

**SUSTAINABILITY STATUS ASSESSMENT OF KENDARI BAY
RECLAMATION AREAS IN KENDARI CITY,
SOUTHEAST SULAWESI, INDONESIA**

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**SUSTAINABILITY STATUS ASSESSMENT OF KENDARI BAY
RECLAMATION AREAS IN KENDARI CITY,
SOUTHEAST SULAWESI, INDONESIA**

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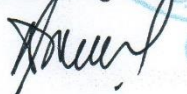
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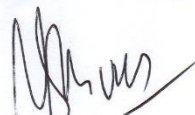
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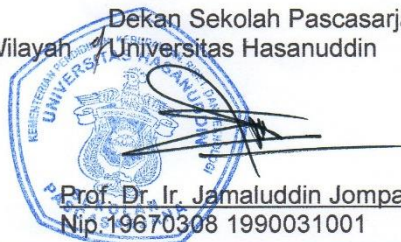
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Yang menyatakan,



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ABSTRAK

Yudha Yuliansyah. Penilaian Status Keberlanjutan pada Kawasan Reklamasi Teluk Kendari di Kota Kendari, Sulawesi Tenggara, Indonesia (Dibimbing oleh Dadang A. Suriamihardja and Peter J. Davey)

Penelitian ini bertujuan untuk menganalisis perubahan luasan habitat mangrove sebelum dan setelah reklamasi Teluk Kendari, status keberlanjutan kawasan reklamasi, dan mengusulkan strategi pengembangan dalam rangka meningkatkan status keberlanjutan kawasan reklamasi Teluk Kendari.

Metode yang digunakan dalam penelitian ini adalah Sistem Informasi Geografis (GIS), teknik Rapid Appraisal for Fisheries (RAPFISH) untuk menilai status keberlanjutan di kawasan reklamasi Teluk Kendari berdasarkan 4 dimensi keberlanjutan: lingkungan, sosial, ekonomi serta hukum dan kelembagaan dengan 20 atribut penilaian, dan Analytic Hierarchy Process (AHP) untuk menganalisis alternatif strategi untuk meningkatkan status keberlanjutan kawasan berdasarkan pendapat ahli.

Hasil penelitian menunjukkan bahwa luas hutan mangrove di sekitar lokasi penelitian sedikit menurun setelah kegiatan reklamasi. Selanjutnya, hasil analisis RAPFISH menunjukkan 3 dari 4 dimensi yaitu lingkungan, sosial, serta hukum dan kelembagaan dikategorikan kurang berkelanjutan. Sedangkan dimensi ekonomi berada pada level cukup berkelanjutan. Analisis AHP menyimpulkan bahwa diperlukan beberapa alternatif strategi untuk meningkatkan status keberlanjutan kawasan reklamasi Teluk Kendari, dengan penekanan pada mendorong pertumbuhan ekonomi berbasis lingkungan, diikuti dengan pembentukan badan khusus pengelola Teluk Kendari, pengelolaan dan mitigasi sedimen, pendidikan dan pendampingan, pendekatan kolaboratif, penataan kota yang berkelanjutan, pengambilan keputusan partisipatif, dan penyesuaian nilai lahan. Rekomendasi utama dari penelitian ini adalah penerapan konsep Integrated Coastal Management (ICM) sebagai solusi komprehensif untuk meningkatkan keberlanjutan kawasan. Konsep ICM ini mencakup seluruh alternatif strategi yang direkomendasikan dalam penelitian ini.

Kata Kunci: Pengembangan wilayah, status keberlanjutan, RAPFISH, AHP

ABSTRACT

Yudha Yuliansyah. Sustainability Status Assessment of Kendari Bay Reclamation Areas in Kendari City, Southeast Sulawesi, Indonesia (Supervised by Dadang A. Suriamihardja and Peter J. Davey)

This study aims to analyse the effect of Kendari Bay reclamation on changes in mangrove forest area, 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.

The methods used in this study are the Geographic Information System (GIS), Rapid Appraisal for Fisheries (RAPFISH) technique to assessing the sustainability status in the Kendari Bay reclamation areas based on 4 dimensions of sustainability: environmental, social, economic and legal and institutional with 20 assessment attributes, and an Analytic Hierarchy Process (AHP) to analyse the alternative strategies to improve the sustainability status of the area based on expert opinions.

The study results found that the mangrove forest area has decreased slightly at the research site after the reclamation activities. Furthermore, based on RAPFISH technique, 3 out of 4 dimensions, namely environmental, social, and legal and institutional are categorized as less sustainable. Whereas, the economic dimension is at the fairly sustainable level. The 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, sediment management, education and assistance, collaborative approach, sustainable urban spatial management, participatory decision making, and land value adjustment. The study recommended to apply the concept of integrated coastal management (ICM) as a comprehensive solution to improve the sustainability of the area. This ICM concept includes all the alternative strategies recommended in this study.

Keywords: Regional development, sustainability status, RAPFISH, AHP

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CHAPTER I

INTRODUCTION

A. Background

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. According to Karrasch, Klenke, and Woltjer (2014), any policy-making in the planning and management process in development area can affect and change mutual interdependencies pattern on the social, economic and environmental circumstances.

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. Moreover, as stated by Veeramony et al.

(2020), 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.

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.

In a limited definition, reclamation is an activity to replace water areas with soil or other solid material. According to Presidential Regulation of the Republic of Indonesia No. 122 of 2012 concerning Reclamation of Coastal Areas and Small Islands, reclamation is an activity carried out by people in order to increase the benefits of land resources in terms of environmental and socio-economic point of view by dredging, draining land or drainage.

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 (Bisaro, 2019). From this point of view, reclamation is carried out to increase the benefits of coastal areas by taking into account the environmental, social and economic aspects of the area.

There are often opposing opinions regarding reclamation activities, especially in coastal areas. In regard to various regulations concerning

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.

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. According to Ma (2014), 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. Table 1 identifies the advantages and disadvantages of land reclamation.

Table 1 Advantages and Disadvantages of Land Reclamation

No.	Advantages	Disadvantages	Source
1	Produces valuable lands for economic growth and infrastructure construction.	Harm the natural heritage and marine ecosystems	Ma (2014)
2	Provide new spaces in the city for the people	Water contamination and change in the coastline	Sandirasegaran and Manap (2016), Ma (2014)
3	Prevent erosion possibility in the reclaimed area	Permanent destruction to the fishing areas	Sandirasegaran and Manap (2016), Ma (2014)

4	Rearrange coastal area to escalate the aesthetics aspect	Contamination of heavy metal and organic pollutants to the filler mud	Adharani, Nurlinda, Nadia, and Yusuf (2019), Ma (2014)
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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 center 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 (Alfiani, Salihin, Usman, & Khairisa, 2019).

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 industrialization) around it. Sedimentation is a major factor related to degradation of Kendari Bay's environmental conditions (Sari, 2017). 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, in the first site and the sedimentation mud ponds as the second site. Furthermore, one of these sedimentation mud ponds was used as a mooring area for fishing boats. These two reclamation sites are located in seven urban

villages in Kendari City, which are directly bordered by the Kendari Bay coastal areas.

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. This dredging activity aims to reduce sedimentation in Kendari Bay. In the future, this area will be used as green open space (Gunawan & Sumarlam, 2018).

The regulation that is the basis for the implementation of Kendari Bay reclamation is the 'Presidential Regulation of the Republic of Indonesia No. 122 of 2012, concerning Reclamation in Coastal Areas and Small Islands'. The Kendari Bay reclamation is also regulated in the 'Kendari City Regional Regulation No. 1 of 2012, concerning the Spatial Planning of Kendari City in 2010 – 2030' and 'Southeast Sulawesi Provincial Regulation No. 9 of 2019 concerning Zoning Plans for Coastal Areas and Small Islands of Southeast Sulawesi Province in 2018 – 2038'.

These three regulations organize Central, Provincial and Regency/Municipal Strategic Areas with various development programs, including reclamation programs. In addition, these regulations point out that reclamation performed to provide the strategic area for economic growth and environmental conservancy in the City, including the public facilities zone such as green open area.

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. Apriyanto (2007), found that 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.

The other distinct characteristic of Kendari Bay is the shape and is known as a semi-enclosed bay. According to Yang (2018), 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 (Yang, 2018).

For several decades, the decline in environmental quality in the 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 (Apriyanto, 2007).

The current Kendari Bay reclamation program began in 2012. It can be seen that the development of infrastructure in the reclamation area has affected the condition of the surrounding environment. For example, the construction of the road leading to the Al Alam Mosque, passes through the mangrove forest, resulting mangrove trees deforestation.

Furthermore, water quality around the reclamation site has become increasingly turbid. Additionally, the mud pond existence has decreased the aesthetic value of Kendari Bay and creating a visually unappealing area. However, the Al Alam Mosque is now an iconic attraction in Kendari City and visited by many local and national tourists.

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 as 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.

Based on the background provided, this research will assess the sustainability status of the reclamation area by indexing various attributes/variables of the sustainability dimensions, such as the environmental, social, economic and legal and institutional dimensions. The index value is weighted based on the current situation at the research

location, employing the experts' and relevant stakeholder opinions. In addition, the proper assessment of the sustainability dimension is expected to produce an accurate score for the sustainability status of the Kendari Bay coastal areas.

B. Research Questions

This research is aimed to answer the following research questions:

1. How has the Kendari Bay reclamation affected changes in the area of mangrove forest from 2014 to 2020?
2. What is the sustainability status of the Kendari Bay reclamation areas?
3. What are the proposed development strategies to increase the sustainability status of the Kendari Bay reclamation areas?

C. Research Objectives

The objectives of this research are:

1. To analyze the impact of Kendari Bay reclamation on changes in mangrove forest area during the period 2014 to 2020.
2. To assess the sustainability status of Kendari Bay reclamation areas based on 4 dimensions of sustainability: environmental, social, economic and legal and institutional.
3. To propose appropriate development strategies in order to improve the sustainability status of the Kendari Bay reclamation areas.

D. Significance of the Study

The significance of this study is divided into three benefits, such as:

1. The results of the study are expected to enrich and enhance the scientific study related to sustainable development in the reclamation areas.
2. For local governments, this research can be used as input into the management of sustainable regional development, particularly in the coastal areas.
3. For the community, this research expects to contribute through scientific thinking and provide new insights as a comparison regarding the sustainable development in Kendari Bay coastal areas.

E. Research Scope

This research will be carried out in Kendari City, particularly in Kendari Bay reclamation areas. Furthermore, this research will assess the sustainability status in such regions through quantifying 4 sustainability dimensions, i.e. environmental, social, economic and legal and institutional dimensions.

CHAPTER II

LITERATURE REVIEW

A. Regional Development

There are varying definitions of a 'region'. The following definition summarizes definitions used across several papers. Dawkins (2003), defines a region as a place where a group of people live together who are bound and influenced by history, culture, natural resources, and the facilities in which they are located. Moreover, the region can be categorized according to geographical criteria, economic features, and social and cultural characteristics (Dhimitri, Gabeta, & Bello, 2015).

Reyes (2001), defines development as a condition that shows a continuous process carried out by a nation to meet the needs of its population by utilizing its natural resources effectively and efficiently. Development is a multidimensional process that requires overall changes in social structures, attitudes, national institutions, economic growth, inequality reduction, and total poverty eradication (Todaro & Smith, 2012).

Regional incongruities have spurred efforts to promote equity in regional developments in the 1990s. The focus is on the creation of adherence through improving economic and living conditions. They are established by the effort in the sustainable development process and the

adaptable directing guideline of evenly distributed living conditions (Heintel, Wanner, & Weixlbaumer, 2018).

Economic issues, particularly those related to growth, have become a central issue in local and regional development. Growth is not only seen as the main objective of the development process. It is determinant of the realization of people's welfare in line with the conditions in which they live. Therefore, the understanding of local and regional economic development cannot be separated from the context. Regional social and political conditions contribute significantly to local and regional development policies in which the balance of power relations between the state, market, and civil society is constituted on this foundation (Pike, Rodríguez-Pose, & Tomaney, 2007).

The basis for optimal expansion of constituents must be used in regional development that include the aspects of social, natural, and economic development. Regional development is aimed to maintain and improve the quality of life through those constituents (Jovovic, Draskovic, Delibasic, & Jovovic, 2017). Furthermore, Pike et al. (2007), added that local and regional developments not only have social and economic dimensions but also expanded to include environmental, political and cultural dimensions.

A new perspective on local and regional development is converged on efforts to elevate regional growth through the identification and optimization of the region existing resources. In this case, regional

development policy features the bottom-up strategy to drive the involvement of all elements in designing and implementing strategies to increase economic growth in all ranges. The integration of policies in land use, infrastructure, and business support is essential to objectify this process (Tomaney, 2010).

On the other hand, an integrated action among environmental, economic and social dimensions in the process of sustainable development at the regional is essential to synergize with various regions to realize economic growth that is in line with social and environmental goals (Jovovic et al., 2017). Integrated action to prioritize all aspects of sustainability and synergy between relevant stakeholders is an essential factor in achieving sustainable regional development. Through an integrated strategy that results in higher economic and social growth, it improves living standards, increases security, and may even contribute to the advancement of neighbouring areas or the country as a whole (JICA, n.d.).

B. Coastal Areas

Coastal areas contain a variety of marine and terrestrial ecosystems that include natural to highly changing environments (Neumann, Ott, & Kenchington, 2017). Furthermore, Zhe (2017), stated that the preservation of the coastal area is one of the most important aspects for the earth system and human life. Therefore, these areas must be protected.

As a transitional area between land and sea, the coast is greatly influenced by natural conditions and changes in the surrounding environment. Coastal areas have an essential role in maintaining the climate and atmosphere as well as the continuity of human, animal and plant life (Bange et al., 2017). The critical role of transitional areas further highlights the need for sustainability management.

The coastal system covering areas near the mean sea level is built based on two support systems, namely natural and human. Natural systems cover all typical coastal ecosystems such as rocky coasts, beaches, barriers and dunes, estuaries and lagoons, deltas, river estuaries, and wetlands. The human system covers all human activities in coastal areas that contribute to the cycle of their life, including formal and non-formal institutions that regulate the community (Wong et al., 2014).

The coast is a volatile and dynamic place, thus it is vulnerable to pressures and changes that occur in various forms (Sevilla, Adeath, Le Bail, & Ruiz, 2019). Moreover, they are not only sensitive to the environment, but also have economic value. A wealth of ecosystems contain useful biodiversity such as protection of the elements, food and opportunities to produce renewable energy (European Commission, 2014). The most important aspects is that, the coastal area support complex interactions of marine and terrestrial habitats, that support the rich biodiversity and complex life cycles including food chain linkages within the water column (Neumann et al., 2017).

The full contribution of coastal areas to the global economy and prosperity sector is undeniable as it provides shelter for the majority of the world's population and enables economic activity and environmental provision services (IOC/UNESCO, IMO, FAO, & UNDP, 2011). Therefore, the balance between economic growth and sustainability that take into account the viewpoints of various stakeholders, create efficient coastal governance (The Economist, 2015). Additionally, to accomplish this aim, coastal regions must now be considered as the geographic and temporal setting for the coevolutionary development of socioeconomic and biological systems (Turner, 2000).

Coastal governance policy must ultimately consider the protection on the environment and social goods that arise from it. It must also maintain the balance between economic development and preservation of surrounding environment. Therefore, the coastal area management policy must be formulated based on a multi-stakeholder approach, where competitive interests are transparent (The Economist, 2015).

Management of coastal areas as part of urban development activities presents its challenges. One of which is related to conflicts among stakeholders. In various countries, this problem is addressed by the formulation of policies that promote a balance between human development and biodiversity preservation in a coastal area (Dhiman, Kalbar, & Inamdar, 2018).

C. Reclamation

According to OSPAR Commission (2008), reclamation is the use of land from the sea or wetlands for agriculture, industry or port expansion. In addition, reclamation is a condition in which the creation of land or water by filling or dosing shallow coastal spaces (Choi, 2014). In this context, reclamation is an option to increase land value and prevent environmental degradation to some extent.

A lack of land resources occur due to population growth that is close to a reclamation area, so that it would be adjusted to reach coastal areas (X. F. Xu, He, Song, Yang, & Yu, 2018). Coastal areas that are exploited and constructed rapidly must be reclaimed intensively due to increasingly high demand for land and resources by humans (Wang, Liu, Li, & Su, 2014). Some of the reasons previously mentioned make land reclamation in coastal areas tend to represent economic motives.

From the economics perspective, reclamation is an activity that could increase land area. Therefore, more projects in terms of agriculture or industry that are built, can increase greater economic benefits (Zhe, 2017). Similarly, Hoeksema (2007) stated that the increase number of reclaimed lands for development would provide a boost to the economic growth of coastal and inland areas.

However, reclamation of coastal areas did not always produce positive results. Reclamation can produce adverse impacts such as the loss

of marine habitat, the decrease of water quality and the threat the security of coastal ecology and sustainable development in the coastal zone (Jin, Yang, Sun, Yang, & Li, 2016; Zhe, 2017). Reclamation activity comes at a cost in terms of negative environmental effect. Environmental expenses are primarily incurred as a result of the degradation of coastal resources (and the ecosystem products and services they supply) and the harmful consequences of landfill quarrying (Montenegro, Diola, & Remedio, 2005).

Reclamation is an effort in coastal area management (Adharani et al., 2019). This effort is considered to damage coastal areas' ecosystem processes due to intensive land-use changes that can affect all biodiversity in the surrounding area (Deng et al., 2019). Problems in the estuary ecosystem that arise due to reclamation activities have become increasingly concerning due to its damaging effects. This also shows the complexity and uncertainty in the management of coastal areas (Y. Xu, Cai, Sun, & Tan, 2017).

Many studies on coastal reclamation have been conducted. Adharani et al. (2019), studied the challenges among the policy, environmental and social impacts of Jakarta Bay Reclamation. The author found that the policy for managing the reclamation area must be integrated and through interdisciplinary studies and pay attention to Integrated Coastal Management (ICM) as a proper instrument in coastal management. This is imperative as the coastal management process affects the socio-economic aspects of the community and other vital aspects.

Priyandes and Majid (2009), studied the impact of reclamation activity in the north coast of Batam. The authors view reclamation activity as an impactful process which could transform all ecological and morphological aspect of the area. The study found various impacts, such as logging and clearing of hills and surrounding vegetation to obtain reclamation material, additional consequences in the form of floods, erosion, sedimentation, and decreased sea water quality.

Sandirasegaran and Manap (2016), investigated the impacts of dredging and reclamation projects in Malaysia. The reclamation process that ignores integrative and comprehensive studies have a considerable impact on the coastal environment and dramatically affects the surrounding community. Stakeholders should be able to apply appropriate environmental management processes, including evaluating and monitoring at each stage of the process.

Wang et al. (2014), investigated the amount of land reclamation in China has increased significantly since 1949. This is driven by economic growth pressures that have not been matched by studies of ecology and marine protection. As a result of this process, the costal ecosystem is presented with several severe threats. This includes a reduction in wetlands by 50%, the threat of reduced biodiversity, and detrimental ecological damage. Therefore, a review of the coastal management policy is necessary. The authors argued that China must revise and strengthen the laws and regulation, make an improvement regarding marine spatial

planning, make a proper evaluation regarding the positive and negative impact of reclamation and increase ocean consciousness and public participation in reclamation management.

D. Sustainability

The primary reference and the most often cited definition of the concept of sustainable development is the definition in the Brundtland Commission Report, published by the World Commission on Environment and Development (Schaefer & Crane, 2005). This report defines sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

To ensure the development would not sacrifice the needs of future generations while population growth can live "in harmony with the changing productive potential of the ecosystem", sustainability needs to consider the adaptation living "within the planet's ecological means" (Talen, 2019). According to Collier et al. (2013), sustainability must take into account the present and future social and economic environment while still focusing on improving the quality of life.

The concept of sustainability is used to address various regional development problems, including policies, development processes, and regional planning strategies (Jovovic et al., 2017). According to Saunders and Becker (2015), there are three crucial elements in the sustainable

development concept: economic, environmental and social welfare. A good economy can create health, wealth and happiness for people. A healthy and productive environment encourages a better life and improved living standards. Social (or human) welfare provides an acceptable standard of living.

In line with the explanation above, Borden (2017), stated that sustainability is not only viewed as the common conception of the future. It is a framework used to deal with complex social and environmental problems. It is also a manifestation of the human ecological relationship as a whole. Moreover, according to Holden, Linnerud, and Banister (2014), there are four main sustainability dimensions extracted from the Brundtland Report, namely: safeguarding long-term ecological sustainability, satisfying basic human needs, and promoting intragenerational and intergenerational equity.

In the objectives of environmental protection and ecological conservation, sustainability integrates the creation of a viable and liveable space for human society. In the economic component, it is explained that all challenges in our environment and sustainability were related to economic production and consumption. This must be considered with other objectives (Mensah & Ricart Casadevall, 2019).

Several tools are needed to promote a balanced process between meeting socio-economic needs and environmental protection to build a sustainable regional development framework. One of these tools emerges

through an institutional component that can produce balanced policies between the economy and the environment (Jovovic et al., 2017). Given the sustainability perspective, it appears that the efficacy of activities taken in the context of sustainable development might be enhanced by developing and strengthening institutions that support consensus-building, participation and cooperation, and fair processes and transparency (Bochańczyk-Kupka & Pęciak, 2015).

The intersection in the sustainability component (pillar) is explained by Vázquez, del Río, Cedano, Martínez, and Jensen (2015). The Venn diagram in Figure 2 showed four interconnected circles in which the combination of the four components is considered to represent sustainability. The diagram shows the conceptual and indicator correlation among environmental, social, economic and institutional components themselves. It shows that indicators not only belong exclusively to one dimension but also a combination of these four dimensions.

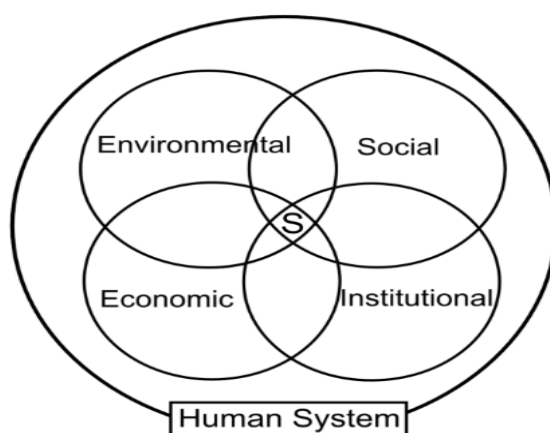


Figure 1 The Intersection of the Four Elements/Dimensions in Sustainability

The concept of sustainability emphasizes the creation of a harmonious and balanced integration among society, economy, and environment in creating an ecosystem that supports sustainability (UN-DESA, 2017). The appropriate policy is needed in the implementation of sustainable development. The policy that is needed for sustainable development is a policy that can reduce or separate local livelihoods from consumptive use of natural resources (WCED, 1987).

1. Sustainability Index

Indicators are used to minimize problems and also focus attention on specific issues (Atkinson et al., 1997). The indicator approach is used for decision making and policy in sustainability assessment. Indicators are quantitative measures that represent the condition of an object such as a complex products or systems (Hezri & Dovers, 2006).

Many distinct concepts and methods have been developed to evaluate the environmental, economic, and/or social aspects of a specific process, product or activity. Therefore, it is necessary to develop an indicator to measure sustainable development provide the basis for decision making (Čuček, Klemeš, & Kravanja, 2012). Furthermore, countries and companies adopted indicators to summarize, focus, and condense the complexities of dynamic environments into a number of meaningful information that could be managed (Godfrey & Todd, 2001). Indicators that

are used appropriately could reduce the amount of data needed to make a decision (Hiremath, Balachandra, Kumar, Bansode, & Murali, 2013).

Modern society's attention to understanding and managing multi-dimensional development issues has become an essential driver to achieve sustainable development. It is imperative to have a clear and comprehensive assessment of the process of measuring the achievements of progress, identifying the focus of attention, and evaluating the consequences of implemented policies related to sustainable development goals (Pinar, Cruciani, Giove, & Sostero, 2014). Hence, identification of operational indicators including manageable information on economic, environmental, and social conditions. It is the essential requirement to monitor sustainable development progress (Böhringer & Jochem, 2007). In evaluating land reclamation, careful consideration is obliged, particularly in determining the appropriate evaluation indexes.

An effective sustainability indicator and index must be multidimensional (Scipioni, Mazzi, Mason, & Manzardo, 2009), that is, it must cover various aspects of sustainability, such as the economy, environment and society (Tanguay, Rajaonson, Lefebvre, & Lanoie, 2010). In addition, according to Scipioni et al. (2009), sustainability indicator can be used as a reference in making policy regarding the current status of a place through efficient information analysis. Sustainability indicators must be objective, relevant to the context and in line with the objectives of sustainable development.

Furthermore, by determining sustainability indicators, it is conceivable to identify the significant environmental, economic, and social trends that tend to create changes. Defining the sustainability indicators is integrative with the three pillars notion. Thus, it is viewed as a measurable aspect of environmental, economic, or social systems that can monitor changes in systems that may affect human and environmental welfare (Fiksel, Eason, & Frederickson, 2012).

2. Environmental Sustainability

Environmental sustainability is seen as a condition in which nature can provide its resources sufficiently for human needs without damaging the supporting ecosystem so that it can accommodate human behaviour in using biodiversity through a balanced and continuous process (Morelli, 2011).

Among the government, policy makers, researchers and the public, the issue of sustainability, especially environmental sustainability, has frequently argued (Čuček et al., 2012). The concept of environmental sustainability considers how the natural environment remains productive and support the surrounding human life. It is related to the integrity of the ecosystem and the carrying capacity of the natural environment (Brodhag & Talière, 2006).

According to Laurent and Owsianiak (2017), environmental sustainability is very dependent on policies made regarding energy utilization where waste emissions are maintained at their assimilative capacity, use resources according to the regenerative capacity of renewable resources, and use non-renewable resources at a level where renewable resources can replace these resources.

In defining environmental sustainability, Organization for Economic Cooperation and Development (2001), determines four criteria, namely regeneration, substitutability, assimilation, and avoiding irreversibility. Regeneration refers to the efficient use of renewable resources to not reduce their ability to renew their resources. Substitutability relates to the use of non-renewable resources virtually and does not exceed the threshold values that renewable resources can tolerate or replace. Assimilation refers to the capacity of the environment to tolerate pollution; in this case, the release of hazardous substances does not exceed the environment's assimilation capacity. Avoiding irreversibility means the environment should not be in stable condition and be able to regenerate continuously.

Environmental sustainability is a fundamental factor in the realization of long-term social progress and economic development. Various social and economic problems in society cannot be separated from environmental problems and irresponsible use of natural resources, and climate change (UNCTAD, 2018). Therefore, it is important to consider the four criteria as described by OECD (2001), when formulating sustainability policies.

3. Social Sustainability

Social sustainability considers how social values, social identity, social relationships, and social institutions can be sustainable in the future (Black, 2004). In addition, Torjman (2000) argued that social sustainability was defined from a social perspective. From a social standpoint, human well-being, in particular, cannot be sustained in the absence of a healthy environment and is similarly improbable in the absence of a robust economy.

The definition of social sustainability included equality, empowerment, accepted standard of honesty, social bonds, participation, cultural identity and institutional stability (Goodland & Daly, 1995). Factors such as the imbalance of social life and various social symptoms that arise due to poverty can become factors that impede economic progress and threaten environmental sustainability. It makes social sustainability necessary to promote social peace (UNCTAD, 2018).

The manifestation of social sustainability is reflected through the interactions of social structures, both formal and non-formal, to create a support system and a shared value that can accommodate the needs of current and future generation. The unprejudiced, heterogeneous and democratic society is the characteristics of socially sustainable societies (McKenzie, 2004).

Focusing on equitable social and economic adaptation processes to increase people's protection from various backgrounds, Eizenberg and Jabareen (2017), propose a framework for social sustainability. The conceptual framework emphasizes the realization of a future sustainability vision, which determines the achievement of sustainability fundamental objectives. It is extracted from the central theoretical premise that views social sustainability as a key and integral part that intersects with social, economic and ecological aspects that can support sustainability.

At the social level, sustainability requires the correctional development of people, communities and cultures in order to achieve meaningful lives, take advantage of proper health care, gender equality education, peace and stability worldwide (Saith, 2006). In this sense, social sustainability prioritizes people and community ability to make a change in both physical and non-physical aspects. According to Eizenberg and Jabareen (2017), the purpose of social arrangement is to encourage people to collaborate cooperatively in order to effect change.

4. Economic Sustainability

Economic sustainability is the implementation of economic principles with the awareness of how current activities can impact humans and nature, both now and in the future. It is useful for organizing our actions to be more focused, systematic and logical to achieve sustainability (Baumgärtner &

Quaas, 2010). In addition, the concept of sustainable economic development suggests that economic systems exist to assist human well-being, that human and economic well-being are inseparably linked to environmental well-being, and that, as a result, the well-being of humans, the environment, and the economy must all be taken into account in the design and evaluation of economic development efforts (Hammer & Pivo, 2017).

Human and financial resources must be used in an efficient and appropriate way to ensure economic sustainability in terms of living standards. Macroeconomic and financial stability and prevention of balance of payments crises were the requirements for sustainable economic and social development. Lifestyles that waste human, natural, and financial resources are dangerous to the natural environment's quality and endanger social peace (UNCTAD, 2018).

An economic system based on the theory of economic sustainability is naturally constrained by the notion of environmental sustainability, limiting the use of natural resources (efficiency) to ensure the sustainability of natural capital (Basiago, 1998). Therefore, as Zhai and Chang (2018) argued, economic sustainability demands the decisions are made in term of the fairest and financially proper while still paying attention to all other pillars of sustainability.

Economic sustainability is an inseparable part of social sustainability. Economic activities involve and incorporate processes of interaction

between various economic factors and multidimensional activities such as social and cultural dimensions (Rosen, 2018). In order to realize sustainability in society, economic strength is necessary as a provider and support for the community's socio-economic activities. Economic growth, measured by gross domestic product, and fundamental economic development, are a means to achieve social sustainability (Rosen, 2020).

5. Legal and Institutional Sustainability

Institutions are a set of rules of the game in the community designed to arrange the relationship or interaction between people. It encompasses formal regulations, informal restrictions and the characteristics of both enforcements (North, 2016). Moreover, the institution arranged human exchange incentives in all aspects, including social, political and economic aspects. The institution was not only an organization such as government and private organizations but also law, social norms, and the system that regulated the interaction of members in a community population that contribute directly to the establishment of recognized standards and law enforcement (Elobeid, 2012; Spangenberg, 2002).

There are two criteria for institutional characteristics that are suitable for identifying these institutions: facilitating decision-making, serving various implicit and explicit purposes of the sustainability paradigm; and facilitating the implementation of political decisions. Therefore, the main concern of the

current policy discourse was good governance towards sustainability because it was impossible without good and appropriate institutions (Spangenberg, 2002). Endogenous factors, such as political and economic conditions, have a vital contribution to determining an institution's strength (Chong & Gradstein, 2007). Moreover, institutions have historically been an instrument for creating order and reducing uncertainty (North, 1991).

Various empirical studies have demonstrated the instability of the current condition. The leading cause is governance and the socio-economic life of the community. These problems are inevitably caused by institutional governance as all individual, rules, values, and culture determine collective behaviour in society, and habits formed in the formal and non-formal social institutions (Dovers, 2001; Lister, 2007). It can be argued that in order to achieve a continuous change towards sustainability, it is necessary to change the institution as changes in the social conditions of society can be carried out comprehensively through institutions, which in turn will contribute to the internalization of values within the institution itself (Dovers, 2001).

E. Previous Research in Sustainability Status

Table 2 lists several studies that have been conducted regarding the assessment of the sustainability index and sustainability status in various research field. Research conducted by Handadari, Soesilo, and Pranowo (2018), aimed to identify the sustainability status of marine and coastal

resources in the Benoa Bay in Bali if the Bay is reclaimed. This research focuses on developing a sustainability index which is assessed using Multidimensional Scaling (MDS) analysis, employed with modified RAPFISH software. It is then combined with Leverage Analysis, Monte Carlo analysis and Kite Diagrams to obtain sustainability values based on the research objectives. The key to this measuring sustainability analysis lies in the judgement of experts as almost all stages of the analysis were assessed by respondents who are categorized as experts. The results of this study indicate the value of the multi-dimensional sustainability index for marine and coastal resources at the Benoa Bay reclamation site is 43.15%. This categorizes it in the 'less sustainable' category. The most sensitive attributes of the analysis (as measured by the four pillars approach), are the suitability of the marine space usage, the regulations regarding that space and its usage, the increase in local revenue related to the economic value of the environment, the perception of community leaders, and the degree of sedimentation that can disrupt fisheries resources. Given these sensitive attributes, appropriate policy interventions must be developed. Especially the review of the suitability of space allocation in order to support stakeholders by considering aspects of multi-dimensional sustainability.

Table 2 Previous Research

Researcher	Title	Methods	Result
Handadari, Soesilo, Pranowo (2018)	Marine and Coastal Resources Sustainability Index of Benoa Coastal Bay Reclamation Site	<ul style="list-style-type: none"> ▪ MDS ▪ Leverage Analysis ▪ Monte Carlo ▪ Kite Diagram ▪ Expert Judgement 	The value of the multidimensional index of sustainability for marine and coastal resources at the Benoa Bay reclamation site is 43.15%. This result is 'less sustainable'.
Supardi, Haryadi, Fahrudin (2017)	Analysis of Sustainable Development of Coastal Cities (Case Study: Baubau City, Southeast Sulawesi Province)	<ul style="list-style-type: none"> ▪ MDS ▪ Poreto Analysis ▪ Leverage Analysis ▪ Monte Carlo 	The results show that the overall score of multidimensional indices of sustainability in Baubau City is 47.20% which is categorized as 'less sustainable'.
Widiatmaka, Munibah, Sitorus, Ambarwulan, Firmansyah (2015)	Appraisal of Multidimensional Sustainability of Land Use for Rice Fields in Karawang	<ul style="list-style-type: none"> ▪ MDS ▪ Leverage Analysis ▪ Monte Carlo ▪ Goodness of Fit ▪ Prospective Analysis 	The results show that the land use for rice fields in Karawang was 'less sustainable'. The social and technological dimensions have slightly sustainable performance while the ecology, economy, and institutional and law dimension show unsustainable performance.
Mahida, Kusumartono, Permana (2019)	Multidimensional Scaling Approach to Assess Sustainability Status of Lake Maninjau	<ul style="list-style-type: none"> ▪ MDS ▪ Leverage Analysis ▪ Monte Carlo ▪ Goodness of Fit 	The results show that the value of the sustainability index on the economic dimension of Lake Maninjau is 75.28% or the status is good. The sustainability index value on the social dimension of Lake Maninjau is 53.99% or fairly sustainable. The sustainability index value on the ecological dimension of Lake Maninjau is 68.80% or fairly sustainable.

Another study was conducted by Supardi, Hariyadi, and Fahrudin (2017), to analyze the sustainability status of the development of Baubau City in Indonesia based on ecological, economic, social, infrastructure, technological and legal and institutional dimensions. The method used in this research was Multidimensional Scaling with RAPFISH software combined with Leverage analysis, Pareto analysis, and Monte Carlo analysis. The multidimensional overall scoring was 47.20%. The results showed that the development of Baubau City was in the 'less sustainable' category. The sensitive attributes that effect the sustainability of development is the degree of irregularities in land use, mangrove cover, the volume of waste, green open space, the level of employment opportunities, the existence of fishing groups, and protection and rehabilitation of coastal ecosystems. Based on this study, the suggested improvements are: spatial planning processes that are in accordance with applicable regulations; the rehabilitation and conservation of coastal ecosystems; fostering and zoning of residential areas, especially in coastal areas and increasing the role of fishermen groups.

Furthermore, a study conducted by Widiatmaka, Munibah, Sitorus, Ambarwulan, and Firmansyah (2015), in West Java in Indonesia aimed to analyze the sustainability of paddy land use, and the determinant factors and policies for increasing sustainability. The method used was multidimensional scaling using an ordination technique called Rap-Land use. This is a modification of RAPFISH and is supported by Sensitivity Analysis, Monte

Carlo Analysis, and Prospective Analysis to determine key sustainability factors that will be used to set policy priorities to improve sustainability status. The results showed that, of the five dimensions of sustainability studied, only two dimensions reached an index value above 50. This indicates the area is fairly sustainable. While other dimensions, such as ecology, economics and law and institutions, are categorized as 'less sustainable'. To improve the sustainability status, the attributes that act as sensitive factors of each dimension are then treated to improve the performance. Prospective analysis of the sensitive attributes found five key factors: the pressure from land-use by industry and settlements; weak law enforcement; community understanding of land conversion; the price stability of rice; and income from agricultural products. Based on these key factors, several strategies are suggested such as: from tightening building construction licenses; implementing consistent regional spatial plans; counselling; and revitalizing the role of BULOG (Indonesia's Logistics Affairs Agency).

Additionally, Mahida and Permana (2019), conducted research regarding the multidimensional scaling approach to assess the sustainability status of Lake Maninjau. This study was based on three dimensions, namely ecological, social and economic. The analytical method used was Multidimensional Scaling with the RAPFISH approach modified to Rap-Lake and supported by the Goodness of Fit test, Leverage Analysis and Monte Carlo simulation. The results showed that the overall sustainability status of Lake Maninjau was categorized as 'fairly sustainable'. Therefore, the policy

interventions carried out were based on maintaining sustainability performance. The proposed policies are: ensuring environmental aspects as a priority consideration in further development; maintenance of the lake's green belt area; maintaining good water quality and availability of water for agricultural needs; and conservation efforts in the upper reaches of Lake Maninjau.

F. Research Frameworks, Attributes and Matrix

The research framework describes the process/steps taken to achieve the research objectives. This is intended to provide an understanding of the research flow. Furthermore, it controls the research process that is conducted.

The study begins by examining regional development programs related to the use of coastal space for development; particularly, the development of coastal areas through reclamation projects and the regulations that govern this reclamation. The study then focuses on assessing the sustainability aspects of the reclamation area by determining the attributes or variables of the four dimensions of sustainability based on literature studies. The four dimensions are the environmental, social, economic and legal and institutional dimensions.

The attributes or variables, of the four dimensions of sustainability are then assessed using selected analytical tools to obtain the value and

sustainability status of the reclamation areas. The attributes that are considered sensitive in the assessment of sustainability status will be further analyzed to identify the best strategy to improve the sustainability status according to the research objectives. The research framework is presented in Figure 2.

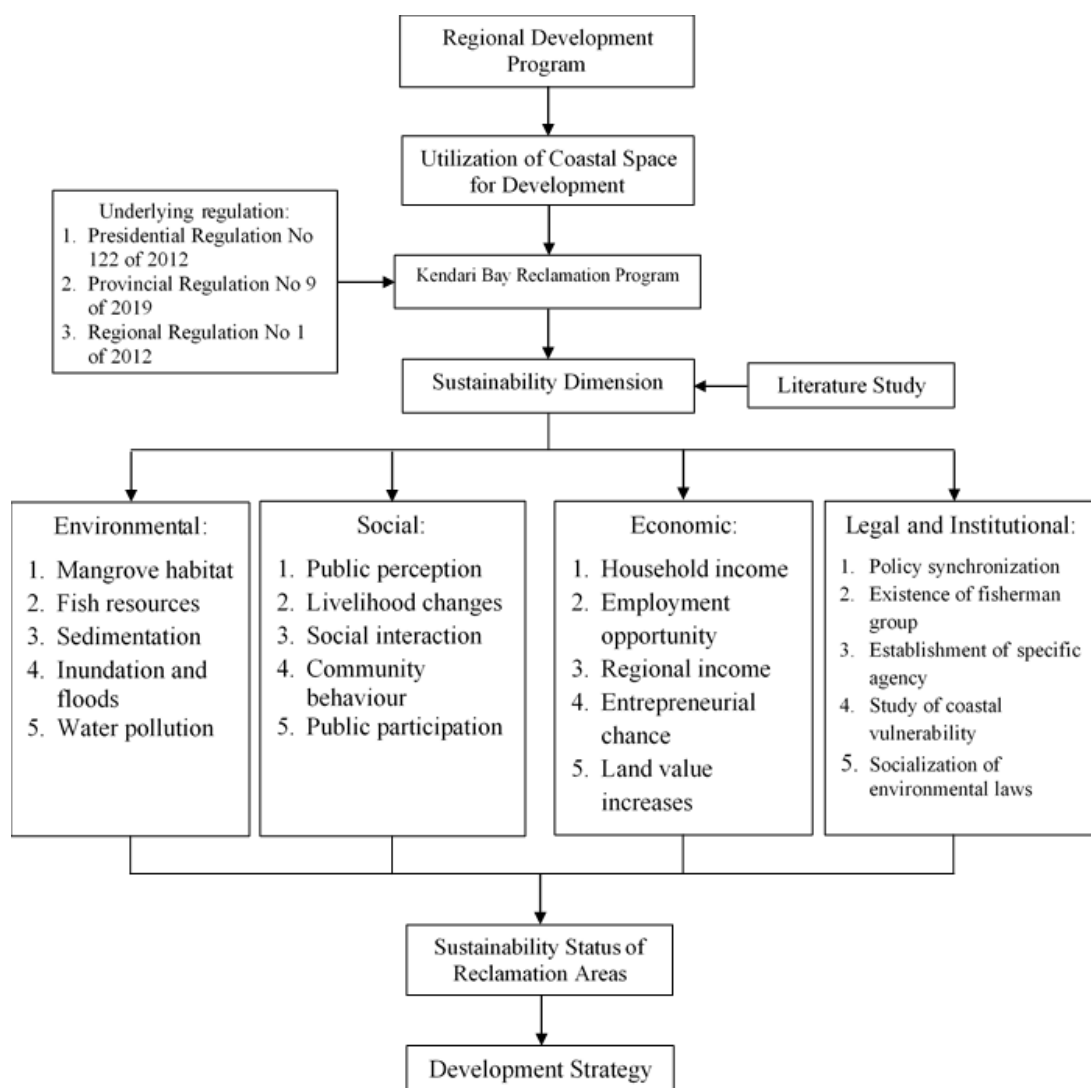


Figure 2 Research Framework

In this study, the attributes used to measure the indications are determined by the researcher to be the focus of the study. These attributes are based on literature studies by considering conditions in the field and the objective of the research to obtain the value and status of sustainability. For example, the assessment of reclamation is developed by analysing 20 attributes representing reclamation conditions based on each dimension. Each of these attributes influences each of the four-dimension groups of sustainability. This is then generated according to the results of the assessment into the following categories: bad, low, fair, and good. The assessment of each dimension group will illustrate the sustainability conditions of the Kendari Bay reclamation area. The research variables or attributes and their relationship are presented in Figure 3.

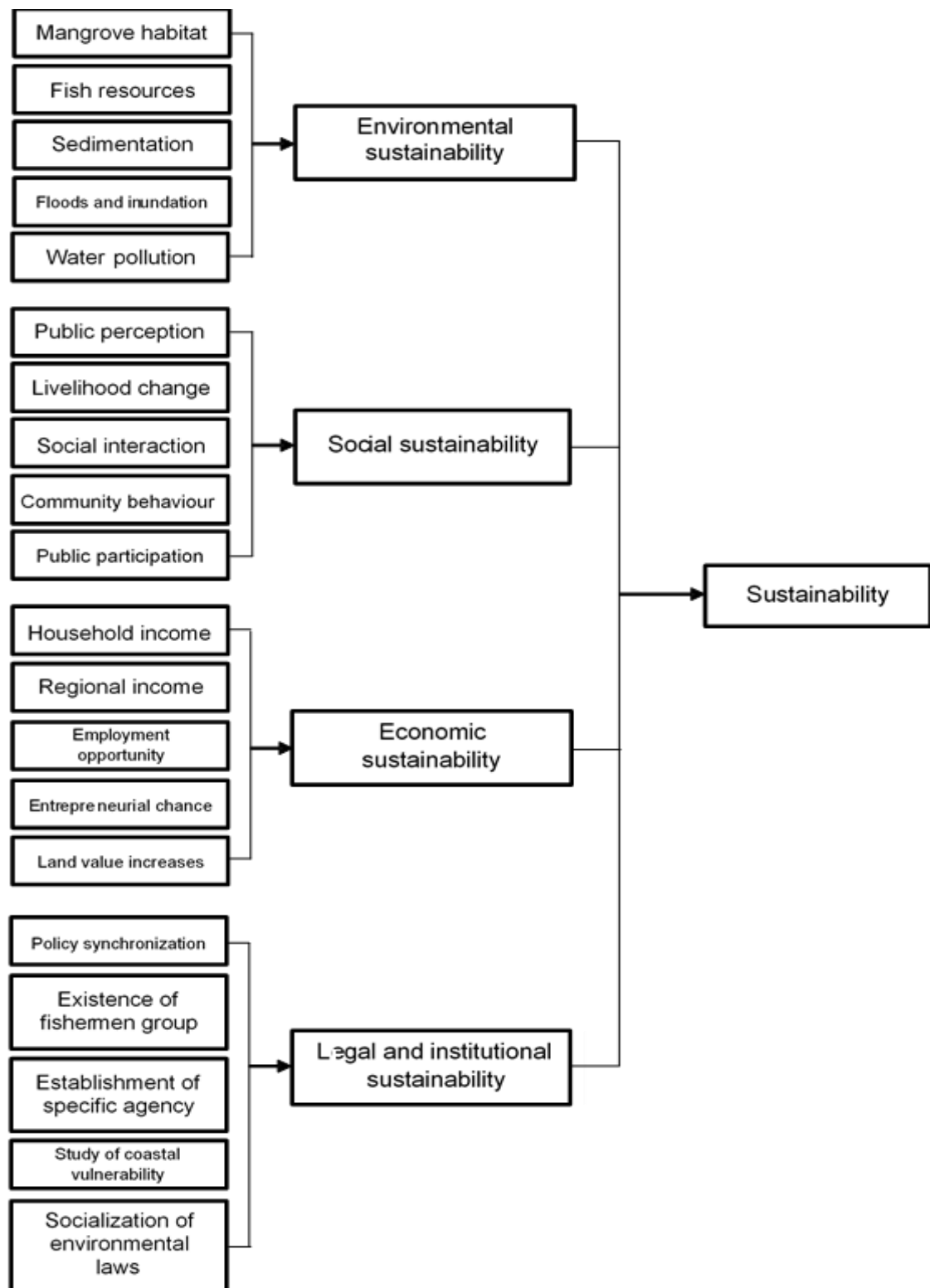


Figure 3 Research Attributes

The research matrix of this study is presented in Table 3.

Table 3 Research Matrix

No	Objectives	Assessment Parameters	Data Source	Analytical Technique	Output
1	Investigate the impact of Kendari Bay reclamation on changes in mangrove forest area during the period 2014 to 2020	Changes in the mangrove forest area around the reclamation site in the period 2014, 2017 and 2020	Google Earth, Geospatial Information Agency	GIS analysis	The extensive change and the percentage of mangrove forest area around the reclamation site based on the predetermined periods
2	Assessing sustainability status of Kendari Bay reclamation areas.	Dimension of Environmental, Social, Economic, and Legal and Institutional	Observation, Respondent, Central Bureau of Statistics, Bappeda, and Marine and Fisheries Service	RAPFISH (MDS, Leverage analysis, Monte Carlo analysis)	Sustainability status and leverage factor of reclamation areas sustainability
3	Propose development strategies to increase the sustainability status of Kendari Bay reclamation areas.	Sensitive/dominant attributes in the sustainability of the reclamation areas	Respondent, RAPFISH analysis results	AHP analysis	Strategies for sustainability of reclamation areas