A management design for cooperative-based seaweed cultivation business in Southeast Sulawesi Province, Indonesia

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Abstract. Aquaculture is a sub-sector of the fisheries sector, which can bring benefits for the economy and welfare of the coastal community. The management of the sub-sector should be designed based on increasing added value, business sustainability, and regional development. Therefore, this study aims to design a management model for cooperative-based seaweed cultivation. The study was carried out in Southeast Sulawesi Province, taking two regencies, South Konawe and Bombana, as study locations. The method was conducted by surveying experts using the Exponential Comparison Method (MPE) analysis. The experts came from several parties, including universities, the fisheries service, the cooperative office, seaweed processing agro-industry managers, and cultivators. The results show that: (1) the management requires a cooperative with a strong capacity to build partnerships, with strength in the aspect of capital, and which can provide roles and services to seaweed cultivators; (2) it is necessary to increase the capacity of human resources in strengthening the cooperative capacity; the cooperative is required to build partnerships with the agro-industry, universities, and financial institutions; banks are needed to increase the cooperative role for the cultivators. Furthermore, the expansion of capital assistance, human resources, and infrastructure are vital.

Key Words: cooperative, development, model, seaweed.

Introduction. Southeast Sulawesi Province is one of the main seaweed centers in Indonesia. Its production during the 2009-2014 period showed an increase of 53.87%, even though there was a decrease from 2009 to 2020 (Table 1) (Ministry of Maritime Affairs and Fisheries 2015; Department of Maritime Affairs and Fisheries of Southeast Sulawesi Province 2021). The volume and production value of dried seaweed is presented in Table 1.

Seaweed production has decreased between 2015 and 2020 due to pests and diseases caused by inadequate biosecurity measures in aquaculture waters, low-quality seeds, and decreased genetic quality (Campbell et al 2022). There was also a decrease in production value of 45.55%, which shows that competitiveness is low. Seaweed is the largest contributor to Indonesian fishery products. However, more than 80% is exported in dry form (Saleh & Sebastian 2020). The utilization of fishery resources prioritizes a production approach, even though Indonesia has cooperatives as structured institutions.

Seaweed business is carried out by coastal communities individually or in groups bound by kinship relations or because of the similarity of places or village communities. The cultivators obtain capital from traders with the obligation to sell the products to investors. This condition makes the supply chain of the marketing system very long and the efforts to create added value difficult. According to Kordi (2011), post-harvest handling is limited to drying and exporting seaweed in dry form without further processing. Limi et al (2018) stated that production without high prices would not necessarily increase

cultivators' income. This position is weak because the capital owners have mastered the marketing network (Nuryadi et al 2017). Therefore, the existence of a cooperative is important in protecting interests. Institutional arrangements through the cooperative movement are expected to support cultivation activities because cooperatives can play an important role in gaining power against various forms of greed and injustice (Baga 2009).

Table 1

Production volume and value of dried seaweed in Southeast Sulawesi Province (2009-2020)

Year	*Production (Tons)*	*Value (USD)*
2009	185229	43284450
2010	348981	60704570
2011	586965	117567784
2012	639192	35999705
2013	917363	87347015
2014	949141	94641638
2015	915895	45862927
2016	830497	-
2017	872172	-
2018	492495	251234348
2019	346886	98958104
2020	272.235	70526816

Note: source: Ministry of Maritime Affairs and Fisheries (2015); Department of Maritime Affairs and Fisheries of Southeast Sulawesi Province (2021); * - no data available.

The institutional activities of a fisheries cooperative in Southeast Sulawesi Province may face various problems. Even though there are not many sustainable fishery cooperatives, cultivator membership is low, and many are not active. The number of active fishing cooperatives in 2019 was only 33 out of 200 registered (Department of Cooperative and MSME, Southeast Sulawesi Province 2020). In the seaweed business, institutions function as capital, information, and input providers (Ramadan et al 2018). Nuryadi et al (2019) stated that developing a seaweed business to increase added value requires a large role in the institutional aspect, including a seaweed cultivator cooperative.

This study aims to design a management model for cooperative-based seaweed cultivation, so that the results of this study can serve as a reference for seaweed businesses in developing their operations.

Material and Method

Study location. This study was conducted with cultivator data obtained in South Konawe Regency, focusing on Bungin Permai, Lakara, Roraya Bombana District in Laeya and Puulemo Village from June to December 2022. The data were collected through field surveys and interviews, with 25 experts serving as respondents for this study. The field survey was carried out by observing cultivation activities, visiting the processing unit, and the seaweed agro-industry trade system to obtain the trading and marketing transactions pattern. In-depth interviews were conducted with local government, research institutions/universities, and practitioners with the ability and knowledge about issues related to seaweed development and institutions.

Data collection technique. The data were obtained through field surveys and interviews with seaweed cultivators and marketing actors. The expert opinion was based on different criteria and alternatives. The criteria used are effectiveness, usefulness, ease of implementation, cultivation needs, and potential for sustainability. The alternatives for each component in the management of cooperative-based seaweed cultivation are the following:

a. Strengthening the cooperative capacity: expanding capital, management's managerial capacity, cooperation capabilities, member participation, and the role of the cooperative supervisory agency.
b. Strengthening cooperative partnerships: increasing partnerships with marketing agencies, financial institutions, government agencies, universities, and agro-industry.
c. Strengthening capital: banking, government, universities, private financial institutions, and seaweed traders.
d. Increasing the role and services of cooperatives to cultivators: developing savings and loan business products, providing capital assistance, increasing assistance with cultivation facilities and infrastructure, expanding marketing assistance, and improving the quality of human resources.

Statistical analysis. Study data were analyzed by quantitative descriptive analysis using the exponential comparison method. This method is used to determine alternative priorities from various criteria. The criteria assist decision-making by designing a well-defined model with alternative values (Marimin 2004). The steps in selecting decisions with this method are: (1) determining alternative decisions, (2) preparation of decision criteria to be reviewed, (3) examining the degree of the relative importance of each decision criterion by using a certain conversion scale, (4) determining the relative importance degree of each decision alternative, and (5) the value ranking obtained from each decision alternative.
The following formula was used:

$$TN_i = \sum_{n=1}^{m} (RK_{ij})^{TKKj}$$

Where: TNi - total score of alternative i; RKij - degree of importance of relative criteria j on decision i; TKKj - degree of importance of relative criteria j; n - number of decision alternatives; m - number of decision criteria.

Results and Discussion

Cooperative capacity strengthening. The analysis of strengthening the capacity of the seaweed cultivator cooperative is presented in Table 2.

Table 2

Strengthening the cultivator cooperative capacity

No	*Alternative*	*Score*	*Priority*
1	Capital strengthening	5.355	2
2	Improvement of human resource management capabilities	5.383	1
3	Improvement of cooperation capabilities	5.329	3
4	Increased member participation	5.289	4
5	Strengthening the role of the cooperative supervisory agency	5.248	5

Strengthening the capacity of the seaweed cultivator cooperative shows that the priority aspects are increasing the human resource capacity, strengthening capital, and increasing cooperation capabilities. According to Nikijuluw & Naamin (1994), the basis of community-based natural resource management is knowledge. Romer (2012) and Lin (2004) stated that the key to success and sustainable economic growth is the continuous flow of technology and innovation. Coaching and developing human resources in cultivating seaweed up to its processing is fundamental. This is because it is a consequence of the increasing demand for products in terms of quality and quantity, as well as an anticipatory

step in facing global competition and the high labor mobility between business sectors. Skills are capital for the workforce (van den Brink & van der Woerd 2004; Bhattacharya et al 2005). According to Asthon et al (2008), DEFRA (2006), and Andrew (1999), workforce skills emerge as an important indicator of social aspects with a real effect on business or industry performance. Soekartawi (2001) reported that human resource quality is one factor affecting agro-industry success.

Henriquez-Antipa & Carcamo (2019) stated that the sustainable seaweed availability as a raw material for the agro-industry could be achieved when there is good attention to small-scale seaweed cultivators in the aspects of funding, innovation, marketing, education, and social justice. Waits (2000) and Porter (1998) stated that industrial organizations are very useful for responding to the challenges of globalization, technological developments, demands for decentralization, and encouraging the network formation of production and distribution activities, as well as for increasing the competitive advantage of the industry. The Directorate of Aquaculture, Ministry of Maritime Affairs and Fisheries (2016) reported that the institutions involved in supporting a competitive and sustainable seaweed business system are cultivator groups, collector traders/cooperatives, financial institutions, capital institutions, and coaching institutions.

Strengthening cooperative partnerships. The results of strengthening cooperative partnerships for seaweed cultivation are presented in Table 3.

Table 3

Strengthening cultivator cooperative partnerships

No	*Alternative*	*Score*	*Priority*
1	Strengthening partnerships with marketing agencies	5.263	4
2	Strengthening partnerships with financial institutions	5.342	3
3	Strengthening partnerships with government agencies	5.254	5
4	Strengthening partnerships with universities	5.397	2
5	Strengthening partnerships with the agro-industry	5.412	1

The priority aspect in strengthening cooperative partnerships for seaweed cultivators is establishing partnerships with the agro-industry. The choice of strengthening partnerships with the agro-industry is also considered a priority by Wibowo et al (2014). It was stated that when the dried seaweed is further processed into alkali treated *Cottonii* (ATC), semi-refined carrageenan (SRC), and refined carrageenan (RC), the value will increase 5, 7, and 18 times. Therefore, increased added value for the cultivators will be achieved when seaweeds are marketed directly to the agro-industry through a cooperative.

For the production to be absorbed or purchased at an appropriate price and the quantity and quality of seaweed produced to be under the needs of the agro-industry, cooperation is needed through a partnership system. Partnership and cooperation are necessary for agro-industry based on fishery commodities because the products are seasonal. Therefore, sustainability is closely related to the continuity of the raw material supply (DEFRA 2006; Setthasakko 2007). Van der Vorst (2004) showed that each company is positioned in a network layer and is involved in at least one supply chain, hence parallel processes can occur at one time. The partnership system can be a cluster organization between public and private institutions (Mulyati 2015). The cultivator position is weak because the capital owners mastered the seaweed marketing network (Nuryadi et al 2017).

The second and third priorities are the choice and participation of tertiary and financial institutions. In the development of cultivator cooperatives, universities are a source of knowledge, technology, and innovation. The implementation of all cooperative programs requires a strong source of funding. Studies related to institutions and policies conducted in Malaysia highlight the low educational level of cultivators and the temporary

nature of work in the seaweed field. This has triggered the slow translation of government policies at the cultivator level (Kambey et al 2021). According to Natalia & Nurozy (2012), increasing competitiveness requires access to capital through banks.

Efforts to increase human resources can be carried out through a dissemination process and a mentoring system. Human resource quality largely determines the sustainability of the aquaculture business. Therefore, it is necessary to increase the resources of the cultivators through coaching programs from both the government and universities. To be effective and efficient, seaweed cultivators should form groups, including cooperatives. Pandelaki (2012) stated that three priority strategies are recommended for developing cultivation. These include streamlining the role of the government or related institutions in fostering and developing human resources, increasing sources of business capital, and procuring market partnership cooperation patterns. This is because the technology for its cultivation is relatively easy, the investment capital is low, harvested within 5 weeks, and the business may be performed by women and children, if possible (Ferdouse et al 2018).

Strengthening the cultivator cooperative capital. The analysis results on seaweed cultivator cooperative capital are presented in Table 4.

Table 4

Cultivator cooperative capital system

No	*Alternative*	*Score*	*Priority*
1	Banks	5.4949	1
2	Government	5.4629	2
3	University	5.2972	5
4	Private financial institutions	5.4549	3
5	Seaweed trader	5.3160	4

Based on Table 4, the most prioritized cultivator cooperative capital system is from banks, the government, and private financial institutions. According to Natalia & Nurozy (2012), to increase competitiveness, it is necessary to promote banks in facilitating access to capital and increasing infrastructure development. Syafiuddin et al (2019) concluded that VoE could not develop the larger scale trading of seaweed products. This is because the capital adequacy to develop a business is still limited, and the members' skills are lacking.

Increasing the cooperative roles and services for seaweed cultivators. The analysis results of increasing the cooperative roles and services for seaweed cultivators are presented in Table 5.

Table 5

Alternative decisions of cooperative roles and services for cultivators

No	*Alternative*	*Score*	*Priority*
1	Developing savings and loan business products	5.2294	5
2	Providing capital assistance	5.3389	1
3	Increasing cultivation facilities and infrastructure assistance	5.3050	3
4	Improving marketing facilities	5.2880	4
5	Improving the quality of human resources for cultivators	5.3366	2

The cooperative roles and services in Table 5 show that the best alternative is to provide capital assistance and improve the quality of human resources, with almost the same scores of 5.3389 and 3366. The issue of capital and human resources for cultivators is an aspect that should be resolved immediately, and cooperative roles are expected to be

dominant. Azis (2011) and Neish (2007) stated that around 60-70% of seaweed cultivators have a binding relationship with collectors or inter-island traders.

The identification results show that 73% of respondents depend on their capital source from traders or courtiers. The consequence is that cultivators are obliged to sell their harvests at a lower price. Cultivators depend on traders, especially in capital and marketing (Nuryadi et al 2017). Nuryadi et al (2019) stated that seaweed business development requires a very large role in institutional aspects to increase added value, including a cultivator cooperative, as presented in Figure 1.

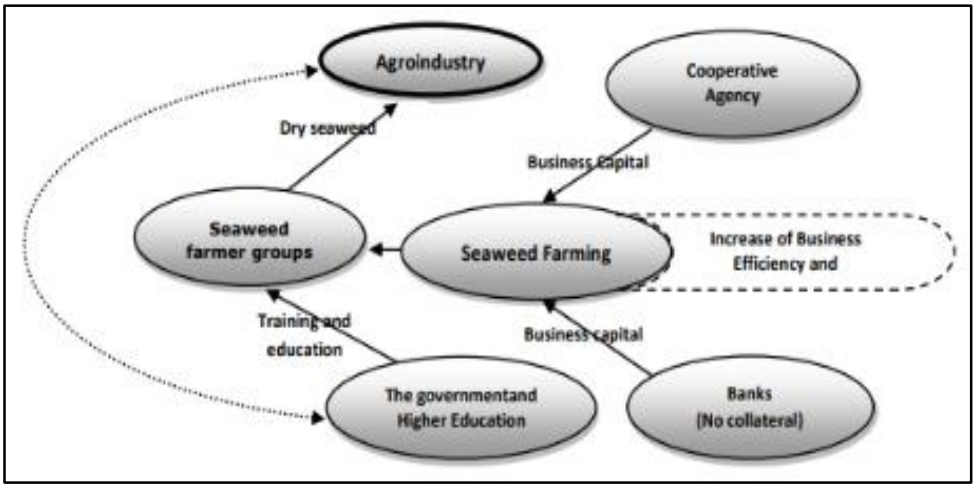

Figure 1. Model for developing seaweed agribusiness (Nuryadi et al 2019).

The formation of a seaweed cooperative management model in terms of increasing cooperative capacity, partnerships, capital, and services to cultivators is expected to improve business quality to realize an increase in the income and welfare of seaweed cultivators. Sirait (2018) stated that the most urgent factor is strengthening coastal community institutions through a cooperative as one of the concrete forms of the people's economy. In the context of the blue economy, increasing the seaweed cultivation business can promote economic growth with the income of cultivators and conserve the oceans and the environment sustainably (Freitas et al 2022).

In the seaweed business, institutions function as providers of capital, information, and inputs (Ramadan et al 2018). Meanwhile, cooperatives can develop the seaweed agro-industry through a collaborative pattern, especially in providing raw materials and marketing (Nuryadi et al 2020). Henriquez-Antipa & Carcamo (2019) stated that the sustainability of seaweed availability could be realized when there is good attention to small-scale cultivators in funding, innovation, marketing, education, and social justice. According to a study in Alaska, seaweed management requires policies that ensure equitable and sustainable development of the seaweed industry, promote the economic benefits and interests of local and rural communities, reduce legal barriers to policy implementation, and promote cooperative business development (Miller 2021).

Seaweed cultivators should prioritize business efficiency and productivity to obtain a high difference between costs and revenues. The business capital for cultivators is expected to be supported by government policies in the form of capital directly allocated through programs or policies facilitating capital acquisition. This is because cultivators have a binding relationship with traders due to the convenience of traders in obtaining capital for the cost of procuring seeds, production facilities, and children's education and health needs (Neish 2007; Azis 2011).

Conclusions. This research concludes that: (1) the management of the seaweed cultivation business requires a cooperative with a strong capacity, which can build partnerships, has strength in the capital aspect, and can provide roles and services for cultivators; (2) in strengthening the capacity of the seaweed cultivator cooperative, it is

necessary to increase the management ability or human resources and strengthen capital. Cooperative partnerships are required to work with the agro-industry, universities, and financial institutions. In strengthening cooperative capital, banks and the government are needed. Meanwhile, efforts can be made to provide and increase capital and infrastructure assistance.

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Conflict of Interest. The authors declare that there is no conflict of interest.

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