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Waqf Model for Mangrove, Seagrass, and Coral Ecosystem Services Management of Coastal and Marine Resources Conservation Area for Human Welfare

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ABSTRACT

The objective of the study was to develop a Waqf model based on conservation of coastal and marine resources that can bring sustainable benefits to human well-being. The study was carried out using a normative approach. Data and information were obtained through literature review on Waqf and conservation of coastal and marine resources. The obtained data and information were processed qualitatively and quantitatively and transformed into a Waqf model based on conservation of coastal and marine resources for the benefit of people. The results of the study indicate that Waqf based on coastal and marine resources can be developed into a viable model for implementing sustainable development and promoting the restoration and conservation of coastal and marine ecosystems. For effective management, Waqf resources should be properly administered to ensure they grow into healthy and productive ecosystems. These ecosystems can provide various regulatory functions, provisioning/production functions, supporting/habitat functions, and cultural/informational functions, contributing to the provision of ecological, social, and economic services for the benefit of society. This Waqf model is expected to serve as a long-term environmental financing solution, supporting the optimal and sustainable management of coastal and marine areas, making them more productive and beneficial to communities. This waqf model will be supported by a combination of granting management rights to waqf institutions and communities, allowing areas or lands to be designated as coastal and marine resource conservation zones to be used as growth mediums for coastal and marine ecosystems.

INTRODUCTION

Mangroves, seagrass and coral reefs are the three main ecosystems in coastal areas and small islands. These coastal and marine ecosystem are vital and integral for the well-being of coastal and small island communities. These ecosystem provide essential and a wide range of ecosystem services, including food, livelihoods and culturral identity, while also supporting biodiversity **(Wahyudin, 2016)**. These services functioned as a source of economic and social development **(Paulangan *et al*., 2020)**. The functions and

essential services provided by coastal and marine ecosystem are regulating services, provisioning services, supporting services, and cultural services **(Costanza *et al*., 1997, 2014; Wahyudin *et al*., 2018, 2022, 2023; Arkham *et al*., 2024)**. The importance of coastal and marine resources lies in their abundant natural resources and their ability to provide various environmental services that benefit human well-being (**Paulangan *et al*., 2020**; **Wahyudin *et al*., 2022, 2023**; **Husen *et al*., 2024**). To ensure long-term sustainability, coastal and marine resources must be managed effectively and properly so that the public, private sector, and local communities can work together, resulting in a sustainable ecosystem with a social, ecological, and economical benefits **(Wahyudin *et al*., 2016; Wahyudin & Mahipal, 2020; Wahyudin, 2021)**. This involves collaboration among the public, private sectors, and local communities to balance conservation with resource use **(Wahyudin *et al*., 2021; Kumar, 2022)**.

One of the main approaches for managing these resources is through social-ecological systems (SES), which integrate both ecological and social sustainability **(Berkes & Turner, 2006)**. A social-ecological system approach management is currently being developed and believed to be able to reconcile resource use and resource conservation goals **(Cumming *et al*., 2006)**. This approach ensures that ecosystems are protected while also supporting the social and economic needs of the community **(Berkes & Turner, 2006; Cumming *et al*., 2006)**. A social-ecological system is an approach that links and balances the sustainability of ecosystems and the sustainability of social systems to achieve benefits for the common good **(Berkes & Turner, 2006; Cumming *et al*., 2006; Arkham *et al*., 2018; Partelaw, 2018; Stephenson *et al*., 2018; Wahyudin *et al*., 2018)**. Social-ecological systems fundamentally guarantee ecological, social and economic sustainability, whereby managed ecological systems must be maintained to provide at least the same benefits to future generations **(Domptail & Easdale, 2013; Nugroho *et al*., 2019; Wahyudin *et al*., 2019; Arkham *et al*., 2020a; Maynard *et al*., 2020)**. Human life depends on ecosystems that allow good use of biological resources **(Wahyudin, 2017)**.

However, coastal and marine resources is facing the challenges of environmental degradation. The growth of population and consumption patterns are growing pressure on ecosystems due to human activities, such as deforestation, illegal-unregulated-unreported (IUU), and conflicts, leading to environmental degradation **(Barbero *et al*., 1990; Ame *et al*., 2011; Wahyudin *et al*., 2018)**. Environmental degradation is causing biodiversity loss, environmental loss, social-ecological loss, ecological-economic loss, and other forms of ecosystem destruction **(Mahipal & Wahyudin, 2019; Nugraha *et al*., 2019; Wahyudin & Mahipal, 2020)**.

The Qur'an (QS. Ar-Rum 41) highlights the moral obligation to protect the environment from harm caused by human exploitation. QS. Ar-Rum verse 41 states that corruption has spread on land and sea as a result of what people’s hands have done, so that Allah may cause them to taste ˹the consequences of˺ some of their deeds and perhaps

they might return ˊto the Right Pathˋ. The environmental damage caused by human activities driven by self-interest leads to the degradation of both land and sea. These are the Islamic perspective on the environmental stewardships. The verse underscores the need for responsible stewardship of natural resources, including mangrove, seagrass and coral reefs ecosystems **(Adrianto *et al*., 2016)**. These harms are enormous and are caused by people who tend to prioritize their own interests and desires so that they are immediately satisfied, but ultimately, real losses occur in the form of uncontrolled environmental destruction. This view emphasizes the ethical duty to safeguard natural resources for present and future generations **(Mahipal & Wahyudin, 2019)**.

Therefore, the restoration and sustainability of the coastal and marine resources management are necessary. The importance of restoration and responsible human actions is emphasized, suggesting that ecosystem restoration can only be achieved through collaboration among various stakeholders **(Gan *et al*., 2019)**. It is necessary to formulate an integrated model or approach to sustainability that incorporates human responsibility, drawing on both religious and social principles. This approach serves as a means to address environmental issues. An integrated framework should embody actions that reflect worship of Allah in its entirety, ethical interactions with fellow humans, and the optimal, sustainable management of natural resources and the environment.

This research proposes an alternative model to protecting coastal and marine resources. The waqf model can be defined as an innovative models for conservation. The concept of waqf, an Islamic endowment system, offers a novel approach for funding the protection of coastal and marine resources. Waqf could be used as a tool for ecosystem protection, with mangrove, seagrass and coral reefs ecosystems are being designated as nature reserves. This could involve establishing protected marine areas funded by waqf contributions, blending spiritual values with practical conservation efforts. This approach could harness both voluntary contributions and legal frameworks for conservation **(Idllalène, 2021)**.

MATERIALS AND METHODS

This research was conducted using a normative approach. The normative approach was chosen because this research aimed to formulate and develop a Waqf model that can be used in the management of coastal and marine ecosystems and resource conservation with a focus on human welfare. This approach emphasizes the analysis of existing norms, principles, and legal frameworks **(Taekema & van der Burg, 2024)**, both sharia and conventional, related to the concept of Waqf and the management of natural resources and the environment. Fig. (1) presents a mind-mapping of how the waqf model for the conservation of natural resources and the environment, specifically coastal and marine resources, is developed. Starting with determining the research objectives, approaches, data collection, data analysis, to the development of the model.

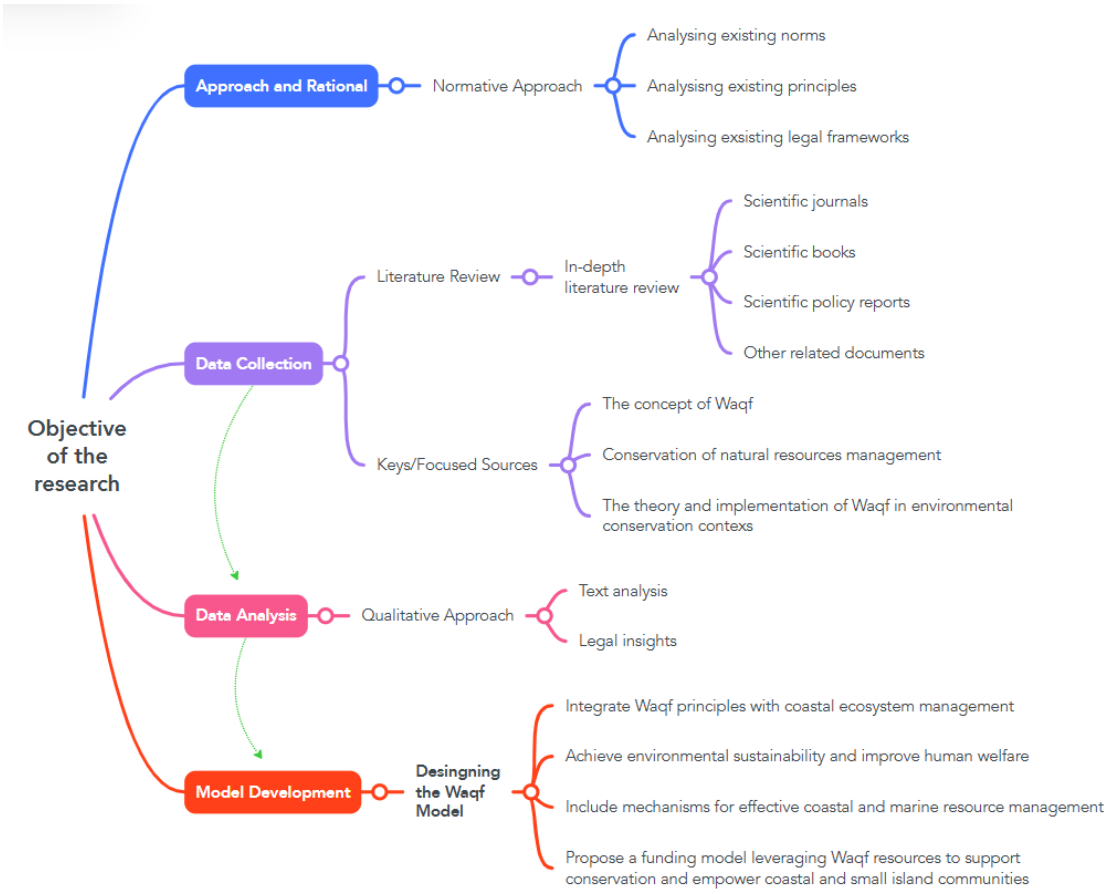

Fig. 1. Mind-mapping of waqf modeling for natural resource conservation

It is further shown in Fig. (1) that data collection was carried out through a literature survey approach. In the literature study approach, the data and information can be collected through an in-depth literature review **(Wolfswinkel *et al.*, 2013)**. In the context of this study, those are related to the concept of Waqf and the conservation of natural resources and the environment. The literature analyzed includes various sources, such as scientific journals, books, policy reports, and other related documents **(Onwuegbuzie *et al.*, 2012)**, relevant to the management of ecosystems and the conservation of natural resources, specifically mangrove ecosystems, seagrass beds, coral reefs, and the theory and implementation of Waqf in the environmental field.

The data obtained from the literature review were then processed qualitatively. The qualitative approach was used to analyze and interpret various existing information regarding the relationship between Waqf and the conservation of natural resources and the environment, as well as the potential for integrating the two to provide benefits to the community **(Dillaway *et al.*, 2017)**. This process involves text analysis, legal insights, and existing theories to develop an appropriate model **(Rubin, 1996)**. After the data and information are processed, the results of this analysis are used to design a Waqf model based on coastal and marine resource conservation **(Caudle, 2004)**. This model is expected to integrate the concept of coastal ecosystem management with Waqf principles

to achieve environmental sustainability goals and to improve human welfare. The model developed contains an effective coastal resource management mechanism, as well as a funding model that involves Waqf potential to support conservation activities and empowerment of coastal communities **(Mas'ud & Mas'ud, 2019)**. Through the development of this model, it is hoped that innovative and applicable solutions can be found in managing coastal and marine resources, which does not only consider environmental aspects, but can also provide socio-economic benefits to the community.

RESULTS

1. Waqf and the imperative for sustainable development

1.1. Definition and legal basis of Waqf

The term "Waqf" indeed originates from the Arabic word "Wakafa," which generally means "to stop," "to hold," or "to stay in place," or "to stay standing." This conveys the notion of holding something in trust or preserving it without transferring ownership **(Laluddin *et al.*, 2021)**. In Islamic law, Waqf refers to the act of dedicating property or assets for charitable or religious purposes, where the ownership of the asset is held by a religious or charitable institution, while the usufruct (benefit) from the asset is used for specific public or community benefits **(Kahf, 2003)**.

The legal basis of waqf (Islamic endowment) in Islamic jurisprudence is indeed often supported by references in the Qur'an, as well as the teachings of the Prophet Muhammad (PBUH) and scholarly consensus (ijma'). QS. Al-Hajj verse 77 and QS. Al Imran verse 92 are important in establishing the concept of charity and selflessness, which are central to the practice of waqf. The verses from Al-Hajj (22:77) and Al Imran (3:92) underscore key principles of charity, sacrifice, and devotion to the welfare of the community, all of which form the foundational legal basis for the practice of waqf in Islamic law.

While the verse 77 of QS. Al-Hajj doesn't directly mention waqf, it calls for acts of worship and righteousness, including charitable acts. The broader context of the verse emphasizes devotion and doing good, which includes acts of charity, one of which is waqf. The act of giving in the way of Allah, especially in the form of creating an endowment to benefit others, is seen as fulfilling this broader command of doing good **(Zaman, 2019)**. The verse 92 of QS. Al Imran is key in Islamic teachings about charity and selflessness. It emphasizes that true piety and righteousness are attained not merely by what one outwardly does but by what one is willing to give up from that which is most cherished, including wealth and property. Waqf is an ideal means to express this, as it involves dedicating something valuable, often land or assets, to a charitable cause or the public benefit in perpetuity **(Abdullah & Ismail, 2017; Laluddin *et al.*, 2021)**. In addition to the Qur'anic verses, the practice of waqf is also strongly supported by the Sunnah (the tradition of the Prophet Muhammad). The Prophet Muhammad (PBUH)

himself established waqf by dedicating his land, such as the well of Ruma to be used for the welfare of the community. There are numerous Hadiths where the Prophet encourages acts of charity, and waqf, as a permanent form of charity, is viewed as one of the best ways to continuously benefit from the rewards of good deeds, even after death.

1.2. The concept of Waqf

The concept of Waqf is linked with the idea of making an asset inalienable **(Moumtaz, 2021)**. Once an asset is designated as Waqf, it cannot be sold, gifted, or inherited **(Kahf, 2003)**. The property remains dedicated to the designated purpose, often benefiting religious, educational, or social needs **(Bharti, 2023)**. The concept of Waqf is indeed a fundamental pillar in Islamic social welfare and philanthropy, promoting sustainability and community welfare through the dedication of assets to charitable, religious, or educational purposes **(Ali *et al*., 2024)**. The inalienable nature of Waqf ensures that the designated asset, once established, cannot be altered, sold, or inherited, thus securing its continuous contribution to the intended cause over generations **(Abdullah & Ismail, 2017)**.

The concept of waqf has been firmly established by Islamic scholars across various schools of thought (madhahib), such as the Hanafi, Maliki, Shafi'i, and Hanbali schools. The scholars provide various interpretations of the principles governing Waqf **(Rusydiana & Devi, 2014; Pratama & Rosyit, 2023)**. While there are differences in interpretation among the classical Islamic scholars, regarding certain aspects of Waqf, all the scholars uphold the central idea that a Waqf should be preserved to serve a charitable or religious purpose **(Dallal, 2004)**. Scholars agree that waqf is a legally valid practice based on the principles found in the Qur'an, the Sunnah, and the consensus of the early Muslim community.

For instance, the Hanafi school tends to emphasize flexibility regarding the use of Waqf assets in some cases, while the Maliki and Hanbali schools typically stress strict adherence to the original purpose of the Waqf **(Siraj, 2012)**. Waqf can be used to fund a wide variety of public services that contribute to the common good **(Ambrose *et al*., 2018)**. These include the construction and maintenance of mosques, schools, hospitals, orphanages, and water systems **(Khan, 2015)**. This system of asset dedication plays an important role in supporting a thriving, self-sustaining community without relying on external financial sources or the need for constant fundraising **(Majid *et al*., 2024)**. Through this framework, Waqf has historically been an effective means of promoting long-term social justice and equity, ensuring that essential services remain available and funded for future generations **(Ali *et al*., 2024)**. It embodies the Islamic values of charity (sadaqah), justice, and communal responsibility, contributing to the collective welfare of society **(Hughes & Siddiqui, 2024)**. However, they all agree on the core idea of preserving the property for a charitable or religious cause **(Laluddin *et al*., 2021)**. In this context, the concept of Waqf plays a significant role in Islamic social welfare and

philanthropic practices **(Alam *et al*., 2018)**. It allows for sustainable support of important community services such as mosques, schools, hospitals, and orphanages, without the need for continuous fundraising or external donations **(Mahomed & Saba, 2024)**.

Imam Hanafi's definition of waqf reflects a specific understanding of charitable endowments **(Ghazali *et al*., 2019)**. According to the Hanafi school of thought, waqf involves setting aside assets for charitable purposes while allowing the donor (the "wakif") to retain ownership and control over the property during their lifetime **(Laluddin *et al*., 2021)**. The key point is that the waqf property itself does not permanently transfer in ownership, but rather its income is designated for charitable uses **(Kahf, 2003; Abdullah & Ismail, 2017)**. This approach to waqf contrasts with some other schools of thought, which may view waqf as a permanent transfer of property with no right of reclamation by the wakif **(Kozlowski, 1985; Hennigan, 1999)**. In the Hanafi view, the wakif retains legal ownership of the waqf property, but their focus is on the earnings or income derived from the property, which can be used for charitable purposes **(Abdullah & Ismail, 2017)**. When the wakif dies, the property is passed on to their heirs, rather than remaining in the hands of the intended charitable purposes **(Kahf, 2003; Hafidz, 2023)**. The waqf's role is not about relinquishing ownership but about contributing income from the property to fulfill the intended charitable cause **(Laluddin *et al*., 2021)**. Thus, in this context, the Hanafi understanding of waqf emphasizes the concept of using income for charity, without transferring permanent ownership of the asset itself **(Abdullah & Ismail, 2017; Laluddin *et al*., 2021)**.

The concept of Waqf (endowment) in the Maliki school of thought emphasizes the notion that the "wakif" (the person creating the waqf) does not actually release ownership of the endowed property **(Abdul-Karim, 2010; Qamariyanti & Aufa, 2024)**, but instead, they are prevented from performing any actions that would transfer the possession of the property to others. The property remains under the ownership of the "wakif", but they have restricted control over it **(Fratcher, 1971)**. The "wakif" does not own the use or usufruct of the property, and instead, they ensure that the benefits generated from the property (such as income or other returns) are directed towards the designated recipients, or "mustahik". In this framework, the "wakif" is obliged to manage the income or benefits of the waqf in a way that serves the public good or other designated charitable purposes, as per their intentions **(Bharti, 2023)**. The waqf is established through a formal declaration, in which the "wakif" specifies the purpose and duration of the endowment. The Maliki view also points out that this form of waqf is not necessarily permanent. While it may be established for a certain duration, it is not regarded as an eternal endowment **(Anderson, 1951; Oberauer, 2013)**. The "wakif" can define the duration for which the waqf is valid, and once this period expires, the property may return to the "wakif" or be dealt with according to their wishes **(Musthafa *et al*., 2022)**. Thus, the essence of waqf in this understanding is more about the regulation of the benefits from the property, rather than a permanent transfer of ownership **(Kahf, 2003)**.

Imam Shafi'i's views on Waqf were unique in some aspects, but they also shared similarities with other Islamic jurists, particularly Imam Malik and Imam Ahmad ibn Hanbal. Shafi'i's approach to Waqf was shaped by his foundational principles of Islamic jurisprudence, which emphasized the importance of textual evidence (from the Qur'an and Hadith) and the consensus (Ijma) of the Muslim community. Imam Shafi'i's perspective on waqf includes stating that waqf has inalienability and permanence, specificity of the purpose and flexibility in some cases **(Collins, 1987)**. As well as other scholars, Imam Shafi'i emphasized the importance of preserving the Waqf as a permanent dedication for a charitable cause **(Laluddin *et al*., 2021)**. Imam Shafi'i agreed that once an asset is designated as Waqf, it cannot be sold, gifted, or inherited **(Kahf, 2003)**. The property must remain intact for the purpose to which it was dedicated, ensuring its long-term utility for religious, social, or charitable purposes **(Bharti, 2023)**. Imam Shafi'i also emphasized that the specific purpose of the Waqf must be clear and adhered to **(Purwanto *et al*., 2016)**. This perspective aligns closely with the views of Imam Malik and Imam Ahmad ibn Hanbal, who also advocated for the strict preservation of the original intent of the Waqf. While Imam Shafi'i emphasized the adherence to the original purpose, he did allow some flexibility in certain situations, especially where it might be needed to preserve the Waqf's utility **(Laluddin *et al*., 2021)**. For instance, Imam Shafi'i accepted that if the original purpose of the Waqf could no longer be fulfilled due to changing circumstances (such as a mosque no longer being needed in a region), the Waqf could potentially be redirected to another beneficial purpose within the same community **(Vygovskyy & Pavliuk, 2024)**. This flexibility in interpretation made Imam Shafi'i's stance somewhat more adaptable compared to that of Imam Malik, who was stricter about maintaining the original intent **(Kamali, 1998)**. Table (1) presents a summary of the similarities and differences in the views of the four great Islamic scholars, Imam Abu Hanifa, Imam Malik, Imam Shafi'i, and Imam Ahmad ibn Hanbal, regarding the concept of Waqf (endowment).

Table 1. A summary of the similarities and differences regarding the concept of Waqf (endowment) in the views of the four great Islamic scholars

Similirities	Summary of Similirities	Differences	Summary of Differences
Inalienability of the Property	All four scholars agree that once an asset is designated as Waqf, it becomes inalienable. This means the property cannot be sold, gifted, or inherited by anyone. It is dedicated permanently to the charitable or religious cause for which it was intended.	Flexibility in Changing the Purpose of the Waqf	Abu Hanifa is the most flexible, allowing for changes if the original purpose becomes irrelevant; Imam Malik and Ahmad are strict, while Imam Shafi'i allows limited flexibility under special circumstances.
Preservation of the Original Purpose	All the scholars agree that the primary purpose of the Waqf must be preserved. The property is meant to serve a specific charitable, religious, or educational	Use of Waqf Income	Abu Hanifa is more lenient, permitting income to be used for other purposes; Malik and Ahmad are strict, with a focus on the original purpose, while

	cause (e.g., supporting mosques, schools, hospitals). Once established, the Waqf should continue to fulfill that purpose as long as possible.		Shafi'i has a middle ground.
Sustainability for the Community	All the scholars recognize the role of Waqf as a means of sustainable support for community welfare. Waqf ensures that essential services continue without relying on external donations or continuous fundraising.	Role of the Waqf Administrator	All scholars agree on the importance of competent administration, but Abu Hanifa is most open to replacing an administrator if necessary, while others emphasize continuity unless there is a clear need for change.

Table (1) shows that, while all four scholars agree on the foundational principle of inalienability of Waqf property and its preservation for charitable purposes, their interpretations diverge mainly on the flexibility of its use and changes to its purpose. Imam Abu Hanifa is the most flexible and pragmatic, while Imam Malik and Imam Ahmad are stricter in maintaining the original intent. Imam Shafi'i strikes a middle ground, offering some flexibility when circumstances demand it.

1.3. Waqf in Indonesia

In the Indonesian context, waqf is regulated by Law No. 41 of 2004 and Government Regulation No. 42 of 2006. These laws provide the legal framework for the management and use of waqf in Indonesia, which has become an important instrument for social and economic development in the country **(Mahipal *et al*., 2024)**. Table (2) below shows the substantial contents of Law No. 41/2004 which defines waqf, objectives, benefits and types of assets in waqf, while PP No. 42/2006 regulates waqf management, waqf certification and waqf registration.

Table 2. A substantial content of Law No. 41 of 2004 on Waqf and Government Regulation No. 42 of 2006

Laws	Substantional Content	Note of Substantional Content
Law No. 41 of 2004 on Waqf	General	This law defines waqf as the act of transferring ownership of assets (such as land or property) to benefit public interests, with the aim of supporting religious, social, and educational activities, in line with Islamic principles. It also establishes the conditions for the validity of waqf, specifying that the asset should be used for purposes that align with Sharia law, and that the property should be durable and not consumable.
	Purpose	The core intention behind waqf is to serve public interest, especially in areas such as religious worship, education, health, and poverty alleviation.
	Beneficiaries	The beneficiaries of waqf are typically the broader community, though specific organizations (like mosques or schools) are often direct recipients.

Laws	Substantional Content	Note of Substantional Content
Government Regulation No. 42 of 2006	Asset Type	The law allows for waqf to be in the form of land, buildings, or other property that has lasting value and can generate sustainable benefits.
	General	This regulation provides more specific guidelines regarding the management and utilization of waqf assets. It emphasizes the roles and responsibilities of institutions involved in waqf, such as the National Waqf Board (BWI), which is tasked with ensuring that waqf is managed effectively and in line with legal and Sharia requirements.
	Waqf Management	The regulation outlines how waqf assets should be administered, maintained, and potentially developed to maximize their social and economic benefits.
	Waqf Certification and Registration	The regulation also mandates the certification and registration of waqf assets to ensure transparency and legal protection for both donors and beneficiaries.

As illustrated in Table (2), waqf in Indonesia defined as the act of transferring ownership of assets (such as land or property) to benefit public interests, with the aim of supporting religious, social, and educational activities, in line with Islamic principles. There are several key features of waqf in Indonesia which include long-term benefits, sharia compliance and the role of the national waqf board (BWI). In addition, there are several types of waqf in Indonesia, including waqf 'ain (permanent waqf), waqf mali (endowment waqf), and waqf for social and public welfare **(DPW DJBMI, 2008)**. Some of the impacts and potentials of Waqf in Indonesia include economic development and religious and social welfare. Table (3) below presents the key features of waqf, types of waqf, and the impact and potential of waqf in Indonesia.

Table 3. The key features, types, impact and potential of waqf in Indonesia

Component	Substantional Content	Note of Substantional Content
Key Features of Waqf	Long-Term Benefit	Waqf is intended to create long-term, sustainable benefits. The assets donated for waqf cannot be sold or transferred, and the income generated from waqf property (such as rental income from waqf land) must be used for charitable or religious purposes.
	Sharia Compliance	All waqf activities must comply with Sharia law. This means that the purpose and management of waqf assets should align with Islamic principles, ensuring that the end-use is beneficial to society and religious life.
	Role of the National Waqf Board (BWI)	The BWI is responsible for overseeing the development, management, and promotion of waqf in Indonesia. It ensures that waqf practices align with legal and religious guidelines.
Types of Waqf	Waqf 'Ain (Permanent Waqf)	This type of waqf involves the donation of an asset, such as land or property, that cannot be used up or consumed.
	Waqf Mali (Endowment Waqf)	In this case, money or assets are donated to generate income for long-term community benefit.
	Waqf for Social	This is a broader category that encompasses various forms of

Component	Substantional Content	Note of Substantional Content
	and Public Welfare	charitable waqf for public interest purposes, such as hospitals, schools, and infrastructure projects.
Impact and Potential of Waqf	Potential of Waqf	Waqf in Indonesia holds great potential as a tool for addressing social and economic challenges, such as poverty alleviation, access to education, and healthcare. By unlocking the value of underutilized or nonproductive assets, waqf can help create a more equitable society and foster long-term sustainability in various sectors.
	Impact of Waqf for Economic Development	Waqf assets, when managed properly, can generate income for development projects. In recent years, Indonesia has seen initiatives aimed at improving waqf asset management, including the development of cash waqf and productive waqf schemes that focus on generating economic activity.
	Impact of Waqf for Religious and Social Welfare	Many waqf assets are dedicated to religious purposes, such as funding mosques, religious schools (madrasahs), and Islamic scholarships. It strengthens religious institutions, enhances access to education, supports poverty alleviation, fosters social cohesion, and promotes Islamic values of charity and justice. By ensuring that religious and social welfare needs are met sustainably and ethically, waqf plays a pivotal role in building a more inclusive, cohesive, and equitable society.

As illustrated in Table (3), waqf in Indonesia is a powerful tool for both social welfare and economic development, and it is governed by a robust legal framework aimed at ensuring that these assets are used for the public good in accordance with Islamic principles.

2. Coastal and marine ecosystem services and their urgency for sustainable development

2.1. Coastal and marine ecosystem services

Ecosystem services are crucial for human well-being and economic activities, as they provide essential benefits that support life, health, and culture **(Wahyudin *et al*., 2016, 2018, 2022; Wahyudin & Mahipal, 2020; Arkham *et al*., 2024)**. Ecosystem services are broadly defined as the benefits people obtain from ecosystems **(Costanza *et al*., 1997, 2014; de Groot *et al*., 2002, 2012; Wahyudin, 2020, 2024)**. These benefits can be tangible (like food and water) or intangible (like recreational opportunities or spiritual enrichment) **(Adrianto *et al*., 2004)**. The importance of ecosystem services lies in their role in supporting life, economic activities, and cultural practices **(Barbier & Strand, 1998; Wahyudin, 2019)**. These services can be divided into different categories, including provisioning, regulating, cultural, and supporting services, as the function of ecosystem **(Costanza *et al*., 1997, 2014; de Groot *et al*., 2002, 2012; Wahyudin, 2020, 2024)**.

Coastal and marine ecosystems, such as mangrove, seagrass, and coral reefs, offer a vast array of services that are indispensable for human survival and well-being

(Wahyudin *et al*., 2016, 2018, 2022; Wahyudin & Mahipal, 2020; Arkham *et al*., 2024). These coastal and marine ecosystems not only provide material goods like food and other raw material but also regulate climate, support cultural traditions, and maintain the very processes that sustain life on Earth **(Costanza *et al*., 1997, 2014; de Groot *et al*., 2002, 2012; Wahyudin, 2020, 2024)**. Understanding and valuing these coastal and marine ecosystem services is essential for the sustainable management of coastal and marine environments, ensuring that future generations can continue to benefit from their rich natural capital **(Adrianto *et al*., 2004; Wahyudin, 2019)**.

Coastal and marine ecosystem services are typically divided into four main categories, such as (i) provisioning/production services, (ii) regulating, (iii) cultural/information services, and (iv) supporting/habitat services **(Costanza *et al*., 1997, 2014; de Groot *et al*., 2002, 2012; Wahyudin, 2020, 2024)**. Each category plays a unique role in the functioning of coastal and marine ecosystems. The function of provisioning/production services is the tangible benefits that humans derive directly from coastal and marine ecosystems, such as food, timber, medicinal plants, and raw materials **(Costanza *et al*., 1997; de Groot *et al*., 2002)**. The function of regulating services help regulate environmental processes, such as climate regulation (e.g., carbon sequestration), flood control, water purification, and disease regulation **(Costanza *et al*., 1997; de Groot *et al*., 2002)**. The function of cultural/information services relate to the non-material benefits that ecosystems provide, including recreational opportunities, aesthetic enjoyment, spiritual enrichment, and cultural heritage **(Costanza *et al*., 1997; de Groot *et al*., 2002)**. Moreover, the function of supporting/habitat services are the fundamental processes that support all other ecosystem services, such as nutrient cycling, soil formation, and primary production **(Costanza *et al*., 1997; de Groot *et al*., 2002)**.

The pioneering work of **Costanza *et al*. (1997)** provided a way to quantify and value these services in economic terms. **Costanza *et al*. (1997)** estimated the total value of global ecosystem services, highlighting the staggering economic value of nature that was often overlooked in traditional economic accounting. This effort brought attention to the essential role that ecosystems play in human economies and quality of life. The work of **de Groot *et al*. (2002)** further refined the understanding and categorization of ecosystem services, making it easier to assess, manage, and preserve natural resources. By classifying services into distinct categories, their framework enabled better decision-making regarding land use, conservation, and policy development, emphasizing the need for sustainable management of natural resources. Together, these foundational studies, **Costanza *et al*. (1997)** and **de Groot *et al*. (2002)** have helped build a more comprehensive and inclusive approach to managing ecosystems, one that recognizes the value of both tangible and intangible benefits provided by nature.

Indonesia, the world's largest archipelago **(Mahipal, 2010)**, is recognized for its unparalleled marine biodiversity, particularly as the center of the Coral Triangle **(Asaad *et al*., 2018)**. As the nation holds the richest marine ecosystems globally, it plays a vital

role in sustaining the global ecological balance **(Mahipal, 2018; Wahyudin *et al*., 2019)**. To protect this natural wealth, Indonesia has initiated various conservation efforts, including the establishment of marine protected areas (MPAs) that safeguard crucial ecosystems such as mangroves, seagrasses, and coral reefs **(Lesmana & Wahyudin, 2016; Wahyudin *et al*., 2018)**. These areas not only contribute to preserving biodiversity but also offer essential ecosystem services that enhance human well-being **(Costanza *et al*., 1997, 2014; de Groot *et al*., 2002, 2012; Wahyudin *et al*., 2016, 2018, 2022; Wahyudin & Mahipal, 2020; Arkham *et al*., 2024)**.

The Coral Reef Restoration Management Program (COREMAP), launched in the 1990s, is a key initiative that focused on conserving coral reef ecosystems. However, the financial challenges of managing MPAs have led to debates about their economic sustainability **(Wahyudin *et al*., 2018)**. Despite these concerns, marine protected areas hold immense value due to the ecosystem services they provide, which are critical for local coastal and island communities **(Lesmana & Wahyudin, 2016; Paulangan *et al*., 2018; Wahyudin *et al*., 2019)**.

Costanza *et al*. (1997) stated that ecosystem services are those provided by ecosystems and natural capital stocks that produce goods and services essential to the functioning of life support systems on Earth. Ecosystem services contribute directly and indirectly to human well-being and are therefore part of the global economic value **(Costanza *et al*., 1997; de Groot *et al*., 2002)**. These services, including climate regulation, waste management, and nutrient cycling, are valued at trillions of dollars annually, with marine and coastal systems contributing 63% of this global value **(Costanza *et al*., 1997)**. For the biosphere, the world's wealth based on the value of services, most of which are outside of markets, is estimated to be between $16 and $54 trillion per year, with an average of $33 trillion per year **(Costanza *et al*., 1997)**.

Costanza *et al*. (1997) postulated that the value of ecosystem services is primarily determined using non-market approaches. Gas management services are estimated to be worth $1.3 trillion per year, disturbance/stress management services are estimated to be worth $1.8 trillion per year, waste management services are estimated to be worth $2.3 trillion per year, and nutrient cycling services are estimated to be worth $1.7 trillion per year. Of these valuable services, 63% come from marine and coastal systems, with marine systems contributing $20.9 trillion in economic value per year and coastal systems contributing $10.6 trillion per year. The remaining 38% comes from terrestrial systems, notably forests, which have an estimated value of $4.7 trillion per year, and wetlands, which have an estimated value of $4.9 trillion per year **(Costanza *et al*., 1997)**.

In Indonesia, coastal and marine ecosystems and their ecosystem services are the main benefits of the existence of protected areas in the world **(Wahyudin, 2024)**. Law No. 32 of 2009 on Environmental Protection and Management defines nature conservation as the management of natural resources to ensure their wise use and continued use while maintaining and improving their value and quality of diversity. Thus,

marine protected areas can be defined as the management of aquatic resources to ensure their wise use and continued use while maintaining and improving their value and quality of diversity **(Paulangan *et al*., 2019)**. Each coastal and marine ecosystem has important functions and benefits and can provide goods and services that contribute to the well-being of coastal and small island communities **(Costanza *et al*., 1997, 2014; de Groot *et al*., 2002, 2012; Wahyudin *et al*., 2019, 2023)**. Each of these coastal and marine ecosystems has high economic value **(Wahyudin *et al*., 2019, 2023)**, thus if a marine protected area contains these three ecosystems, it becomes a valuable natural resource **(Wahyudin *et al*., 2019)**. The value of this asset is certainly worth preserving so that it can continue to provide the greatest possible well-being to communities, especially coastal communities and the small islands around them **(Wahyudin *et al*., 2023)**.

Based on data from the Indonesia Land Cover Recalculation Report 2014-2018 published by the Ministry of Environment and Forestry (2018), Indonesia's forest ecosystems are rich in biodiversity, covering an area of 120,385,700 hectares in 2018. This area decreased by 384,600 hectares (0.32 percent) compared to 2014 (120,773,000 hectares) **(Wahyudin *et al*., 2019)**. Meanwhile, for coastal and marine ecosystems, the area of each ecosystem was recorded based on data from the book "Indonesia Coastal Marine Resource Statistics" published by the Ministry of Marine Affairs and Fisheries in 2016 **(Wahyudin *et al*., 2019)**, Indonesia has 3,668,345.60 hectares of mangrove forests, 474,920.93 hectares of seagrass beds, and 2,424,721.23 hectares of coral reefs.

According to **Costanza *et al*. (2014)**, the annual value of mangroves is estimated at $193,843 per hectare, seagrass beds at $28,916 per hectare, and coral reefs at $352,249 per hectare. When combined (tropical forests, mangroves, seagrass meadows, and coral reef ecosystems) using the Benefit Transfer Method (BTM) approach, these ecosystems contribute to an estimated $2.23 trillion annually in ecosystem service value for Indonesia **(Constanza *et al*., 1997; de Groot *et al*., 2002; Adrianto *et al*., 2012)**. Given the extraordinary value of Indonesia’s biodiversity, it is imperative for the nation to strengthen efforts in conserving its coastal and marine resources **(Mahipal & Wahyudin, 2011)**. Proactive, integrated, and sustainable management of these ecosystems will ensure that they continue to provide environmental, social, and economic benefits, ultimately supporting the well-being of the nation’s people **(Wahyudin & Mahipal, 2013)**.

2.2. The urgency of coastal and marine ecosystem services for sustainable development and its SDGs

Coastal and marine ecosystems are fundamental for maintaining global biodiversity, ensuring food security, and supporting economic growth **(Pauly *et al*., 2005)**. However, these ecosystems are increasingly under threat from a range of human-induced pressures, including overexploitation, pollution, climate change, and habitat destruction **(Crain *et al*., 2009)**. The urgency for an immediate and comprehensive action to conserve and sustainably manage these resources is critical for preserving their ability to continue providing essential services **(Arkham *et al*., 2019; Yonvitner *et al*., 2021)**.

Coastal and marine ecosystem, such as mangrove, seagrass and coral reefs ecosystems, face several significant threats, including overfishing, plastic pollution, coastal development, and the impacts of climate change such as ocean acidification and rising sea levels **(Wahyudin *et al*., 2019a, 2019b)**. These threats undermine the integrity of marine biodiversity and the ability of marine ecosystems to perform essential services such as carbon sequestration and food provision **(Roberts *et al*., 2017)**. Establishing and managing MPAs is an effective strategy to conserve marine biodiversity, restore degraded ecosystems, and support sustainable resource use **(Grorud-Colvert *et al*., 2021)**. However, effective governance, adequate funding, and proper enforcement are necessary to ensure that these protected areas are successful in conserving marine resources and maintaining ecosystem services **(Lookwood, 2010)**. While the economic costs of establishing and managing MPAs can be significant, the long-term benefits of preserving ecosystem services far outweigh these costs **(Davis *et al*., 2019)**. These benefits include enhanced biodiversity, improved fisheries, resilience to climate change, and the potential for sustainable marine tourism **(Wahyudin *et al*., 2018)**. Immediate action is crucial to prevent further degradation and loss of valuable marine ecosystems **(Roberts *et al*., 2017)**.

Coastal and marine ecosystems play a pivotal role in the achievement of several Sustainable Development Goals (SDGs), serving as a cornerstone for environmental health, economic development, and social well-being **(Bhatnagar & Kumar, 2024)**. The services provided by these ecosystems directly contribute to the success of multiple SDGs. The conservation of marine ecosystems is at the core of SDG 14, which aims to conserve and sustainably use the oceans, seas, and marine resources **(Neumann *et al*., 2017)**. Healthy marine ecosystems support biodiversity, provide food, and are crucial for the well-being of millions of people worldwide **(Wahyudin, 2013; Wahyudin, 2016; Wahyudin *et al*., 2016, 2019c)**. Marine ecosystems, such as mangroves, seagrasses, and salt marshes, are key players in climate change mitigation through their ability to sequester carbon (blue carbon) **(Wahyudin, 2017)**. Their conservation and restoration are vital for reducing greenhouse gas concentrations and combating climate change **(Wahyudin, 2024)**. The health of coastal and marine ecosystems supports a range of industries, including fisheries, tourism, and shipping, which provide jobs and contribute to economic growth **(Wahyudin & Lesmana, 2016; Lesmana & Wahyudin, 2016)**. Sustainable management of marine resources ensures the continued availability of these economic opportunities, supporting livelihoods and fostering inclusive growth **(Suharyanto *et al*., 2024; Wahyudin & Mahipal, 2024a)**. Sustainable management of marine resources is essential for ensuring food security, especially for coastal communities that rely on marine resources for their daily sustenance **(Kusumastanto & Wahyudin, 2012)**. Fisheries and aquaculture are critical sources of protein for millions of people, and their sustainable management ensures the long-term availability of these vital food sources **(Wahyudin & Mahipal, 2024b)**. The connection between coastal and

marine ecosystems and the achievement of these SDGs highlights the importance of adopting integrated and sustainable management practices that balance ecological, social, and economic goals **(Raman *et al*., 2024)**.

Indonesia holds a strategic position in global marine conservation due to its location within the Coral Triangle, one of the most biodiverse marine regions in the world **(Mahipal, 2010)**. As the largest archipelagic nation, Indonesia's coastal and marine ecosystems are of global significance, and its actions are crucial to preserving biodiversity and supporting the health of the world's oceans. Indonesia is home to some of the most diverse marine ecosystems globally, with an extraordinary variety of corals, fish, and other marine species. The conservation of Indonesia's marine ecosystems is not only vital for national environmental health but also for global biodiversity preservation **(Wahyudin *et al*., 2019)**. Indonesia's rich marine biodiversity provides essential ecosystem services such as food, climate regulation, and tourism opportunities that support local and global economies **(Suharyanto *et al*., 2024)**. Initiatives such as the COREMAP (Coral Reef Rehabilitation and Management Program) demonstrate Indonesia's commitment to marine conservation. These programs focus on restoring coral reefs, improving resource management, and building local community capacity **(Paulangan *et al*., 2019)**. However, Indonesia faces significant challenges in terms of funding, governance, and aligning conservation with socio-economic development needs. Integrated, sustainable approaches to marine management are necessary to ensure the success of these efforts **(Wahyudin *et al*., 2018)**. As a leading nation in the Coral Triangle, Indonesia has a global responsibility to protect and sustainably manage its marine resources, the nation's engagement in regional and international marine conservation efforts is crucial for the health of the entire marine ecosystem. Indonesia's proactive participation in global conservation initiatives is essential to achieve the broader objectives of the SDGs and ensure the sustainability of marine biodiversity for future generations **(Mahipal, 2010; Wahyudin & Lesmana, 2016)**. Effective marine conservation and sustainable resource management in Indonesia and beyond require integrated approaches that consider ecological, social, and economic factors **(Paulangan *et al*., 2019)**. Policies and strategies must align with global conservation goals, such as those outlined in the SDGs, to ensure that the benefits of healthy marine ecosystems are equitably distributed and preserved for future generations **(Pauly *et al*., 2016)**. This includes strengthening governance, increasing funding for conservation programs, and fostering collaboration between governments, local communities, and international organizations **(Wahyudin & Mahipal, 2013; Nugroho *et al*., 2019)**.

The urgency of conserving and sustainably managing coastal and marine ecosystems cannot be overstated **(Lesmana & Wahyudin, 2016)**. These ecosystems provide invaluable services that are directly linked to the achievement of several SDGs, from climate action to food security and economic growth **(Roberts *et al*., 2017)**. Indonesia's critical role in global marine conservation underscores the need for integrated

and sustainable resource management strategies, both at the national and global levels **(Mahipal & Wahyudin, 2011; Mahipal, 2018)**. By prioritizing the protection of marine ecosystems and aligning conservation efforts with the SDGs, we can ensure that these resources continue to support biodiversity, human well-being, and sustainable development for generations to come **(Mahomed & Saba, 2024)**.

3. Designing the waqf model for coastal and marine conservation

Designing a waqf model for coastal and marine conservation presents a powerful opportunity to simultaneously address environmental degradation and improve the welfare of coastal and island communities **(Masud & Masud, 2019)**. By integrating waqf principles into coastal resource management, creating mechanisms for effective management, and proposing a sustainable funding model, it is possible to develop a collaborative approach that regenerates ecosystems while generating long-term economic benefits **(Mahomed & Saba, 2024)**. This model offers a viable solution to the challenges faced by coastal and marine ecosystems, ultimately leading to a sustainable future for both the environment and the communities that depend on it.

3.1. Integrating Waqf principles to coastal ecosystem management

The concept of productive waqf can play a crucial role in addressing the challenges facing coastal and marine ecosystems **(Mahipal *et al.*, 2024)**. Traditionally, waqf involves the endowment of property or assets for charitable purposes, and its productive model has been extended to various sectors, including agriculture, industry, commerce, and services **(Wahyudin, 2016)**. A productive waqf refers to properties that are utilized for productive purposes, where the returns are generated not directly from the object but from the development of the property **(Hasan & Sari, 2021)**. This model can be effectively adapted for coastal ecosystem management, where the endowment is directed toward environmental restoration and sustainable resource use.

Incorporating waqf principles into coastal ecosystem management involves using community-owned or managed waqf funds to finance and sustain coastal conservation projects, such as mangrove reforestation, seagrass restoration, and coral reef rehabilitation **(Majid *et al.*, 2024)**. These models, which focus on restoring vital coastal ecosystems (mangrove, seagrass, coral reefs), align with the goal of generating ecological, social, and economic benefits over time, consistent with the productive waqf model.

Several activities related with the innovative action in collaborative rehabilitation have been done in Indonesia. These activities named OTAM (mangrove foster parent), OTAL (seagrass foster parent), and OTAK (coral foster parent) programs could illustrate the potential of waqf for coastal and marine restoration **(Wahyudin *et al.*, 2023)**. These programs allow the broader community to invest in and manage coastal ecosystems, and they emphasize community ownership and participation in the restoration process

(Wahyudin *et al*., 2017; Wahyudin *et al*., 2023). By integrating these programs with the waqf model, the community can collectively take responsibility for the long-term preservation of the coastal environment, while benefiting from its productive value.

3.2. Achieving environmental sustainability and improving human welfare

The ultimate goal of adopting the waqf model for coastal and marine conservation is to achieve environmental sustainability while simultaneously improving human welfare **(Wahyudin *et al*., 2017)**. Coastal and marine ecosystems are essential not only for biodiversity but also for the livelihoods of coastal and small island communities **(Paulangan *et al*., 2019)**. Mangroves, seagrasses, and coral reefs provide critical ecological services, including coastal protection, carbon sequestration, fish habitat, and water purification **(Costanza *et al*., 1997; de Groot *et al*., 2002)**. Therefore, the restoration and sustainable management of these ecosystems can contribute directly to the well-being of local communities by improving food security, health, and income **(Wahyudin *et al*., 2018)**.

As referenced in the Quranic Surah Ar-Rum verse 41, environmental degradation caused by human actions, both on land and at sea, has lasting consequences. Repairing the damage to coastal ecosystems through productive waqf can help restore the balance of nature and mitigate further degradation, ensuring the continued provision of ecosystem services **(Roberts *et al*., 2017)**. Moreover, restored ecosystems can act as economic assets, with substantial financial returns generated from activities like sustainable fishing, ecotourism, and carbon trading **(Wahyudin *et al*., 2018; Suharyanto *et al*., 2024)**. By using waqf funds to support these activities, communities can benefit from a sustainable source of income while also fostering a deeper sense of environmental stewardship. Over time, this approach contributes to both environmental recovery and economic resilience for coastal and island populations.

3.3. Including mechanisms for effective coastal and marine resource management

For the waqf model to be successful, it is essential to have mechanisms in place that ensure effective management of coastal and marine resources. This involves creating robust governance structures, clear management plans, and appropriate monitoring systems **(Mahipal, 2011)**. Given the complexity of coastal and marine ecosystems, restoration projects like mangrove planting, seagrass restoration, and coral reef rehabilitation require expertise and long-term commitment.

The management of waqf-funded projects must be transparent, with clear delineation of responsibilities among stakeholders **(Mahipal, 2011)**. Local communities, government agencies, and conservation organizations must collaborate to implement projects that are both ecologically sound and economically viable. Additionally, competent community leaders and project managers must be trained to carry out restoration activities, monitor ecosystem health, and ensure the sustainability of these

projects. For example, restoring a mangrove ecosystem requires a comprehensive approach, including the planting of 10,000 mangrove trees per hectare, careful monitoring of growth, and regular maintenance of the ecosystem **(Sinambela *et al.*, 2022)**. Such projects also need to be scaled up and integrated into the broader ecosystem management strategies to maximize the impact on both the environment and the community. Fig. (2) below shows the mind-mapping for effective waqf mechanisms for coastal and marine resource rehabilitation and management.

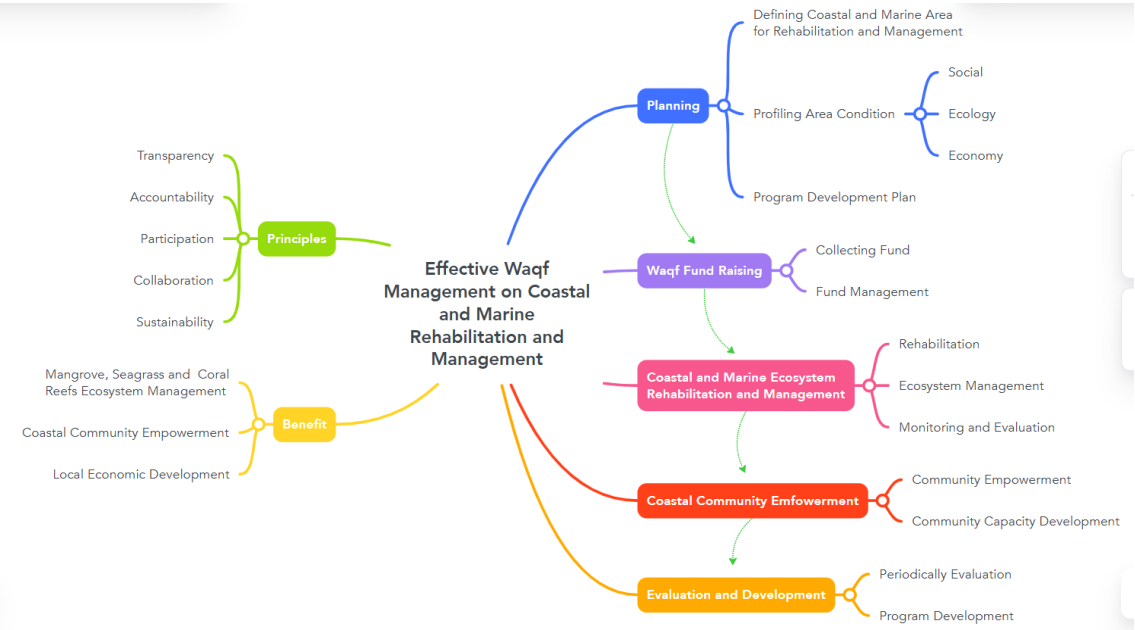

Fig. 2. Mind-mapping for effective waqf mechanisms for coastal and marine resource rehabilitation and management

Fig. (2) shows that effective waqf management for coastal and marine rehabilitation and management is carried out with the aim of (i) sustainably rehabilitating and managing mangrove, seagrass, and coral reef ecosystem, (ii) involving and empowering local communities to manage mangrove, seagrass, and coral reef ecosystem, and (iii) increasing local economic development efforts through sustainable management of mangrove, seagrass, and coral reef ecosystems. This program is implemented based on five principles, namely transparency, accountability, participation, collaboration, and sustainability. Fig. (2) also shows that this effective management can be carried out by following several adaptive steps starting from planning, rehabilitation and management, community empowerment, to evaluation and development. All of which lead to the interests of public welfare as a whole.

3.4. Proposing a funding model leveraging waqf resources to support conservation and empowering coastal and small island communities

A sustainable and innovative funding model is necessary to support coastal and marine conservation through the waqf system **(Thaker *et al.*, 2022)**. One of the main advantages of waqf is its ability to generate long-term funding through community

collaboration **(Maulidizen, 2024)**. In the context of coastal ecosystem restoration, the waqf model can be structured in various ways, such as cash waqf, land waqf, or a share-based model that empowers local communities.

In this model, cash waqf can be used to fund initial restoration activities, while land waqf, in the form of coastal land or marine areas, can be allocated for conservation. The returns generated from these projects can be reinvested into the restoration efforts, creating a cycle of growth and regeneration for the ecosystems. Additionally, this funding model could be designed around a sharing model, where profits derived from the restored ecosystems, through activities like sustainable fishing, ecotourism, or carbon credits, are shared with the communities involved in the conservation efforts.

For instance, in the case of mangrove restoration, an initial capital cost of IDR 600 million per hectare is needed for planting, monitoring, and maintaining the ecosystem. However, after five years, the benefits from the restored mangroves can be significant, including improved fisheries, coastal protection, and increased tourism revenue **(Costanza *et al*., 1997, 2014)**. By leveraging waqf resources in this way, the funding model not only supports the conservation efforts but also empowers coastal communities, enabling them to reap the long-term benefits of a healthier and more sustainable environment.

The OTAM, OTAL, and OTAK programs in areas like Karawang (PHE ONWJ) and Bintan demonstrate how such a model can be applied in practice **(Wahyudin *et al*., 2017, 2018, 2023)**. These programs involve community participation and collaborative management, ensuring that the benefits of ecosystem restoration are equitably distributed among local populations. In the OTAM, OTAL and OTAK programs, the wider community can become foster parents of coastal and marine ecosystems by purchasing and handing over their management to a community in accordance with the activities and management they carry out. OTAM has currently been developed in Karawang by PHE ONWJ, a subsidiary of Pertamina Oil Company, as an inseparable part of the implementation of CSR in the company. Management is carried out by the Sedari Village community involving various stakeholders. Currently, the coastal area in Sedari Village has been overgrown with mangrove ecosystems and is able to provide ecological, social and economic benefits felt by the local community **(Wahyudin *et al*., 2017)**. This coastal and marine resource conservation-based waqf financing model can be communal and collaborative, as cash waqf or other waqf designed as a "share" or communal ownership model. This coastal and marine resource conservation-based waqf model can at least be carried out, as shown in Table (4).

Table 4. Waqf funding model based on coastal and marine resource conservation

Component	Coastal and Marine Ecosystem			Unit
	Mangrove	**Seagrass**	**Coral Reefs**	
Type of	Trees	Trees	Media/Module	Unit

Goods/Objects				
Value of Waqf	60,000	50,000	1,000,000	- Mangrove: IDR/unit tree - Seagrass: IDR/package - Coral Reefs: IDR/module
Alternative Management	Community	Community	Community	Groups

Table (4) presents a Waqf (endowment) funding model focused on the conservation of coastal and marine ecosystems, specifically for mangroves, seagrasses, and coral reefs. The components of this model are outlined with the corresponding values and management structures. Table (4) shows the type of goods/objects of waqf consist of mangrove trees are the primary objects for conservation, seagrass is represented in the form of packages, likely referring to restoration or conservation efforts that focus on planting or protecting seagrass beds, and coral reefs are represented by modules, which likely refers to coral restoration or conservation units, such as coral planting kits or artificial reef modules. The value of Waqf offered is IDR 60,000 per mangrove tree. This is how much of a funding value needed to sustain the preservation and restoration of mangroves. Moreover, IDR 50,000 per package of seagrass, signifies the investment needed to fund the project, as well as IDR 1,000,000 per module of coral reef restoration. This highlights the higher cost of managing and conserving coral reef ecosystems due to their complexity and the technologies involved. Meanwhile, community groups would be the best alternative responsible institution for rehabilitating and managing the coastal and marine ecosystem and conservation. Each of these components shown in Table (4) aligns with the principle of Waqf, where funds are allocated for the long-term preservation of these vital ecosystems through community management. This model emphasizes the importance of collective action and funding to ensure the sustainability of coastal and marine environments for future generations.

The basis of mangrove trees is cooperative in nature as they need to be planted in a specific area and carried out simultaneously so that the activities can be achieved effectively and efficiently. The benefits of this ecosystem can be calculated quickly using the BTM (Benefit Transfer Method) approach after at least five years of reforestation. Hence, there is a need for managers with the capacity to carry out mangrove restoration. Mangroves play a major ecological role and function for biota and human life **(Muarif *et al.*, 2019; Yonvitner *et al.*, 2021; Wahyudin, 2021; Sinambela *et al.*, 2022)**. One hectare of mangrove ecosystem requires approximately 10,000 mangrove trees. This means that a capital cost of IDR 600 million per hectare is required. After five years, mangrove ecosystems can provide very different benefits, both ecological and economic. **Costanza *et al.* (1997)** stated that the minimum value of mangrove ecosystems reached $13,786 per hectare per year, which was updated to $193,843 per hectare per year in 2014 **(Costanza *et al.*, 2014)**. **De Groot *et al.* (2012)** stated that the value of mangrove

ecosystems reached $193,845 per hectare per year. **Arkham *et al*. (2023)** estimated the value of mangrove ecosystems in Bintan Island to be IDR 31,157,664.71 per hectare per year. Moreover, **Prasetiyo *et al*. (2016)** estimated the value of mangrove ecosystems in Seribu Islands at IDR 254,700.87 per square meter per year. **Adrianto *et al*. (2016)** estimated the value of mangrove ecosystems in Bontang at IDR 374,915,741.43 per hectare per year, while mangrove ecosystems in the Lombok Strait were valued at IDR 50,643,919.98 per hectare per year **(Wahyudin & Adrianto, 2012)**.

Seagrass tree spin-off is also a community effort since they need to be planted in specific areas and carried out simultaneously so that the activity can be carried out effectively and efficiently. The benefits of this ecosystem can also be calculated quickly using the BTM (Benefit Transfer Method) approach after at least two years of planting. Therefore, seagrass restoration requires competent managers to carry it out. One hectare of seagrass ecosystem requires approximately 20,000 seagrass tree points. This means that the spin-off costs about Rp 1 billion per hectare. After two years, seagrass ecosystems can provide vastly different ecological and economic benefits. **Costanza *et al*. (1997)** reported that the minimum value of a seagrass ecosystem reached $26,226 per hectare per year, which was updated to $28,916 per hectare per year in 2014 **(Costanza *et al*., 2014)**. **Wahyudin (2017)** estimated the value of Bintan Island's seagrass ecosystems at IDR 1.23 billion per hectare per year. This value comes from a fishery of about 250 to 500 million rupiah per hectare per year **(Wahyudin, 2018, 2022)**. Unlike **Adrianto *et al*. (2016)**, who estimated the value of the Bontang seagrass ecosystem at 16,263,480.86 rupiah per hectare per year.

Setting up a coral reef ecosystem requires a more extreme approach, as it requires diving skills to transplant the corals underwater. The modules must be installed on the seabed at a depth of at least 7 meters, and the corals must be transplanted into the modules in seawater and installed in specific locations that are close to the natural reef ecosystem. Activities can be performed simultaneously or in specific areas, allowing for effective and efficient activity execution. The benefits of this ecosystem can be calculated quickly using the Benefit Transfer Method (BTM) approach, at least 5-7 years after transplantation. Therefore, managers with the capacity to perform transplantation and maintenance are also required. Coral reefs play important ecological roles and functions for marine biota and human life **(Arkham *et al*., 2021)**. Approximately 10,000 transplantation module units are required for one hectare of coral reef ecosystem. This implies a capital cost of Rp 10 billion per hectare. After 5-7 years, coral reef ecosystems may provide ecological and economic benefits, but this also varies widely. **Costanza *et al*. (1997)** reported that the minimum value of a coral reef ecosystem reached $8,384 per hectare per year, which was updated to $352,249 per hectare per year in 2014 **(Costanza *et al*., 2014; de Groot *et al*., 2012)**. **Adrianto *et al*. (2016)** estimated the value of the Bontang coral reef ecosystem at IDR 92,872,745.88 per hectare per year, and the Lombok Strait coral reef ecosystem at IDR 289,445,874.70 per hectare per year **(Wahyudin and**

Adrianto, 2012). **Wahyudin and Mahipal (2020)** estimated the value of coral ecosystems in some areas affected by environmental destruction in 2017-2018 to be approximately IDR 120,000-900,000 per square meter per year.

DISCUSSION

Coastal and marine ecosystems have now been declared to be high-value natural resources and environmental assets. Several cases of environmental disputes handled by the Ministry of Environment and Forestry between 2017 to 2024 demonstrated that they need to be compensated for the loss of ecosystem services when affected by activities that cause pollution and environmental damage. Some related cases that have been resolved or closed have been published in several journal articles related to the economic value of coral reef ecosystems **(Arkham *et al*., 2020b; Wahyudin, 2020; Wahyudin & Mahipal, 2020; Wahyudin *et al*., 2022)**. What is clear is that coral reef ecosystems have important functions that support underwater life that is beneficial to humans, including those that surround them **(Gove *et al*., 2023)**. As another example, coral reef ecosystems provide habitat for lobsters as breeding, brooding, and feeding sites, and therefore their management requires special regulations, including controls on the marketing of products produced by lobsters **(Riadi *et al*., 2018, 2020)**. Therefore, if the coral reef ecosystem is damaged, there will certainly be losses that will negatively impact the reef ecologically, socially, and economically. The Minister of Environment Regulation No. 7 of 2014 on Environmental Losses Due to Pollution and/or Environmental Damage has been a reference in efforts to resolve environmental disputes **(Mahipal & Wahyudin, 2019)**. It provides a derived legal framework on how the environmental dispute resolution process can be carried out based on a scientific approach.

Waqf is a type of Infaq directly commanded by Allah SWT in the QS. Al-Baqarah verses 195, 254, and 267. It is similar to Zakat, Infaq, and Shadaqah (ZIS) mentioned in the QS. At-Tawba verse 53, QS. Yasin verse 47, QS. Al-Hadid verse 7, QS. Al-Munafiqun verse 10 and QS. At-Tagabun verse 16 **(Wahyudin, 2023)**. Waqf, like ZIS, should be given in the best way as part of the livelihood given by Allah SWT and as part of the fruits of hard work and should be taken from savings. He who spends his wealth in the way of Allah is likened to a seed that produces seven stems, with each stem having 100 seeds. Allah increases whom He wills, and Allah is All-Knowing, All-Knowing (QS. Al-Baqarah, verse 261).

The Waqf Management Model proposed here offers an innovative and sustainable approach to managing coastal and marine ecosystems, particularly by empowering local communities and establishing long-term funding mechanisms for conservation. By granting local communities and Waqf institutions the management rights over coastal and marine areas, this model emphasizes the active role of communities in both the management and restoration of these environments. This not only helps with the sustainable management of natural resources but also aligns conservation efforts with

local needs and priorities. The establishment of conservation zones within coastal and marine areas is central to the model. These zones are managed with the aim of conserving and restoring ecosystems, ensuring that these critical environments remain healthy and productive for future generations.

The model relies on the Waqf concept to provide sustainable financing for long-term environmental initiatives. Revenue generated through ecotourism, sustainable fisheries, and other eco-friendly industries will fund conservation efforts, ensuring that financial resources are available for ongoing environmental management and restoration. This model also emphasizes the socio-economic benefits that can be derived from a sustainable approach to coastal and marine resource management. By developing livelihoods based on ecotourism, sustainable fisheries, and other sustainable industries, the model not only supports environmental conservation but also generates economic opportunities for local communities. The model integrates Waqf with natural resource conservation to create a unique and effective funding mechanism. Waqf funds can support activities like ecosystem restoration, conservation area management, and community empowerment. This ensures a continuous funding stream for these initiatives and reduces dependence on short-term or external funding sources.

The integration of Waqf with conservation ensures that coastal and marine ecosystems are managed in a way that prioritizes their long-term health. By involving local communities in resource management and benefiting from sustainable industries, this model provides economic upliftment while maintaining environmental balance. Waqf provides a model for long-term, self-sustaining funding for coastal and marine conservation, ensuring that the areas are not dependent on one-time donations or fluctuating external funds. The Waqf Management Model presents an innovative and sustainable way to address the dual challenges of conserving coastal and marine ecosystems while empowering local communities. By leveraging the financial and management principles of Waqf, it offers a long-term solution to the challenges of resource depletion, community welfare, and environmental degradation.

In the context of coastal and marine resource management, there is a very strong correlation between fishery resources and their ecosystems, such as the relationship between fishery resources and seagrass ecosystems **(Wahyudin, 2017, 2018, 2023)** and the relationship between fishery resources and coral reef ecosystems **(Rachmawati *et al*., 2021; Dewantara *et al*., 2020)**. **Schaefer's (1954)** model states that there are three biotechnological and ecological parameters that affect fishery management, namely the specific growth rate of fish stocks (r), the fishing capacity coefficient of fishing gear (q), the potential of fishery resources to increase catches through fishing gear, and the carrying capacity of the aquatic environment (K) that provides ecological support for the aquatic environment to grow and reproduce well. In this context, Allah SWT's promise to increase the “infaq” (Z) given by His servants in His path is then introduced to all the biotechnological and ecological parameters developed by **Schaefer (1954)**. This is

because all three are certainly related to Allah's permission, those relating to intrinsic growth rate (r), obtaining returns from fishing effort (q), and supporting fish growth and reproduction (K), all of which are the graces and gifts of Allah SWT **(Wahyudin, 2023)**.

Several incorporations of ecosystem function into fisheries models have been developed and published, such as **Barbier and Strand (1998)**, **Cinner *et al*. (2009)** and **Wahyudin (2022, 2023)**. All three introduce the ecological influence into the carrying capacity (K) parameter, introducing that carrying capacity is a function of the quality and quantity of habitat in mangrove ecosystems **(Barbier & Strand, 1998)**, coral reef habitat function **(Cinner *et al*., 2009)** and seagrass habitat function **(Wahyudin, 2022, 2023)**. The "Zakat Infaq Shadakah" (ZIS), entrusted to the people (including fishers) to be issued, is replaced many times by the Almighty, Allah SWT, by different parameters related to the fishing system **(Wahyudin, 2023)**. A few of ecological parameters, as well as those mentioned by **Wahyudin (2023)**, influence the fishery system, these include: the intrinsic growth rate (r) which is going to increase fishes biomass, the parameter of the fishing gear coefficient (q) which affects the increase in fishing opportunities (E) and the parameter of the ecological carrying capacity (K) which affects the frequency of fish reproduction (x), and all together they affect the increasing of the catch of fish production. The ability of the ecosystem to provide spawning, breeding and feeding grounds for an increase in fish population (f(x)), the fish price parameter (p) that influences the increase in the selling price of fishery products (revenue, TR), and the parameter (c) of the cost of fishery resource extraction that affects the efficiency of the extraction cost (expense, TC) per unit of fishing effort carried out **(Wahyudin, 2023)**.

The link between coastal and marine resources indicates that a waqf based on conservation of coastal and marine resources may have a direct impact on people, especially coastal and small island communities, more specifically fisherfolk whose livelihoods are heavily dependent on exploitation of large-scale and marine resources. The quality carrying capacity of coastal and marine resources depends on it. Ultimately, the management of a waqf based on conservation of coastal and marine resources requires an independent management body and/or a management body under the auspices of inter-ministerial cooperation such as the Ministry of Environment and Forestry, Ministry of Marine Affairs, Ministry of Fisheries, Ministry of Finance, and Ministry of Religious Affairs including the Ministry of Maritime Affairs and Investment Coordination. This executive body, with all its major mandates and functions, will act as the supervisory body in implementing the management of a waqf based on conservation of coastal and marine resources. This body must be able to apply the principles of good institutional governance, including the implementation of TARIF (Transparency, Accountability, Responsibility, Independence, and Fairness) principles in its operations **(Mahipal, 2011)**.

CONCLUSION

Waqf is a legal act that voluntarily transfers the right to use goods and services from a previous owner to an individual or institution for use for a period of time as per the wishes of the previous owner for public benefit. These include coastal and marine resources present in the area and/or held in a particular area of the coastal region. Coastal and marine ecosystems, both natural and restored, can provide ecosystem services for human well-being in the form of regulating services, provisioning/production services, support/habitat services, and cultural/information services. Waqfs that are based on the conservation of coastal and marine resources can encourage Waqf donors to be vessels or vehicles for donating Waqf in the form of trees/corals/seaweeds and even suitable planting media or land for planting and renovation, ready to be channelled. This land may also be developed or promoted and/or designated as a coastal marine resource conservation area. The existence of an area or land in a coastal and marine region can benefit human welfare due to the high use value of coastal and marine ecosystems that grow and develop there. Waqfs based on conservation areas have the potential to develop into a productive and sustainable waqf model and could be an innovation in environmental financing models in future. Coastal and marine protected areas can provide a window for protecting local and waqf lands so that environmental, social and economic benefits can be optimally and sustainably utilized for the benefit of the people.

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