

**ANALYSIS OF BLUE ACCOUNTING SUSTAINABILITY IN SEAWEED  
CULTIVATION FROM ECONOMIC, SOCIAL & ENVIRONMENTAL  
PERSPECTIVES (STUDY ON: SEAWEED FARMERS IN BANGGAI REGENCY,  
CENTRAL SULAWESI)**

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**Abstract**

Seaweed farming has become one of the primary livelihoods for coastal communities in Indonesia, particularly in Tanjung Tuwis Village, Banggai Regency, Central Sulawesi. Despite its potential, the sustainability of seaweed cultivation remains challenged by economic, social, and environmental issues. This study seeks to examine the sustainability of seaweed farming practices within the framework of Blue Accounting by addressing the problem of how cultivation activities contribute to the economic welfare of farmers, social dynamics of the community, and ecological impacts on coastal resources. The research aims to provide a comprehensive understanding of seaweed farming sustainability that can guide policymakers in the fisheries sector. Using a qualitative descriptive approach, data were collected through observations, semi-structured interviews, and focus group discussions with farmers, village officials, community leaders, and representatives from the Fisheries Service of Banggai Regency. Secondary data were obtained from academic literature, reports, and supporting documents. Data validation employed triangulation of sources, techniques, and time, while thematic analysis was conducted based on the Triple Bottom Line framework, covering economic (profit), social (people), and environmental (planet) aspects. The results reveal that seaweed farming significantly contributes to household income and local economic development, enhances social cohesion and institutional participation, but also poses challenges in environmental management, particularly related to waste, cultivation impacts, and conservation awareness. Overall, the study highlights the importance of integrating economic benefits with social empowerment and ecological preservation to achieve sustainable coastal resource management.

**Keywords:** Seaweed Farming, Blue Accounting, Triple Bottom Line, Sustainability

## INTRODUCTION

Central Sulawesi is recorded as one of the main seaweed producers in Indonesia, with a total production of 645,279 tons (wet weight) in 2022. This potential is supported by vast water quality and development programs from the local government, particularly in Banggai Regency, which has positioned seaweed farming as the driving force of coastal community economic development (BPS Sulteng, 2022). Indonesia itself has enormous marine potential, as two-thirds of its territory consists of seas, with marine biodiversity reaching 27.2% of the world's total species, including 8.6% of seaweed (Lestari, 2013; Nanda et al., 2024). Globally, seaweed aquaculture has grown rapidly, with production rising from 10.6 million tons in 2000 to 35.1 million tons in 2020, of which 97% was produced in Asia. Indonesia contributes 27% of total world production, ranking second after China (Wang, 2020; FAO, 2021). The growing demand from the food, pharmaceutical, and cosmetics industries has driven this sector's rapid expansion. This shows that seaweed not only has ecological value but also high economic value and strong potential to support sustainable coastal economic resilience (Suparmi & Achmad, 2009; Michelle & Horista, 2022).

From a social perspective, seaweed farming has been proven to improve the welfare of coastal communities. Kaseng (2022) found that income from harvests can be used to finance children's education and improve household living standards. In addition, the involvement of women in the production process strengthens family and community economic empowerment. Thus, seaweed farming plays an important role not only as a source of livelihood but also as an instrument of social empowerment in coastal areas (Pesisir et al., 2024). Within the framework of sustainable development, the implementation of Blue Accounting is crucial as it integrates economic, social, and environmental aspects. This approach aligns with the principles of the Blue Economy, which emphasize the optimal use of marine resources while ensuring ecosystem preservation (Negara & Darmawan, 2021; Morgan et al., 2022). By applying Blue Accounting in seaweed farming in Banggai Regency, it is expected that a balance can be achieved between improving community income, strengthening social empowerment, and maintaining environmental sustainability, in line with the goals of the Sustainable Development Goals (SDGs) (Buana et al., 2024; Singh-Renton, 2024).

## REVIEW OF LITERATURE

The Triple Bottom Line (TBL) theory introduced by Elkington (1997) emphasizes that organizational performance is not only measured by economic aspects but also by social and environmental contributions under the principle of People, Planet, Profit. The People dimension highlights the role of organizations in improving community welfare, Planet emphasizes the obligation to preserve the environment, while Profit stresses the importance of achieving financial performance ethically and sustainably (Aulia & Kertawijaya, in Peby Selviona, 2024). Thus, these three aspects are interconnected in creating long-term sustainability. The TBL concept later developed into a performance reporting instrument that balances social, environmental, and economic aspects. From the perspective of profit, business sustainability is achieved through operational efficiency and community support (Wahyuni & Febriansyah, 2023). From the people perspective, organizations are expected to provide positive benefits for stakeholders (Heruyani et al., 2019). Meanwhile, the planet aspect emphasizes the importance of maintaining ecosystems that ultimately support the

sustainability of both business and society (Heruyani et al., 2019). Therefore, TBL serves as an integrative framework in evaluating organizational success holistically.

In line with this, the concept of Blue Accounting emerged as a response to the need for integration of economic, social, and environmental dimensions in marine resource management. Hopwood (1992) emphasized that accounting plays a role in shaping socio-economic truths, while Gray et al. (1996) added that Blue Accounting expands social accounting by highlighting maritime assets. This concept supports the Blue Economy, which promotes the utilization of marine resources for economic growth while ensuring ecosystem sustainability (Abreu & David, 2019; Ilma, 2016). Furthermore, Blue Accounting is viewed as a reporting system that enhances transparency and accountability in marine governance. It helps measure the contribution of maritime activities to the economy, identify environmental risks, and improve farmers' access to government incentives (Krestiwanda & Utami, 2024). This aligns with the framework of Sustainable Economy, which emphasizes balancing economic, social, and environmental dimensions as regulated in Law No. 32 of 2009. Within the global development agenda, the implementation of the Sustainable Development Goals (SDGs) further strengthens the urgency of integrating these three dimensions to achieve inclusive, equitable, and environmentally conscious growth (Ellina Nuril Firdaus, 2023; BPS, 2014).

## RESEARCH METHOD

This study was conducted in Tanjung Tuwis Village Km8, Banggai Regency, Central Sulawesi, which has great potential in seaweed farming while also facing challenges in sustainable coastal resource management. A descriptive qualitative approach was applied to explore in depth the practice of seaweed cultivation from economic, social, and environmental perspectives within the Blue Accounting framework. Primary data were collected through observations, semi-structured interviews, and focus group discussions (FGDs) with key informants, including seaweed farmers, village officials, neighborhood leaders, and representatives of the Fisheries Service of Banggai Regency, while secondary data consisted of academic literature, reports, and supporting documentation (Creswell, 2018). Data analysis was carried out through triangulation (sources, techniques, and time) and thematic analysis based on the Triple Bottom Line framework (Elkington, 1997), covering economic (profit), social (people), and environmental (planet) dimensions. Triangulation was used to validate information related to farmers' income, community social relations, and the ecological impacts of cultivation. Thematic analysis further categorized the data into economic themes (income, profit, production costs), social themes (well-being, institutional roles), and environmental themes (cultivation impacts, pollution, conservation awareness). Through this approach, the research is expected to provide a comprehensive understanding of seaweed farming sustainability within the Blue Accounting framework and offer strategic insights for policymakers in the marine and fisheries sector.

## RESULTS AND DISCUSSION

### General Overview of Seaweed Farmers in Banggai Regency

Seaweed farmers in Banggai Regency, particularly in Tanjung Tuwis Km8 Village, are an essential part of the coastal community whose livelihoods depend on marine aquaculture. They have direct access to fertile waters with high seaweed potential. As a

coastal area, this region is recognized as one of the seaweed production centers in Central Sulawesi, contributing significantly to both provincial and national output. Supported by favorable geographical conditions and abundant natural resources, seaweed farmers in Banggai Regency rely on this commodity as their primary source of daily income. However, the farming practices remain largely traditional, and the lack of systematic business recording or reporting to the government poses challenges for establishing sustainable and transparent management. Therefore, it is crucial to analyze the role and potential of the Blue Accounting approach as a solution to improve the effectiveness of seaweed farming management from economic, social, and environmental perspectives in a holistic manner. Seaweed farming in Banggai Regency has become one of the sustainable income sources for the local community, requiring proper management by both farmers and the local government. In in-depth interviews with seaweed farmers, it was revealed that this sector is considered a vital social safety net, especially during difficult times such as economic crises when income from other sectors declines or becomes unstable. Most seaweed farmers depend on this sector as their main source of income, which provides economic stability even in uncertain conditions. Moreover, seaweed farming activities in Banggai Regency also serve as a platform to raise collective awareness about the importance of preserving the marine environment, particularly concerning sustainable natural resource management.

The potential for capacity building among farmers is significant if accompanied by proper assistance. Farmers demonstrate openness to training and are willing to adopt innovations, especially those related to increasing income and business efficiency. With a participatory and contextual approach, the introduction of Blue Accounting in this region is not only relevant but also holds great potential to establish more transparent, inclusive, and sustainable seaweed farming governance in the future.

### **Sustainability Analysis of Blue Accounting in Seaweed Farming in Banggai Regency**

The research findings show that seaweed farmers in Banggai Regency have not yet applied Blue Accounting practices systematically, either in the form of economic recordkeeping or reporting on social and environmental aspects. In interviews with the Head of the Farmer Group (Nurdin), it was conveyed that business records such as harvest yields, production costs, and profits are not kept in writing. All farming activities are carried out manually and based on experience, without structured documentation or reporting. Farmer groups in Tanjung Tuwis Village are generally still informal and lack complete organizational structures. The group leader's role is primarily as an administrative liaison with the village government rather than as a business manager who implements recordkeeping or performance evaluations of farming activities. This weak institutional role further reinforces the reality that Blue Accounting practices are still far from implementation. Therefore, a gradual and locally tailored approach is needed to introduce this concept inclusively and adaptively.

### **Blue Accounting in the Social Perspective (People)**

Seaweed farming in Banggai Regency, particularly in Tanjung Tuwis Village, shows a significant contribution to improving the social welfare of coastal communities. The Bintang Fortuna farmer group, consisting of eight members, consistently produces an average of three tons of seaweed every month. This achievement reflects the economic potential of the seaweed farming sector as a stable and productive source of livelihood for local communities. However, the farmers reported that although the income earned is quite

good, there are still structural barriers in the form of limited attention and support from the local government. Lack of access to production facilities, training, and pro-farmer policy interventions are considered factors that hinder the optimization of farming outcomes and the sustainable improvement of farmers' welfare. As stated by Mr. Nurdin (44 years old) on March 13, 2025, at 12:05 WITA:

*"So, our Bintang Fortuna seaweed farming group in Tanjung Tuwis consists of only 8 people, but there are already other seaweed farmers outside our group. The income from seaweed is very profitable. We hope that the village apparatus and even the government can promote seaweed farming, which would motivate the community here to cultivate seaweed and help them earn more income."* [Mr. Nurdin]

*"Here, there is a lack of attention from the authorities and the government towards seaweed farming."* [Mr. Nurdin]

Although they already experience benefits, the lack of attention from the village apparatus and government becomes a barrier to realizing greater potential from this business. Farmers believe that if more support were provided, such as outreach, training, and marketing assistance, their efforts would grow further. This was confirmed in an interview with the village official, Mr. Baharu (49 years old), on March 13, 2025, at 15:40 WITA:

*"Well, how can we, as village officials, educate them if they don't even report their seaweed farming activities? At the very least, they should establish mechanisms regarding farming activities, from production to sales, as I mentioned earlier. There is a lack of communication between the village authorities and farmers. They only come to us when there is a problem."* [Mr. Baharu]

*"If only these farmers would open communication with us, the village apparatus, we could certainly forward their needs to the licensing office and even strengthen their branding. But they operate independently without approaching us officials here, and that makes them feel neglected."* [Ms. Nirma, 38 years old]

Statements from Mr. Baharu and Ms. Nirma reveal that seaweed farmers, particularly those in the Bintang Fortuna group, have limited communication with the village apparatus. This creates a communication gap, making farmers feel neglected. Farmers do not report their activities in a structured way, which makes it difficult for officials to provide necessary assistance or support. A statement from the Fisheries Department, through Mr. Rofiq (51 years old) on April 10, 2025, at 15:34 WITA, acknowledged that farmers in this area are still unfamiliar with institutional practices and lack understanding of how to report or communicate with the government. According to him:

*"The obstacle for the Fisheries Department is simply that the community is still unfamiliar with institutional matters. It goes back to the human resources of the community, which may still be at an intermediate level. However, the support provided by the Fisheries Department includes outreach and technical guidance on how to farm seaweed properly, how to select good seedlings, and even the correct planting methods, which we have already implemented."* [Mr. Rofiq]

The above statement highlights the issue of education and skills among seaweed farmers. Although there is support from the Fisheries Department in the form of training and outreach on technical aspects of seaweed farming, many farmers still do not understand the importance of institutional structures and organizing their activities more systematically. Without adequate knowledge of the importance of institutionalization and reporting, this

potential cannot be maximized. Therefore, institutional education and training on seaweed farming management need to be enhanced so farmers can better manage their production and receive optimal government support. From a social perspective, Blue Accounting emphasizes the importance of community empowerment and improving social welfare, which can be achieved through sustainable natural resource management. As expressed by Mr. Nurdin and Mr. Baharu, although seaweed farmers in Banggai Regency already feel the benefits of this sector, they complain about the lack of attention from village officials and the government. This reveals a gap in communication and management that hinders the broader potential of the business.

This situation indicates that the social aspects of farming activities have not been systematically documented and are not yet part of an information system that can be used in resource management. Blue Accounting focuses on the importance of transparent and participatory recording and reporting of social aspects to ensure fairness, inclusivity, and the sustainable capacity-building of coastal communities. Blue Accounting can provide solutions by promoting transparency and accountability in seaweed management. If farmers are involved in a more structured reporting process and receive clear support from the government, it will enhance community participation and strengthen collective resource management. With a system that records and integrates social contributions (for example, improvements in farmers' family welfare and job creation), Blue Accounting helps create a more inclusive economic model based on social intuition principles.

#### 1. Employment

Seaweed farming in Banggai Regency also creates employment opportunities for local communities, including vulnerable groups such as women. Activities such as seed planting, drying harvested seaweed, and product packaging are often carried out collaboratively by family members and neighbors. In interviews, farmers expressed pride in being able to contribute to family income, especially in supporting children's education and daily household needs. This reflects social inclusion in farming practices, where women not only play roles in the domestic sphere but also contribute directly to the family's economic sector. Within the Triple Bottom Line framework, this strengthens the societal dimension by enhancing broad community participation. Meanwhile, the Blue Accounting approach emphasizes the need for reporting non-financial social aspects, such as women's participation and the social impacts of farming activities on community welfare. However, there is still no formal recording mechanism for these informal labor contributions. Therefore, integrating social reporting into the Blue Accounting system is expected to provide a comprehensive overview of the social impacts of farming activities and serve as a foundation for inclusive, socially just, and marine-based policy-making.

#### 2. Community Social Welfare

Seaweed farming in Banggai Regency clearly contributes to improving the social welfare of coastal communities. Interviews with the head of the "Bintang Fortuna" Farmer Group, Mr. Nurdin, revealed that income from seaweed harvests not only meets daily needs but also supports children's education up to higher education levels. Some farmers have even been able to save money or improve their housing conditions. This indicates consistent improvements in the living standards of seaweed farmers. The neighborhood head (RW) and village official, Mr. Baharu, added that although there is no formal reporting system to the village government, it is evident that most farmers have experienced improvements in

welfare. He stated that the results of this farming significantly help farmers' families meet basic needs independently, without relying too heavily on external aid. In the Blue Accounting approach, this social welfare aspect needs to be recorded and reported systematically as part of non-financial performance metrics. Welfare indicators such as children's education levels, housing conditions, and access to basic needs can serve as measures of overall coastal development success. With accurate and participatory data, Blue Accounting can bridge the gap between community needs and policy-makers, enabling the design of more targeted and inclusive interventions.

### 3. Social Relations

Seaweed farming activities in Banggai Regency not only have economic impacts but also strengthen social relations at the community level. Cooperation within farmer groups, such as "Bintang Fortuna," fosters a culture of mutual aid in activities like tying ropes, maintaining seedlings, and transporting harvests. Interactions among group members reinforce social cohesion and solidarity among farmers. However, interviews with the neighborhood head and village official, Mr. Baharu, revealed that the relationship between farmer groups and the government remains weak. Farmers tend to manage their businesses independently without reporting harvests or production activities to the village office. As a result, government officials face difficulties in designing assistance programs or interventions due to the lack of accurate data. He emphasized that "*if there were reporting, the village could submit the farmers' needs, such as seedlings or production facilities, in the development planning forum (musrenbang).*"

The farmer group leader, Mr. Nurdin, also admitted that no formal reporting system exists because sales activities often go directly to middlemen or collectors. The absence of reporting is not due to rejection but rather limited administrative understanding and resources among farmers.

### **Support, Challenges, and Solutions of Blue Accounting in Seaweed Cultivation**

Blue Accounting as an accounting approach that integrates economic, social, and environmental aspects in marine resource management has great potential to be applied in seaweed farming in Banggai Regency. However, its success largely depends on actual field conditions, including local strengths that support it, challenges that remain, and strategies that can be properly designed. To understand its implementation thoroughly, it is necessary to explain the supporting factors, challenges faced by farmers, and concrete solutions that can be applied to strengthen the continuity of Blue Accounting in seaweed cultivation practices.

#### 1. Supporting Factors of Blue Accounting Sustainability in Seaweed Farming

Seaweed farming in Banggai Regency holds significant strategic value as it is the main source of income for coastal communities. This activity not only sustains household economies but also creates collective awareness of the importance of protecting marine ecosystems. Cultivation is carried out using the long-line method and involves family members, including women, in the post-harvest process. This pattern reflects strong social engagement in sustainable coastal resource management. In addition, the Fisheries Service of Banggai Regency has provided support in the form of technical assistance such as supplying nets and harvest transportation. The government has also promoted technical capacity development through training, although its coverage remains limited. These

supports provide an important initial foundation for the application of Blue Accounting principles, particularly in economic and technical management aspects.

## 2. Challenges in Implementing Blue Accounting in Seaweed Farming

Nevertheless, many challenges hinder the continuity of Blue Accounting. Most farmers still run their businesses traditionally without financial, social, and environmental recording systems. The low level of education mostly elementary or junior high school graduates affects their financial literacy, so that recordkeeping is seen as a burden rather than a management tool. As a result, farmers find it difficult to know their actual profits or losses and lack a basis to access capital or assistance. Furthermore, the absence of permanent farming areas and legal certainty becomes a major challenge. Farmers use public marine areas based on customary agreements, which makes it difficult to obtain formal business legality. Infrastructure limitations such as drying facilities and market access also cause high dependency on middlemen, with prices determined externally. This weakens farmers' bargaining power and hampers business efficiency.

## 3. Solutions and Strategies for Blue Accounting Sustainability in Seaweed Farming

To strengthen Blue Accounting, one strategy is to build a simple community-based reporting system. This system should include recording harvest results, business expenditures, social participation, and environmental management such as drying sites and waste. Reporting can start manually with farmers' group record books and later develop into digital systems. Local governments may provide incentives for groups that actively report, such as priority access to tools or training. In addition, cross-sector collaboration is crucial, involving village governments, technical agencies, academics, and private partners. Training and mentoring should also be strengthened so that farmers are skilled not only in cultivation but also in recordkeeping and reporting. With stronger institutional support and multi-stakeholder participation, Blue Accounting can be implemented in practice not only as discourse but as a transparent, accountable, and sustainable coastal management approach.

### **Synthesis of Findings**

From the economic perspective, seaweed farming contributes significantly to household income and provides local employment. However, financial records and business reports remain simple and unstructured. Three main indicators were identified:

1. The selling price of seaweed is still largely influenced by middlemen and market fluctuations, showing the need for fairer and more transparent market mechanisms.
2. Seaweed farming is proven to be the main economic source for farmers' households, but weak income records lead to inaccurate business evaluations.
3. Profits are generally stable from harvest to harvest, yet the absence of Blue Accounting-based recordkeeping prevents these profits from being fully reflected in evaluative reporting systems.

From the social perspective, seaweed farming encourages community participation, including women, in economic activities, and strengthens local social solidarity. However, challenges remain in communication with government institutions and the lack of continuous training. Indicators such as community welfare, social relations, and institutional roles reveal that:

1. Community welfare has improved along with steady income from seaweed farming, positively impacting education access and household consumption.

2. Social relations among farmers in groups demonstrate solidarity and cooperation, with cultivation serving as a social space for community interaction.
3. However, the role of local institutions, including government and village officials, remains limited in terms of training and reporting, resulting in untapped potential for aid programs.

From the environmental perspective, seaweed farming shows potential for maintaining marine ecosystem quality, though there are risks of contamination and uncontrolled space use. Findings reveal that:

1. Farming has relatively low environmental impact because the methods remain natural, but no periodic monitoring system ensures long-term sustainability.
2. While no significant pollution was found, post-harvest processing and drying practices may disturb public spaces and cleanliness.
3. In terms of spatial use, no zoning regulations for seaweed cultivation exist, creating risks of conflict with other marine sectors.

Although Blue Accounting practices have not been fully applied by seaweed farmers in Banggai Regency, awareness of the importance of recording multidimensional information economic, social, and environmental is increasing. The implementation of Blue Accounting emphasizes the need for stronger information systems and decision-making processes at both farmer and government levels. Local government support is therefore vital, including technical training, the provision of simple recordkeeping systems, and policies promoting multidimensional reporting. With collaboration among government, communities, and supporting institutions, Blue Accounting can serve as a foundation for a sustainable, fair, and data-based seaweed farming system.

## CONCLUSION

The application of Blue Accounting in seaweed cultivation in Banggai Regency highlights the importance of integrating economic, social, and environmental dimensions into a holistic and transparent management system. While seaweed farming has shown significant potential to improve farmers' livelihoods, enhance community welfare, and contribute to marine ecosystem sustainability, its current practices remain insufficiently structured. The absence of systematic reporting, limited institutional support, and inadequate collaboration between farmers and local authorities hinder the optimization of economic and ecological benefits. Nonetheless, the existing positive practices such as community participation and environmentally friendly cultivation demonstrate a strong foundation for implementing Blue Accounting to support long-term sustainability. Overall, this study indicates that advancing sustainability in seaweed farming requires institutional strengthening, capacity building, and the establishment of structured reporting systems that cover economic, social, and environmental indicators. By adopting Blue Accounting, farmers and stakeholders can improve accountability, transparency, and resource management, while governments can provide more targeted support. Cross-sector collaboration involving local government, technical agencies, academia, and private partners will be crucial to building a participatory and contextual Blue Accounting framework. Such an approach not only supports sustainable coastal development in Banggai but also offers a replicable model for other coastal regions seeking to balance economic productivity with marine ecosystem preservation.

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