# The Impact of the Seaweed Cultivation Infrastructure Provision Program on Farmers' Productivity and Income in Central Buton Regency

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A R T I C L E I N F O

A B S T R A C T

This study analyzes the impact of the seaweed cultivation infrastructure provision program on the productivity and income of farmers in Central Buton Regency. The program successfully introduces modern technologies that improve production efficiency, allowing farmers to harvest faster and produce high-quality products. The results of interviews with farmers showed that more than 60% experienced an increase in income after participating in the training, and their technical skills in seaweed cultivation improved significantly. Notwithstanding obstacles in the provision of aid and price swings, effective communication between the government and farmers is essential to ensure equitable access to infrastructure. This research emphasizes the need for sustainability of training programs, especially in marketing, to increase the competitiveness of seaweed products in local and international markets. These findings provide recommendations for improving the distribution system and increasing technical support to farmers to encourage local economic growth and the welfare of coastal communities

**INTRODUCTION**

The program to provide seaweed cultivation infrastructure in Central Buton Regency has successfully introduced modern technology that makes it easier for farmers. Farmers can reduce the time needed for harvesting and processing with the help of modern tools such as boats and seaweed processing machines (Syam & Taher, 2023). Additionally, it improves the efficiency and quality of the products produced, opening up opportunities for a wider market (Kiesel et al., 2017). In addition, farmers in the village have begun to follow industry standards for more environmentally friendly cultivation. Especially in the fisheries and marine sectors, productivity increases can be significantly achieved through the provision of appropriate infrastructure (Asimu & Hapsari, 2018). In addition, through appropriate infrastructure support, this program promotes local economic growth and sustainability (Putra & Rahaju, 2023).

The training provided to farmers has strengthened their knowledge and skills, allowing for the implementation of more effective cultivation practices and improved crop yields. The training provided to seaweed farmers has been proven to improve technical skills in selecting superior seeds, monitoring plant growth, and overcoming pests or diseases that often attack seaweed plants (Waruwu et al., 2022). In addition, this training helps farmers understand the importance of planting and harvesting time management following the seaweed biological cycle to maximize production (Wahyuni et al., 2023). In the training, farmers are also taught to use simple tools and technologies such as salinity and water temperature meters, which are very important in supporting optimal seaweed growth (Mahayasa et al., 2022). This increased knowledge allows farmers to reduce the risk of crop failure and improve efficiency in each stage of cultivation. As a result, farmers are not only able to meet the needs of the local market but also increase the competitiveness of their products in the export market (Lumenyela et al., 2023).

Despite the headwinds, many farmers say they are making more money thanks to the program's support, indicating an improvement. According to a survey conducted by the Marine and Coastal Resources Development Agency (2023), more than 60% of seaweed farmers in coastal areas reported an increase in income after participating in the training program. The Ministry of Marine Affairs and Fisheries also reported that training directly increased seaweed harvest (Ernawati, 2023; Salam & Yambe, 2022). The marketing guidance provided has enabled most of the farmers participating in this program to increase their selling prices (Suciyati, 2019). In addition, the quality of life of seaweed farmers has improved due to this program, as more families can meet their basic needs and have higher purchasing power (Nurcomariah et al., 2021). Effective communication between the government and the community, especially seaweed farmers, is essential to ensure they understand the programs available. Farmers can be aware of the opportunities offered, such as technical and financial assistance that can improve the quality and quantity of their crops, with clear communication (Wang & Cai, 2022). Government programs that are not well understood will make them difficult to access, which in turn

hinders the progress of farmers' businesses (Seli et al., 2024). Therefore, the adoption of new technologies that can increase seaweed productivity can be more easily achieved through good and open communication (Nichols, 2021). Additionally, good communication helps to build a more trusting relationship between farmers and the government, which allows them to work better together for the advancement of the local economy (Yi, 2022).

Limitations in the distribution of assistance prevent many farmers from getting equal access to cultivation infrastructure, so the positive impact of this program is uneven. Limitations in aid distribution are often caused by a lack of coordination between the government and related parties, resulting in uneven distribution among farmers (Mohamed & Shafiai, 2021). In addition, inequality of access to aquaculture infrastructure, such as agricultural tools and facilities, hinders the potential for increased production in certain areas (Li et al., 2022). Limitations in aid distribution can also be exacerbated by a lack of transparency in distribution mechanisms, which causes many farmers to feel distrustful of existing programs (Mira, 2015). Furthermore, research by Anwar shows that the allocation of aid that is not on target often widens the gap between small farmers and large farmers, so the aid program fails to achieve the goal of improving the welfare of farmers equally (Anwar, 2013).

Many farmers do not have equal access to aquaculture infrastructure due to limitations in aid distribution, resulting in uneven positive impacts of this program. Limitations in aid distribution are often caused by a lack of coordination between the government and related parties, resulting in uneven distribution among farmers (Mohamed & Shafiai, 2021). Additionally, the lack of access to agricultural infrastructure, such as agricultural equipment and facilities, can hinder opportunities to increase production in some regions (Li et al., 2022). Due to limited distribution networks, many farmers in remote areas face difficulties in obtaining the assistance that is supposed to support them (Tisdell & Sen, 2004). As a result, only farmers from more developed areas can make optimal use of the program, while other farmers remain left behind (D'Exelle & van den Berg, 2014). This suggests that the unfair distribution of aid can exacerbate disparities between regions (Thennakoon et al., 2022).

Volatile seaweed price fluctuations cause uncertainty for farmers, hindering them from investing further in cultivation efforts. Farmers have become uncertain due to unstable seaweed price fluctuations, which hinder them from making further investments in cultivation (Mansor & Kamarulzaman, 2020). Undoubtedly, unstable fluctuations in seaweed prices endanger the sustainability of seaweed cultivation businesses. Many farmers are afraid of losing money when prices drop drastically because they are worried that they will lose money (Sunadji & Lukas, 2023). In addition, price uncertainty has an impact on farmers' business plans in the long term (Fatimah & Situmorang, 2023). For example, farmers often struggle to cover rising production costs, such as labor and land maintenance, when market prices are low. Therefore, price stability is essential to encourage farmers to invest and develop their cultivation businesses (Yanamisra et al., 2023). Uncertainty in the

price of agricultural commodities, including seaweed, can reduce farmers' incentives to innovate or increase their production (Hermalena et al., 2022).

Often, the government and the public are unable to communicate properly, which leads to unclear information about the programs available. Many farmers have difficulty understanding how to get government assistance, even though it is needed. Studies show that farmers in various regions are often unaware of the procedures for applying for assistance and the types of assistance they can obtain (Wale & Mkuna, 2023). In addition, the limitations of communication channels used, such as information centers or social media, make people more ignorant about existing programs (Ranga & Pradhan, 2014). Therefore, the government must communicate more frequently with the public to ensure that information about assistance programs arrives clear and targeted (Nuritha et al., 2017).

Some farmers say they do not receive advanced training, which prevents them from fully using the available tools and facilities. Many farmers face difficulties in operating modern agricultural machinery if they do not receive sufficient training, which means that the tools cannot be used optimally (Torky & Hassanein, 2020). Farmers do not know how to combine tools with effective farming techniques, which means they cannot achieve the potential for increased agricultural yields through technology (Mgomezulu et al., 2023). Advanced training is also important to introduce farmers to new, more efficient techniques, but many of them feel they do not have the resources for training (Rae & Josling, 2003). Proper training can help farmers improve their agricultural yields and well-being by improving their ability to use the tools available (Ar Riyadh et al., 2023)

## LITERATURE REVIEW

The program to provide infrastructure for seaweed cultivation has been identified as one of the main strategies for increasing farmers' productivity and income. Providing facilities such as superior seeds, mooring ropes, and buoys plays a very important role in increasing seaweed yields, especially in coastal areas with great cultivation potential (Sujarwo & Fitriyanny, 2016). Other studies show that adequate infrastructure, such as transportation and drying facilities, is essential to help farmers increase the added value of their seaweed products (Akrim et al., 2019). In addition, technical training provided along with infrastructure has been proven to improve farmers' ability to manage cultivation efficiently (Ramdhan, 2018). In Langkomu Village, Central Buton Regency, the natural potential that supports seaweed cultivation is still underutilized due to the lack of facilities (Yulius et al., 2019). Therefore, the implementation of this program is expected to increase productivity through efficiency in cultivation and increase farmers' income, which is in line with the results of previous research. Thus, this literature emphasizes the importance of evaluating the impact of infrastructure provision programs in encouraging local economic growth through the fisheries sector

**METHODS**

This study uses a descriptive qualitative research approach. This study aims to understand better how the program to provide cultivation infrastructure by the Central Buton Regency Fisheries Office is used to help the seaweed farming community in Langkomu Village. The research was conducted in Langkomu Village, a seaweed cultivation center in Central Buton Regency. The study subjects consisted of seaweed farmers and other parties related to the topic, and nine informants were purposively selected to be used as informants. The data collection method involves documentation, in-depth interviews, and observations to obtain complete information. Data analysis consists of three important stages: data reduction, recitation, and conclusion. The goal of data reduction is to obtain relevant information. All available information is considered when concluding. This is done so that the research results can provide a clear picture of how the program is run. The target of the research conducted using this method is to provide an overview of how effective this program is in providing agricultural facilities and the problems faced by the seaweed farming community in Langkomu Village. In addition, this research can also offer suggestions for future improvements.

**RESULTS**
**1. A Systematic Approach to Aid Distribution**
**a. Goals and Approaches of Assistance Programs**

Determining the right targets is a key element in ensuring the effectiveness of aid distribution, including for seaweed farmers in Central Buton Regency. The local Fisheries Service uses a field survey mechanism as a verification effort aimed at ensuring that assistance is provided to aquaculture groups in need. A group-based approach in aid programs is essential to ensure that aid is on target so that the efficiency of social assistance distribution can be improved by targeting groups that need it (Abidin et al., 2022). In addition, the group-based approach recommended by the Ministry of Maritime Affairs and Fisheries can improve the assistance program's sustainability by improving recipient groups' capabilities and increasing participation and cooperation between group members (Sukari, 2020). Therefore, the combination of determining the right target and a group-based approach is a determining factor in the success of distributing aid to seaweed farmers in the Central Buton Regency.

**b. Methodology of Data Collection and Verification of Recipients**

The data collection process carried out by the Central Buton Regency Fisheries Office aims to identify groups of seaweed cultivators who have been registered and those who have not. This is very important so that the distribution of aid can follow applicable guidelines and ensure the fairness and effectiveness of the program. This process also strengthens synergy between group members and supports equality in assisting. Data collection through development planning deliberations (Musrenbang) starts from the village level and is expanded in stages to sub-districts and districts to verify real needs in the field. Accurate data collection is critical to the success of aid programs, with structured data collection methodologies that can fully identify community

needs and ensure targeted resource distribution (O'Keeffe et al., 2016). A thorough verification process of beneficiaries is essential to prevent abuse, increase program accountability, and strengthen public trust in the effective and transparent implementation of assistance programs (Georgieva-Andonovska, 2014). Thus, a good data collection and verification methodology ensures program efficiency and improves social justice.

**c. Assistance Application and Verification Process**

Applying for assistance at the village level starts from Musrenbang, which involves planning based on regional needs. The proposed assistance is verified to ensure that assistance is given to seaweed cultivators who are following the provisions, namely those registered in the Kusuka application and domiciled in Central Buton Regency. While the system aims to optimize distribution, more frequent re-data collection is required to ensure the accuracy of aid recipient data. The process of submitting and verifying aid recipients is an important step to ensure that assistance is provided in a targeted manner to those who need it.

Research reveals that region-based planning through Musrenbang, by involving stakeholders, can increase the effectiveness of village aid distribution through participatory identification of priority needs (Supriyanto et al., 2023). It is important to verify the data of aid recipients using application technology such as Kusuka to ensure the accuracy and validity of the data to prevent target errors so that aid management can be more transparent and accountable (Lina Susilowati et al., 2023).

**d. Evaluation of Aid Distribution**

The assistance distribution, which includes various cultivation tools such as buoys, ropes, boats, and seaweed seeds, has experienced significant obstacles due to the limited amount of assistance available. This results in uneven distribution, with some cultivators getting no help. One clear example of this distribution inequality is the recognition of some cultivators who only receive one-time assistance with a limited amount, such as seaweed straps, while other needs are not met. Some cultivators even revealed that despite being enrolled in the system, they never received assistance.

Evaluation in the distribution of aid is important to identify distribution gaps and reduce inequality so that each recipient receives assistance according to their needs (Sukmana, 2021). Without proper evaluation, assistance often does not reach groups in need, which has an impact on the low effectiveness of the program (Maryam & Candra, 2022). Therefore, the institution responsible for distributing aid must conduct periodic evaluations so that the aid program can run smoothly and evenly.

**e. Improvement of Data Collection and Distribution System**

Based on the results of the research, it is clear that the aid data collection and distribution system in Central Buton Regency needs to be improved. Despite efforts to provide group-based assistance, limited amounts hinder maximum coverage. To ensure equitable distribution, it is necessary to increase the quantity of aid, strengthen the verification system, and distribute aid more transparently. This will allow all seaweed farmers, both existing and

unregistered, to benefit from the assistance program and increase their productivity more optimally.

Suboptimal data collection and distribution systems are often an obstacle to the success of aid programs. Studies show that a lack of transparency and a poor verification system can lead to unfair distribution of aid, resulting in many recipients who do not meet the requirements for assistance (Sulaiman, 2016). In addition, farmers' productivity can be significantly increased through an increase in the amount of aid, especially if it is distributed evenly (Patunru & Respatiadi, 2017). However, improving the digital data collection system can reduce errors and increase public trust in government assistance programs (Ministry of Investment/BKPM, 2021)

## 2. Infrastructure and Training Program

### a. Program Objectives

The program to provide seaweed cultivation infrastructure implemented by the Fisheries Office of Central Buton Regency aims to improve the welfare of the seaweed farming community by providing infrastructure assistance that supports the cultivation process. It is hoped that with this assistance, the productivity and income of seaweed farmers can increase significantly. The Head of the Aquaculture Fisheries Business Division of the Central Buton Regency Fisheries Office stated that the essence of this program is to provide convenience in seaweed cultivation so that the community's economic income can be raised (Interview, April 23, 2024).

Adequate infrastructure support in the seaweed cultivation sector can increase crop yields, which impacts improving farmers' welfare (Mikkelsen & Chapagain, 2023). In addition, providing infrastructure assistance, such as supporting equipment and training, can reduce production costs and improve product quality, thus having a positive impact on the income of seaweed farmers (Putri Hanifa et al., 2023). Thus, this program can be a strategic step in optimizing the economic potential of coastal communities.

### b. Role of Mentoring and Training

In addition to providing infrastructure assistance, the Central Buton Regency Fisheries Office also assists seaweed farmers directly. The Head of the Aquaculture Business Development Section of the Central Buton Regency Fisheries Office stated that this training aims to improve the community's ability to produce high-quality seaweed and increase their knowledge about seaweed cultivation (Interview, April 23, 2024). The program to provide seaweed cultivation infrastructure is very important in increasing the productivity and quality of cultivation products.

The provision of adequate infrastructure, such as facilities for cultivation and transportation, can increase seaweed production yields and accelerate its distribution to the market (Mikkelsen & Chapagain, 2023). In addition, training and assistance for seaweed farmers in the use of appropriate cultivation technology also contribute to improving the quality and competitiveness of seaweed products (Putri Hanifa et al., 2023). Therefore, support for the provision of good infrastructure and technical assistance is key to the success of sustainable, high-quality seaweed cultivation.

**c. The Impact of Training on the Knowledge and Skills of Seaweed Farmers**

Based on interviews with seaweed farmers in Langkomu Village revealed that the training held by the Fisheries Service was very beneficial in improving their understanding of more efficient seaweed cultivation techniques. Farmers like Mr. Ladi hope this program will continue and expand, especially in marketing seaweed products, to increase their income (Interview, April 26, 2024). Mr Agus, another farmer, expressed his hope that similar training can be carried out regularly by the government to explore effective and efficient cultivation techniques further to increase their production (Interview, April 26, 2024).

Overall, interviews with seaweed farmers in Langkomu Village showed that the training provided by the Central Buton Regency Fisheries Office had a positive impact on improving the knowledge and skills of farmers in seaweed cultivation. With the new skills acquired, farmers can increase their production output, which leads to an increase in income. Farmers hope that this training program can be continued and held more often to maximize the potential in their area.

Training in seaweed cultivation techniques is very important to improve the efficiency and quality of production products because trained farmers tend to be more able to optimize environmentally friendly and sustainable cultivation methods (Najamuddin et al., 2019). Research shows that regular training can increase farmers' productivity, reduce losses due to technical errors, and open up wider marketing opportunities through a better understanding of product processing and marketing techniques (Sululing et al., 2024).

**3. Evaluation of the Seaweed Cultivation Infrastructure Provision Program**
**a. Background of the Seaweed Cultivation Infrastructure Provision Program**

The program to provide seaweed cultivation infrastructure implemented by the Central Buton Regency Fisheries Office aims to empower the seaweed cultivation community. This program is expected to improve community welfare through increasing seaweed cultivation yields. The increasing number of seaweed products every year is an indicator of the success of the program. The program to provide seaweed cultivation infrastructure has an important role in increasing the productivity and income of seaweed farmers, which can positively impact community welfare.

The provision of adequate infrastructure in seaweed cultivation can significantly increase production yields, especially in areas that have abundant marine natural resource potential (Ali Mursit et al., 2022). In addition, support for seaweed cultivation infrastructure also contributes to improving the quality of crops and strengthening the competitiveness of seaweed products in local and international markets (Setiajatnika & Dwi Astuti, 2022). This program, thus, is key in creating jobs and improving the economy of coastal communities.

b. Program Success Indicators

According to the Head of Aquaculture Business Development of the Central Buton Regency Fisheries Office, the number of seaweeds produced by the community indicates the success rate of the program.  In an interview on April 23, 2024, he explained that seaweed production has continued to increase

since the program's implementation. The data in Table 1 shows that the seaweed production in Central Buton Regency increased yearly from 20,153 tons in 2020 to 38,189 tons in 2023, with a total production of 110,241 tons from 2020 to 2023. This increase is proof that this program has a positive impact on the seaweed farming community.

Table 1. Total Seaweed Production Based on Year in Central Buton Regency

| No. | Year | Production Amount (Tons) |
|---|---|---|
| 1 | 2020 | 20.153 |
| 2 | 2021 | 23.175 |
| 3 | 2022 | 28.724 |
| 4 | 2023 | 38.189 |
| Sum | | 110.241 |

Source: Central Buton Regency Fisheries Office, 2023

The success of the aquaculture sector program can be measured by the increase in production by the community. The increase in the production of fishery products, such as seaweed, reflects the effectiveness of the program in improving the welfare of farmers and strengthening regional economic resilience (Hehre & Meeuwig, 2016). In addition, research shows that programs that focus on capacity building and technical support to seaweed farmers can drive higher yields, which in turn increases the income of local communities (Tuahuns et al., 2022). Thus, the significant increase in seaweed production, as recorded in Central Buton Regency, shows that this program has a real positive impact on the community.

**c. Social and Economic Impact on the Community of Langkomu Village**

This program has had a significant impact on the people of Langkomu Village. In an interview with the Secretary of Langkomu Village on April 25, 2024, he stated that the Seaweed Cultivation Infrastructure Assistance is very helpful to the local community, who mainly depend on this effort to meet their livelihoods. This program has eased the burden on people's lives and simplified the cultivation process. The seaweed cultivation infrastructure assistance program has indeed had a significant impact on the people of Langkomu Village.

Infrastructure support greatly affects the success of seaweed cultivation businesses because it increases efficiency and production results (Seberini, 2020). In addition, this kind of program can increase the income of coastal communities that depend on seaweed cultivation, thereby helping to ease their economic burden (May et al., 2023). With infrastructure assistance, the community can optimize the potential of local natural resources, which leads to an increase in their welfare.

**d. Seasonal Factors and Land Area in Affecting Production**

Seasonal factors also affect seaweed cultivation yields. Mr Ladari, one of the seaweed cultivators, explained that in a good season, he could produce up to 150 kilograms of seaweed in a month. However, under normal conditions,

production can decrease to around 120 kilograms per month (interview, April 26, 2024). In addition, the land area owned by cultivators also plays a big role in determining the results obtained. Mr. Muhsin, another seaweed farmer, said that the land area greatly influences the results of seaweed cultivation, and the increasingly limited land causes the yield to decrease.

Seasonal factors and land area do have a significant influence on seaweed cultivation results. Research by Santoso (2022) shows that seasonal changes, such as the rainy and dry seasons, can affect the quality and quantity of seaweed produced, with better results in the dry season (Radiarta et al., 2016). In addition, a study by Rahman and Saputra (2023) also found that limited land area can lead to a decrease in seaweed cultivation yields because limited space reduces the production capacity of these plants (Wu et al., 2020). Thus, seasonal factors and land area are crucial elements to consider when managing seaweed cultivation.

**e. The Effect of Selling Price on the Spirit of Cultivators**

The selling price of seaweed is also an important factor affecting farmers' enthusiasm. Mr. Nardin, one of the seaweed farmers, revealed that when the selling price is high when the price reaches 30 thousand per kilogram, farmers' enthusiasm increases, and the production can reach up to 200 kilograms per month. However, when the price drops to 15 thousand per kilogram, the farmers' enthusiasm decreases, and the yield obtained decreases. This shows how important selling price stability is to maintain the sustainability of seaweed production in the village (interview, April 26, 2024).

The stable selling price of seaweed significantly impacts the motivation and production of seaweed farmers. Sharp price fluctuations can lead to a decrease in farmers' morale, which in turn affects their production quantity (Kartika, 2020). In addition, higher prices encourage farmers to increase their work intensity, potentially resulting in greater production, which can create sustainability in seaweed cultivation (Wahyu, 2021). This emphasizes the importance of seaweed price stability as a key factor in maintaining the productivity of seaweed farmers.

**CONCLUSIONS AND RECOMMENDATIONS**

Based on the research results, it can be concluded that the program organized by the Central Buton Regency Fisheries Office, in the form of providing infrastructure and training, has positively impacted increasing seaweed production and community welfare. This program has succeeded in providing the necessary facilities and improving farmers' ability to manage their businesses, which has an impact on increasing production and income. However, the community still expects the continuation of training that includes product marketing aspects as a step to improve more optimal results. Therefore, it is important to include training on marketing strategies in this program to strengthen the competitiveness of seaweed products in the market.

The implications of this study are the importance of the sustainability of the training program that has been carried out, as well as the need for synergy between the government and the community in optimizing the potential of natural resources. The government is expected to be more responsive to the

problems faced by the community, especially related to seaweed marketing issues. Continuous training that covers all aspects of cultivation, including marketing, can have a greater impact on the economy of the seaweed farming community. Therefore, strengthening this program is the key to ensuring sustainability and improving community welfare in Central Buton Regency.

## FURTHER STUDY

This research still has limitations, so further research is needed related to the long-term evaluation of the program's impact on the sustainability of seaweed cultivation businesses, as well as in-depth analysis of external factors such as climate change and government policies that can affect price stability and market access for seaweed products.

## ACKNOWLEDGMENT

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