheries (RAPFISH) method based on 4 dimensions of sustainability: environmental, social, economic and legal and institutional with 20 assessments attributes. The result revealed that 3 out of 4 dimensions, namely environmental, social, and legal and institutional were categorized as 'less sustainable'. Whereas, the economic dimension was at 'fairly sustainable' status. The Analytic Hierarchy Process (AHP) analysis concluded that several alternative strategies are required to improve the sustainability status of Kendari Bay reclamation areas, with greater emphasis placed on the green economy, followed by the establishment of a specific agency, and sediment management. The study findings recommended to apply the concept of integrated coastal management (ICM) as a comprehensive solution to improve the sustainability of the area.

Keywords: Regional development; sustainability status; RAPFISH; AHP

1. Introduction

The development paradigm should put consideration on balance between economic growth, social equity, environmental conservation and institutional strengthening. This paradigm requires measurable development planning management. Any policy-making in the planning and management process in the development area can affect and change mutual interdependencies patterns on the social, economic and environmental circumstances [1].

However, in practice, the economic growth aspect commonly has become a priority, especially for developing countries. These economic-oriented policy choices tend to be exploitative and will have a negative impact in the long term if not followed by adequate attention to other aspects of development. Therefore, it is necessary to implement the notion of sustainable development, which aims to balance all of the development aspects.

One of the regions with the highest economic growth rates in Indonesia is the coastal region. Economic development activities are one of the main attractions for the community, contributing to urbanization and increasing population density. Coastal areas are frequently densely populated areas and home to various industries with great economic value. In this context, the coastal region becomes both very important and vulnerable particularly from an ecological perspective due to various development interests within it [2].

In order to accommodate development in the coastal areas, sufficient resources are needed. Land availability for development is the most important

resource. Furthermore, to overcome the restricted supply of land, reclamation becomes a common development policy implemented in coastal areas. There are often opposing opinions regarding reclamation activities, especially in coastal areas. In regard to various regulations regarding reclamation in Indonesia (e.g. Law of the Republic of Indonesia No. 27 of 2007; Regulation of the President of the Republic of Indonesia No. 122 of 2012; Regulation of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia No. 25 / PERMEN-KP / 2019); it appears that the reclamation aims to convert damaged or unusable wetlands/waters to be more productive and beneficial through changes in land use by reclamation for settlements, industry, agriculture, and tourism. Furthermore, reclamation includes adaptation to severe coastal disasters, particularly in coastal urban areas, great economic attractiveness due to increased land values and can be used as a barrier for sea level rise which can cause flooding or inundation [3].

Conversely, many organizations or academics who are oriented towards environmental sustainability argue that, reclamation, results in increased negative impacts, especially on coastal and marine ecosystems and resources. Reclamation has an adverse impact on the environment, such as the coastline's disruption, water pollution and destruction to natural inheritance and marine ecosystems. Furthermore, reclamation can affect, both directly and indirectly, the socio-economic conditions of the surrounding community [4].

Kendari City is one of the regions that apply reclamation policy. Kendari City is the capital of Southeast Sulawesi Province, Indonesia. Kendari City, which stretches around Kendari Bay, is the centre of activity, life and growth. Moreover, the City of Kendari has unique geographical condition because there are up to 18 rivers and the tributaries that run through the city and empties into Kendari Bay [5]. Due to Kendari Bay's value and strategic location, the Bay becomes vulnerable to environmental pressure as a result of various activities (e.g infrastructure and industrialisation) around it. Sedimentation is a major factor related to degradation of Kendari Bay's environmental conditions [6]. The problem of sedimentation in Kendari Bay has become of particular concern to the local government. Thus, the policy to revitalize the Kendari Bay through reclamation has become the primary focus for the local government.

The reclamation program implemented in Kendari Bay in Southeast Sulawesi, Indonesia, included the construction of Al Alam Mosque, and the sedimentation mud ponds, with an area length of approximately 40.32 Ha or 0.403 km². The material used to fill sedimentation ponds derived from the dredging of sedimentation silt/mud substrate at the Bay's bottom around the reclamation site [7]. This dredging activity aims to reduce sedimentation in Kendari Bay. In the future, this area will be used as green open space [7]. These two reclamation sites are located in seven urban villages in Kendari City, which are directly bordered by the Kendari Bay coastal areas.

The coastal areas in each region have different characteristics and activities. Due to this, coastal management policies must be an effort to balance the various importance associated with the condition or features of the region itself. Therefore, Kendari Bay coastal area must be managed from this perspective. One of the distinctive factors of the area is the physical condition of this region

which resembles an estuary; where, the Kendari Bay area is the gate of Kendari City and Southeast Sulawesi Province from the sea [8]. The other distinct characteristic of Kendari Bay is the shape and is known as a semi-enclosed bay. In a semi-enclosed bay, the water body of the bay is notably bordering by natural shorelines or urbanized coastlines and just partially open to the ocean. This area is typically productive and rich in biodiversity that benefits both nature and humans. The semi-enclosed bay is a fertile area, and is in an important position regionally and globally [9].

For several decades, the decline in environmental quality in Kendari Bay area has been of serious concern for environmentalists, academics, and the government. Various problems have occurred as a result of the development of the city and the adjacent regions. Several issues faced by the Kendari Bay area include siltation of Kendari Bay due to river sedimentation, and pollution caused by households and boat waste. The arrangement of Kendari Bay area, is chaotic due to physical irregularity of development in terrestrial regions leading into slums, and in turn has resulted in the depletion of mangrove forests [8].

Distinctive characteristics and the environmental conditions of Kendari Bay require a more comprehensive approach to assess the sustainability status of the coastal area, especially around the reclamation areas. This approach can help evaluate the sustainability aspects of a phenomenon and provide a basis to formulate appropriate management in order to increase the sustainability status of the reclamation areas. The proposed draft is expected to influence the policy and strategies to be more sustainable.

This study has the following objectives: (1) to assess the sustainability status of Kendari Bay reclamation areas in Kendari City, Southeast Sulawesi, Indonesia; and (2) to propose appropriate development strategies to improve the sustainability status of the Kendari Bay reclamation areas. Moreover, this study employed two appraisal techniques as support tools, namely Rapid Appraisal for Fisheries (RAPFISH) and Analytic Hierarchy Process (AHP).

RAPFISH is a statistical technique that emphasizes rapid assessment of certain entities based on attributes that have been determined, and appropriate for the distinct evaluating fields and disciplines [10]. In addition, although in practice RAPFISH is more widely used in the evaluation of fisheries sustainability, the RAPFISH technique is flexible and can be applied to assess conditions of sustainability on other topics [11]. It is reasonable as the foundation of the attribute design used by this method is based on sustainability in general [12]. To date, the RAPFISH technique has been used in various research fields, such as in the analysis of sustainable development in the coastal city of Baubau City [13], the study of the sustainability of marine and coastal resources at the Benoa Bay reclamation site in Bali Province [14], and the assessment of the sustainability status of Lake Maninjau in West Sumatra Province [15].

The next analysis method is the AHP. In the context of natural resource management, AHP is effective in the creation of suitable alternative policy options [16]. The AHP is a methodology to appraise the quantifiable and/or intangible criteria by structuring, measuring, and synthesising complex problems [17,18]. It is based on the fundamental proposition that people's knowledge

level and experience are at least as important as the data they use in the context of decision making [17]. Furthermore, The AHP is a decision support tool that applies a multilevel-hierarchical structure and a pairwise comparison process to determine priority and relatively important alternatives [19]. This method is used in various fields, including in analysing sustainable development through the determination and analysis of structured attributes and criteria [20].

The results of the study are expected to enrich and enhance the scientific study related to sustainable development in the reclamation areas and can be used as input into the management of sustainable regional development, particularly in the coastal areas.

2. Materials and Methods

A. Study area

This research was conducted in Kendari City, the capital of Southeast Sulawesi Province, Indonesia. Kendari City is located south from the equator, between 3°54'40" and 4°5'05" south latitude and stretches from west to east between 122°26'33" and 122°39'14" east longitude. Kendari city consists of 11 sub-districts with a total land area of 271.76 km² [21]. Kendari City is considered a coastal city as 6 out of 11 sub-districts are directly contiguous to the Kendari Bay coastal area.

Kendari Bay as the study site, is well-known as a natural landmark of Kendari City due to its location, right in the city centre. The bay juts deep into the city has an area of ± 11.49 km². The waters of Kendari Bay can be divided into two parts: the inner part located on the west side and the outer part, which borders the ocean in the east (Figure 1). Kendari Bay is distinguished due to its peculiarity. This bay is a semi-enclosed bay where the water area is narrowed on the outer part of the bay and blocked by Bungkutoko Island that is located right in front of the bay's mouth. The inner part of Kendari Bay is the estuary of approximately 13 rivers. Three rivers are categorized as large rivers, namely the Wanggu, Kambu and Lahundape Rivers [22].

Kendari Bay's presence is an inextricable aspect of the activities of the Kendari City community and cannot be separated from them. Kendari Bay has become a transportation, fishing, shipping, and tourism hub along the city's coastal area [23]. It has various public facilities such as public inter-island ports for goods and people, fuel supply port, fishing port, industrial area, rowing sport, boat moorings, scientific activity and research, landing sites for the fish market, farming and fishing activities, and scuba diving in the cultivation area [22].

B. Data collection

The primary data in this research was collected through observation, questionnaires, and interviews, regarding the sustainability dimension of reclamation such as environmental, social, economic and legal and institutional sustainability. The questionnaires and interviews were conducted with respondents that are expert in their respective fields in which they are distinguished by their professional or educational expertise or from government institutions that were stakeholders in the project. The respondents are intentionally chosen with purposive sampling. This research population sample consists of 5 groups, namely Provincial Government, Academics, Practitioners, Non-Governmental Organizations, and Community Leaders.

The secondary data used in this research included information in published journal and/or reports acquired from related institutions, such as the

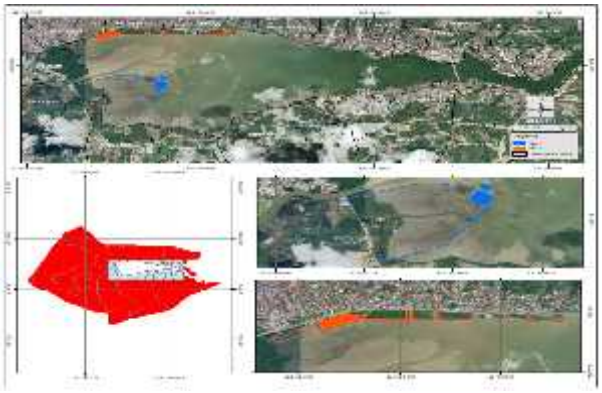

Figure 1. Kendari Bay reclamation site map

Regional Development Agency (Bappeda), the Department of Human Settlements, Construction, and Spatial Planning, and the Central Bureau of Statistics Kendari.

C. Rapid Appraisal for Fisheries

The sustainability analysis performed in this study used the Rapid Appraisal for Fisheries (RAPFISH) method. The University of Columbia in Canada was the first institution that developed and introduced RAPFISH in 1999 [24]. Essentially, the RAPFISH method assesses the attributes of each predetermined sustainability dimension using the multidimensional scaling (MDS) approach. This assessment is carried out by scoring each attribute according to the preferences of the experts involved. Further, the stages involved in the RAPFISH technique are detailed as follows.

C.1 Determination of dimensions and attributes

Determination of dimensions and attributes in this study is undertaken based on literature studies and considering the condition of research location. Moreover, each dimension attributes used is built based on the objectives to be achieved. After compiling all available data and creating a comprehensive review, 20 attributes were obtained in 4 dimensions, namely environmental (n = 5), social (n = 5), economic (n = 5), and legal and institutional (n = 5). Table 1 presents the complete matrix of the attributes in each dimension and the RAPFISH scoring criteria.

Table 1. Dimension, attributes and RAPFISH scoring criteria of sustainability in Kendari Bay reclamation areas

No	Dimension	Attributes	Remarks	Source
1	Environmental Dimension	Mangrove habitat	Level of damage: High (0); moderate (1); low (2)	[14]
		Fishery resources	Reduced greatly (0); reduced slightly (1); unchanged (2)	[14]
		Sedimentation	High (0); moderate (1); low (2)	[14]
		Floods and inundation	Frequency: Frequent (0); Occasionally (1); None (2)	[14]
		Water pollution	Increased highly (0); increased slightly (1); unchanged (2)	[25]
2	Social Dimension	Public perception of the reclamation policy	Disagree (0); neutral (1); agree (2)	Modified from [14]
		Livelihood change	Exists in various types of jobs (0); exists in a limited amount (1); none (2)	Modified from [14]
		Social interaction	Frequency and intensity: Unchanged (0); increased slightly and seldom (1); increasing and frequent (2)	Modified from [26]

Table 1. (continued)

No	Dimension	Attributes	Remarks	Source
		Community behaviour	Low (0); moderate (1); high (2)	Modified from Persada (2014)
		Public participation (individual/group)	In policy determination and / or development activities: None (0); exists in a limited amount (1); exists and actively involved (2)	Modified from Widiatmaka et al. (2015)
3	Economic Dimension	Household income	Decreasing (0); unchanged (1); increasing (2)	Handadari et al. (2018)
		Regional income	Unchanged (0); increased slightly (1); increased highly (2)	Handadari et al. (2018)
		Employment opportunity	None (0); exists in a limited amount (1); exists in various types of jobs (2)	Modified from Handadari et al. (2018)
		Entrepreneurial chance	None (0); exists in a limited amount (1); exists in various types of business (2)	Modified from Handadari et al. (2018)
		Land value increases	Normal (0); increased slightly (1); increased highly (2)	Persada (2014)
4	Legal and Institutional Dimension	Policy Synchronization	Among related institutions: Out of sync (0); less sync (1); sync (2)	Setiawan (2010)
		Existence of fisherman group	Decreased and inactive (0); decreased and active (1); fixed or increased in number and active (2)	Modified from Supardi et al. (2017)
		Establishment of specific agency	Does not exist (0); exist yet inactive (1); exist and active (2)	Modified from Setiawan (2010)
		Study of coastal vulnerability	Seldom (0); frequent but limited to certain institutions (1); frequent and carried out by various related institutions as well as across sectors (2)	Modified from Supardi et al. (2017)
		Socialization of environmental laws	Never (0); seldom (1); often (2)	Haya and Fuji (2020)

C.2 Scale determination and scoring of attributes

In this stage, the experts score each attribute and is then processed according to the necessity of the RAPFISH technique. Every attribute in each dimension is given a score that reflects the sustainability of the dimensions studied. The score ranges from 0-2 (Table 2).

C.3 Multidimensional Scaling (MDS)

MDS is a multivariate statistical technique that processes the RAPFISH attribute data that has been scored by determining the research object's position and portrayed through the ordinate point [24]. Ordination is a process of plotting (point) throughout prepared axes. In this case 'GOOD' and 'BAD' axes. The horizontal axis shows the differences in objects studied. They are described in terms of 'GOOD' or 'BAD', and expressed in percent (%). The vertical axis shows the difference of the combined/mixed scores of each attribute in every dimension of the object being studied [24]. Therefore, the ordination of each evaluation field or dimension using MDS is an important aspect in RAPFISH. The attributes on each dimension can be substituted or redefined according to research needs and available information due to flexibility [11].

Table 2. Scale of attribute assessment in the dimension of sustainability (modified from [14])

Attribute	Bad	Moderate	Good
Attribute 1	(0)	(1)	(2)
Attribute n	(0)	(1)	(2)

The index values to determine sustainability status in reclamation areas range from 0 – 100%. The sustainability status is considered good and categorized as sustainable if the value is above 50%, while the sustainability status is considered to be deficient or unsustainable if the value is below 50% [14], as shown in Table 3.

Table 3. Sustainability values and categories (modified from [29])

No	Values	Categories
1	0,00 – 25,00	Bad (Unsustainable)
2	25,01 – 50,00	Low (Less Sustainable)
3	50,01 – 75,00	Fair (Sustainable Enough)
4	75,01 – 100,00	Good (Sustainable)

C.4 Sensitivity Analysis

Leverage or sensitivity analysis, measured as the Root Mean Square (R^2) value, is performed to identify the most sensitive attributes that affect the sustainability index in each dimension [27]. The

effect of each attribute is measured by observing the change in the root mean square (R^2) of ordination, particularly on the x-axis or sustainability scale. The transformation of the R2 value at a higher level due to the omission of a specific attribute greatly impacts the index [16]. The greater the change (R^2) due to the loss of certain attributes, the more sensitive to sustainability [27]. In other words, the attribute with the highest score is the problem that most influences sustainability status [16]. These high sensitivity levels are then used to formulate recommendations for improving sustainability in the Kendari Bay reclamation areas.

C.5 Monte Carlo Analysis

A Monte Carlo Analysis assists in the sustainability analysis to notice the effect of scoring errors on each attribute caused by procedural errors or understanding of the attributes and variations of the scoring [27]. These errors may be caused by: differences in opinion or different assessments by researchers; the instability of the MDS analysis process; errors in entering data or data loss; or high stress value [13]. Furthermore, the model is categorized as good or almost good if the analysis results in an S-stress value of less than 0.25 (S <0.25), and R^2 is close to 1 (100%) [30].

D. Analytic Hierarchy Process (AHP)

The AHP approach solves an issue in a structured state of mind that allows it to be communicated to make effective judgments on the problem [31]. In this study, after the most sensitive attributes of each dimension resulting from the RAPFISH analysis are obtained, the attributes are then examined and further analyzed using an AHP analysis.

To implement the AHP method, the initial step is to identify the issues and organize them into hierarchical trees [16]. Based on the dissection of the difficulties, three hierarchies, or levels, were established. The first hierarchy was the goal of the analysis. The second hierarchy was made up of the four dimensions of the sustainability of reclamation areas. The third hierarchy included alternative strategies or policies for improving the sustainability status of reclamation areas.

The next step is comparative judgement. It is an assessment of the relative importance of two elements [32]. In this sense, the experts determine scores of each selected strategy according to the relative importance of each of the hierarchy level being assessed [16]. This assessment will determine the suitable prioritized alternative strategies to improve the sustainability status of Kendari Bay reclamation areas. The choices/judgments are following the standardized comparison scale (Table 3).

The last step is logical consistency. Logical consistency states a measure of the consistency of an assessment or the weighting of pairwise comparisons [16]. To assess the consistency of the random decisions, the consistency ratio (CR) is computed. If the consistency ratio (CR), which is calculated by dividing the confidence interval (CI) by the random index (RI), is more than 0.1, the expert's judgements are regarded to be logically inconsistent [33]. In this study, the comparative judgment for prioritization, the synthesis of priority and the logical consistency was conducted using Expert Choice 11 Software.

Table 4. Scale of relative importance for comparative judgement (modified from [34])

Intensity of importance	Definition (Explanation)
1	Equal importance (Two criterion/alternative equally important)
3	Moderate importance (Criterion/alternative A is slightly more important than criterion/alternative B)
5	Strong importance (Criterion/alternative A is strongly more important than criterion/alternative B)
7	Very strong importance (Criterion/alternative A is very strongly more important than criterion/alternative B)
9	Extreme importance (Criterion/alternative A is absolutely more important than criterion/alternative B
2,4,6, and 8	(Intermediate values between the adjacent numbers)

3. Results

A. Assessing the sustainability status of Kendari Bay reclamation areas

Development activities are performed to the fullest degree to fulfil the elements and balance all aspects of sustainability. The summary data reveals that there are 20 attributes of 4 dimensions that describe the current status of the Kendari Bay reclamation areas. The environmental, social, economic, and legal and institutional components all have five attributes.

A.1 Environmental dimension

The questionnaire scoring results shows that the value of the sustainability index of the Kendari Bay reclamation areas on the environmental dimension was 40.75, counted in the 'less sustainable' category (Figure 2).

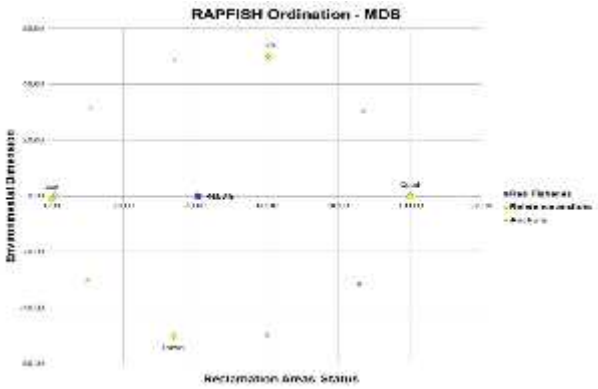

Figure 2. MDS diagram on environmental dimension

Meanwhile, sensitivity analysis shows the most sensitive attributes that affect the sustainability status of the Kendari Bay reclamation area on environmental dimensions, namely sedimentation and floods and inundation (Figure 3).

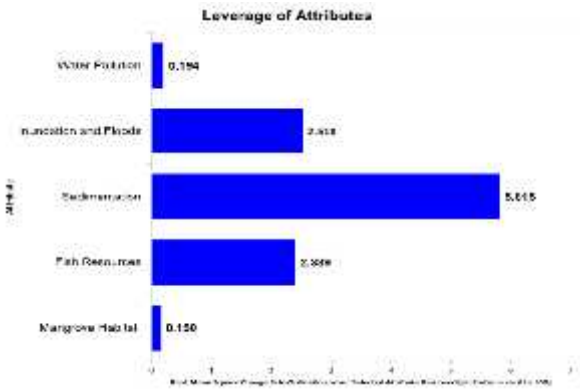

Figure 3. Sensitivity analysis on environmental dimension

A.2 Social dimension

Multidimensional Scaling (MDS) analysis based on expert opinion on the social dimension shows the sustainability index in the Kendari Bay reclamation areas is at a value of 44.52 (Figure 4). On the sustainability scale, this value is in the 'less sustainable' condition. Regarding sensitivity analysis, out of a total of 5 attributes of the social

dimension, public participation was the most sensitive attribute, followed by the attribute of changes in community livelihoods (Figure 5).

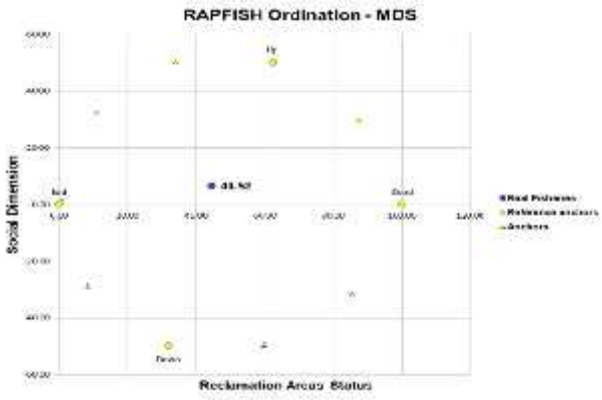

Figure 4. MDS diagram on social dimension

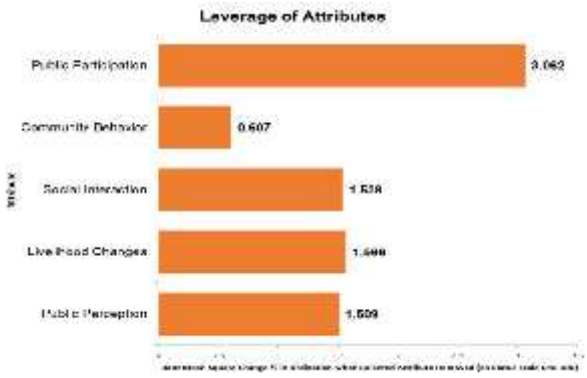

Figure 5. Sensitivity analysis on social dimension

A.3 Economic dimension

Based on the analysis results on the economic dimension, the sustainability value index is obtained at 50.18 (Figure 6). Thus, this value is slightly above the 'safe' limit of the sustainability scale and is considered 'fairly sustainable'. In the sensitivity analysis of attributes for the economic dimension, two attributes have the highest sensitivity, namely the land value and household income (Figure 7).

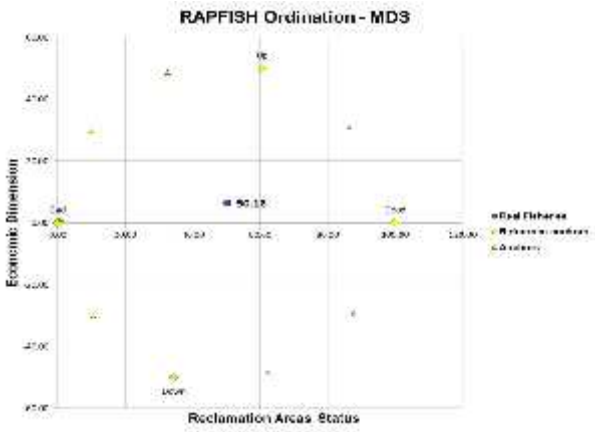

Figure 6. MDS diagram on economic dimension

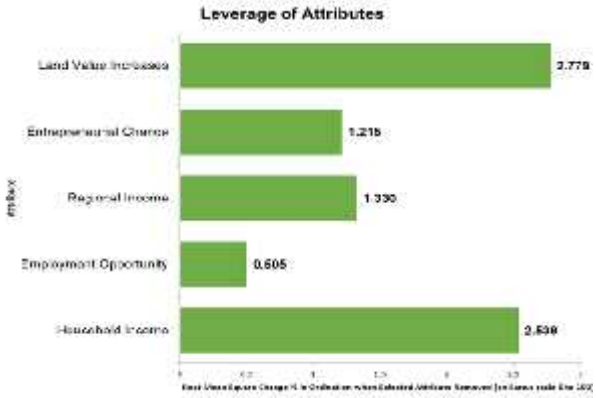

Figure 7. Sensitivity analysis on social dimension

A.4 Legal and institutional dimension

In calculating the sustainability analysis for the legal and institutional dimensions, the sustainability index value is 46.19 (Figure 8). This value is included in the 'less sustainable' category, as are the environmental and social dimensions. Additionally, of the total 5 attributes assessed in the sensitivity analysis, the two most sensitive attributes are establishing specific agency and fishers group existence (Figure 9).

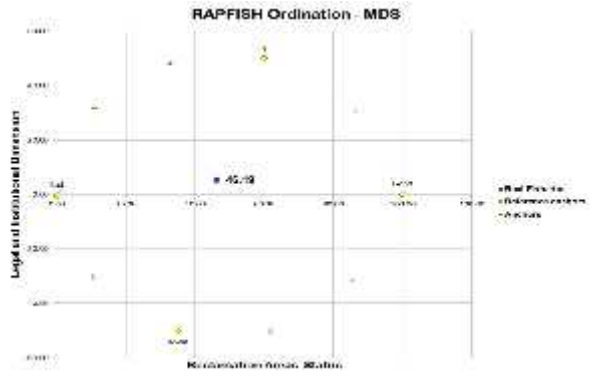

Figure 8. MDS diagram on legal and institutional dimension

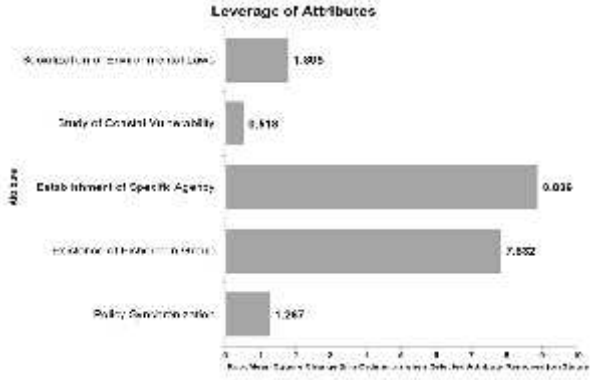

Figure 9. Sensitivity analysis on social dimension

B. Summary of multidimensional sustainability

The summary of the sustainability assessment results of the 4 sustainability dimensions in this study, 3 dimensions were categorized in the 'less sustainable' range (environmental, social, and legal and institutional), and one dimension was categorized as sustainable (economic). There were only minor discrepancies (<1.00) between the findings of the MDS and the results of the Monte Carlo analysis, indicating that the degree of error in the study was tolerably low. Furthermore, the stress value of each dimension is <0.25, and the coefficient value of R^2 is relatively stable in the range of 93 to 94. Overall, the results indicate that the RAPFISH analysis performed in this study followed the statistical criterion and that the analytic quality was acceptable (Table 5).

Table 5. Values of MDS, monte carlo and statistical parameters

Dimensions	Sustainability Index (%)			Statistical Parameters	
	MDS	Monte Carlo	Difference	R^2 (%)	Stress
Environmental	40.75	41.11	0.36	93.79	0.17
Social	44.52	44.4	0.12	93.84	0.17
Economic	50.18	50.52	0.34	93.58	0.17
Legal & Institutional	46.19	46.37	0.18	93.70	0.15

4. Discussion

A. Sustainability of Kendari Bay reclamation areas

Overall, the assessment of the 4 dimensions of sustainability in the Kendari Bay reclamation areas is included in the 'less sustainable' category. Based on the assessment results in section 3, the following is a discussion of the attributes that have the highest sensitivity values for each dimension.

A.1 Environmental dimension

Sedimentation problem is the main reason for the Southeast Sulawesi Provincial Government to conduct the Kendari Bay reclamation program. However, conversely, reclamation activities can result in sedimentation. The material that accumulates can contribute to an increase in sedimentation volume. There is an increase in suspended sediment content around the western part of Kendari Bay due to the reclamation [5].

Additionally, reclamation activity has the potential to cause flooding and inundation in terrestrial areas. This occurs when the water area has narrowed due to the changing functions to the land and the siltation of the waters due to sedimentation.

A.2 Social dimension

Public participation and changes in people's livelihoods were two social issues in the study area. The absence of public participation in the decision-making process or policy-making has resulted in

certain groups of community experience a disadvantage by the decisions taken, one of which is the fishermen community. People assume that reclamation affects the balance of ecosystems in coastal areas [14]. It harms the environment and affects the socio-economic conditions of the community. This is certainly counterproductive in the context of efforts to achieve sustainable development as [35], argued that public participation in sustainability and environmental preservation is crucial.

In addition, the continued impact of reclamation on the social dimension, according to the respondents, is a change in livelihoods. The environmental degradation, which is then exacerbated by reclamation activities, reduces fishermen's catches and decreases income, making the fishermen community seek supporting sources of livelihood outside the fisheries sector.

A.3 Economic dimension

Reclamation of Kendari Bay which has not been completed, and the location of the Al Alam Mosque, which is quite far from the mainland, are some of the possible causes that reclamation activities have not significantly impacted the increase in land value. Therefore, this infrastructure development, which can indirectly trigger an increase in regional income through taxes attached to land ownership and the economic activities on the land, has not contributed adequately to the development of the economic sector. The household income of fishers, who are directly affected by reclamation activities, actually decreased due to the narrowing of the Kendari Bay waters space and waters column, which is their fishing location. Infrastructure development in the coastal area of Kendari Bay causes disruption of the primary livelihoods of fishermen, and on the other hand, they are unable to generate side incomes for their families, resulting in a reduction in the amount of income and ownership of fishermen's assets [36].

A.4 Legal and institutional dimension

The lack of effective management has led to the declining condition of the Kendari Bay coastal area from various aspects. Hence, well-planned management and its implementation are important elements for sustainable development. To realize comprehensive and independent management, proper institutional arrangements are needed. As [37] maintain, in the search of a future society that is both environmentally sustainable and humanly desired, professional and independent institutional arrangements can be beneficial.

Furthermore, fishermen's organizations must be one of the targets that the government must empower. The existence of fishermen's organizations can help to reposition themselves to be a bridge between the development plans (interests) of the local government and the interests of the fishers' community.

B. Strategies to improve the sustainability of Kendari Bay reclamation areas

Sustainability status was negatively affected by the many issues outlined earlier. This demands a remedy in the shape of alternative strategies to help enhance the sustainability condition of this area. Eventually, it is intended that this plan would become a model for future management of the Kendari Bay coastal area.

The recommendation of the proposed strategy is based on the priority ranking of the alternative strategies. Encouraging environmental-based economic growth (Green economy) had the highest score (0.178), followed by the establishment of a

special agency for the management of Kendari Bay (0.151), sediment management (0.143), education and community assistance (0.135), collaborative approach to communities and fishing community groups (collaborative approach) with a value of 0.13, sustainable urban spatial management (0.119), participatory decision making (0.1), and land value adjustment (0.046). The ranking of each alternative strategy is shown in Figure 10.

Figure 10. Recommended alternative strategies

We suggest that the following actions be made to enhance the condition of the Kendari Bay reclamation sites in particular, and the Kendari Bay coastal area in general.

Green economy: In principle, the green economy is environmental-based economic growth. The green economy presented in this study is mostly in the tourism sector. Tourism development for the Kendari Bay reclamation area includes ecotourism and ecosystem services, especially the mangrove ecosystem. This choice was mostly based on the compatibility of the area's social, economic, and environmental characteristics concerning ecotourism and ecosystem services. Furthermore, the development of ecotourism and the utilization of these ecosystem services can leverage the community's economy (especially fishermen's households) and function as mangrove forest conservation in the area.

Establishment of specific agency: This strategy aims to strengthen the management function in an area that is independent and unfettered of sectoral barriers. An independent management agency can simplify the coordination mechanism, determine the best management formulation solution due to its cross-sectoral and multi-aspirational nature (including bottom-up), and balance the involvement of regulators and the community as beneficiaries of development.

Sediment management and sustainable urban spatial management: These two strategies aim to effectively manage the sedimentation problem in Kendari Bay, such as proper and environmentally conscious sediment management around the reclamation area and river estuaries, and mitigating sediment or sediment transport in watersheds, including upstream areas, which empties into Kendari Bay. In addition, the arrangement of the urban physical development and the management of household and industrial waste is necessary due to its impact on the occurrence of sedimentation.

Education and assistance, collaborative approach, and participatory decision making: These three alternatives are about community empowerment, especially for fishing communities. Community empowerment is a significant issue when it comes to sustainable development. Education and assistance to fishing communities are important to improve their environmental insight and socio-economic skills, while collaboration is focused on soliciting opinions and input from fishing groups for the management of Kendari Bay. Discover the community's needs, and then increase their level of involvement in every activity related to efforts to

improve the sustainability status of the Kendari Bay reclamation areas.

Land value adjustment: Several factors that influence land prices are the distance to the city centre, the socio-economic activities hub, intrinsic factors such as land extent and status, environmental factors, and large-scale development activities in the vicinity. By adjusting the land value after development activities, government revenues can also increase through tax revenues imposed on land and any transfer of land rights, such as Land and Building Tax (PBB) and Acquisition Duty of Right on Land and Building (BPHTB).

5. Conclusion

The environmental conditions in Kendari Bay are experiencing severe degradation. The reason is the increase in regional economic activity and the acceleration of development, particularly regional physical infrastructure, including reclamation. This infrastructure development impacts land conversion, which causes sedimentation, increased household and industrial waste, and disruption of the mangrove ecosystem. Therefore, it can be concluded that reclamation is neither the main cause nor the only cause of environmental degradation in the coastal area of Kendari Bay. However, reclamation activities contribute to the worsening environmental conditions in Kendari Bay. The reclamation of Kendari Bay also impacts the decline in the socio-economic conditions of the fishing community.

Based on RAPFISH analysis, the sustainability status of the Kendari Bay reclamation area is categorized 'less sustainable' from the environmental, social, and legal and institutional dimensions. The AHP results identifies alternative strategies to improve the sustainability status of the Kendari Bay reclamation areas. The strategy with the highest priority is the green economy, followed by establishing a specific agency, sediment management, education and assistance, and collaborative approach.

The 8 policy recommendations can be grouped into 2 main policies, namely the establishment of a special agency for Kendari Bay management that oversees the planning and implementation of ICM in Kendari Bay management and community empowerment around the area. Therefore, we recommend applying the concept of integrated coastal management (ICM) and community empowerment as a comprehensive solution to improve the sustainability status of the area.

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