Research Article

Collaborative Governance in Supervizing the Development of Seaweed Cultivation in Nunukan Kaltara Province Through Supervisor Community Group

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Abstract.

Based on the Decree of the Regent of Nunukan No. 188.45/486/X/2021 concerning the Determination of Superior Products, Mainstay Products and Potential Products for 2001-2026, seaweed is one of the renewable old resource commodities in the form of regional superior goods or services and will be developed collaboratively to create value chains so as to generate added value, increase community income and create jobs as well as become regional icons. In this study, the method used is the qualitative method which, according to Ansell, uses a qualitative descriptive approach. Five main indicators, namely face-to-face dialogue, trust building, commitment to the process, shared understanding and intermediate outcome uses data collection techniques through in-depth interviews with stakeholders, participatory observation in collaboration forums and policy documentation studies, meeting minutes, and other supporting documents. The purpose of this study is to identify and analyze the collaborative process between Pokmaswas, Regional Government, and other stakeholders in the supervision of seaweed cultivation, especially in the context of the effectiveness of zoning supervision and shipping flows and others. Expected results identification of effective collaboration models between Pokmaswas, Regional Governments/Prop Governments, and other stakeholders in supervision, to strengthen synergy and communication between parties, policy recommendations and supervisory strategies. . So that the impact of seaweed cultivation, like zone overlapping, and plastic waste can be minimized. In general, it can be concluded that with a collaborative government in optimizing Pokmaswas, seaweed cultivation in Nunukan can be sustainable.

Keywords: Collaborative Governance Through Supervisor Community Group

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1. Introduction

Public Seaweed (Eucheuma cottonii) is a major commodity in Nunukan, with production reaching up to 4,000 tons of dried seaweed (with moisture content approximately 40%) per month, more than 4.770 seaweed cultivation households work in that area (not included others job which is still related with seaweed cultivation such as seaweed

seedling binder, buoy and stretch rope cleaners, dryer, squeezing and transport workers). The range of average prices per year (late 5 years, from 2018 t0 2023), fluctuate from IDR 11,833 per kilograms (in 2020) to IDR 24.979 per kilograms (in 2022), with the highest price approximately IDR

43.000 per kilograms in August 2022.

From the economic perspective, if one seaweed cultivator household consist of 2 to 3 people, per hectare of seaweed cultivation area needs 13 people as seaweed seedling binder, 10 people as buoy and stretch rope cleaners, and 5 people as dryer, squeezing and transport workers, so, it's all approximately need 31 people per hectare as seaweed workers.

In 2024, the total area of seaweed cultivation is approximately 13.050 hectare. The total production of seaweed (wet) is 764.264,69 tons, or 65.908,37 of dried seaweed. Average prices is IDR 18.000 with the total value IDR 1.186.350.660.000,-

From 65.908,37 tons of production in 2024 (also in the years before), approximately 25% is sent to Surabaya, and the rest 75% is sent to Makassar.

Ansell and Gash (2007) define collaborative governance as follows: A governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets.

This definition stresses six important criteria: (1) the forum is initiated by public agencies or institutions, (2) participants in the forum include nonstate actors, (3) participants engage directly in decision making and are not merely "consulted" by public agencies, (4) the forum is formally organized and meets collectively, (5) the forum aims to make decisions by consensus (even if consensus is not achieved in practice), and (6) the focus of collab oration is on public policy or public management. This is a more restrictive definition than is sometimes found in the literature. However, the wide-ranging use of the term has, as Imperial notes, been a barrier to theory building (Imperial 2005, 286). Since our goal is to compare apples with apples (to the extent possible), we have defined the term restrictively so as to increase the comparability of our cases. Introduce the concept of collaborative governance and its importance in sustainable seaweed cultivation.

Theoretically, supervisory community group (POKMASWAS) in Nunukan Regency should play a crucial role in overseeing seaweed cultivation by facilitating collaborative

governance among local farmers (seaweed cultivators, seaweed trawler), government agencies, and other stakeholders.

The advantages of this supervisory community group (POKMASWAS} in their involvement of seaweed cultivation area supervising are : 1. Normally, there are local community that know more about the area of seaweed cultivation, make it simple to do monitoring the boundaries of cultivation area based on Zone Regulation. 2. Support Local Engagement to help the provincial government in conflict resolution because of they have known each other. 3 Help Provincial government especially for Marine and Fishery Service in the form of Integrated Supervisory Team to facilitate supervision. 4. It's easier to promote government policy about the supervision because of one of the role of Supervisory community group (POKMASWAS) is to tell about government regulation before or in a simple way can be said as something like informan.

This objective State the aim of the article-to analyze the role and effectiveness of Supervisor Community Groups (POKMASWAS) in collaborative governance for supervising seaweed cultivation development in Nunukan.

2. Material and Methods

Study Area: Describe Nunukan Regency as the study location, focusing on areas with active seaweed cultivation, (e.g., 4 subdistricts, namely Nunukan, Nunukan Selatan, Sebatik dan Sebatik Barat). One of the material is presentation material as in the Figure 1.

Data Collection in this article, literature review has been used to analyze and describe the role and effectiveness of Supervisor Community Groups (POKMASWAS) in collaborative governance for supervising seaweed cultivation development in Nunukan, Annual Report of Marine and Fisheries Resources Monitoring (PSDKP) of Kaltara last 4 years (2021, 2022, 2023, 2024), and Data From Nunukan Fisheries Service (Dinas Perikanan Nunukan), last 5 years (2019, 2020, 2021, 2022, 2023), and other sources were used in this article.

Analytical Approach, use descriptive analysis to assess the effectiveness of collaborative governance and community group supervision, and to choose or determine the stakeholders include in this methods for this article, we've identified locally as Nunukan district condition since several years ago (Suhadi, 2018, Presntation Material for Coordination Meeting of Nunukan Seaweed Cultivation), as Figure 1 below :

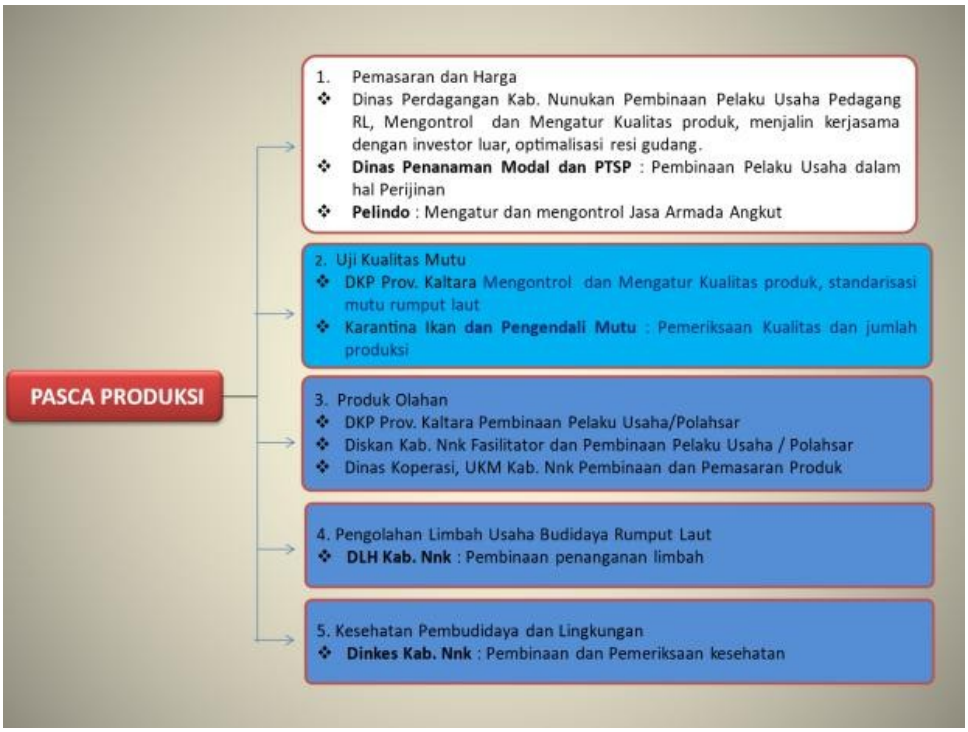

Figure 1: The Stages of Seaweed Cultivation and The Task of Related Stakeholders outside Local Community.

With Figure 1, it can be described about the related stakeholders outside local community (seaweed cultivators, trawlers, and others), or in other words who does what, which also makes it easier to select stakeholders related to this research.

3. Results and Discussion Findings

Tabel. 1. Describe about the objectives of Marine and Fisheries Resources Monitoring by Kaltara Province of Marine and Fisheries Service (DKP Kaltara). The Objectives of Marine and Fisheries Resources monitoring are :

1. To Prevent IUU Fishing (Illegal, Unreported and Unregulated Fishing) and Destructive Fiishing.

2. Fostering public awareness of fisheries business actors to comply with regulations in the use of marine and fisheries resources.

3. Enhancing cooperation between integrated marine resources and fisheries monitoring teams.

4. Increasing the sense of security for fishery community business actors against pirates, and providing solutions to conflicts between fellow fishery business actors.

5. To keep the sustainability of fishery resources.

From the Tabel 1. below, we can see the comparison between the objectives above (in the documents) and the results which have been reached after supervising activities have been done, from 2021 until 2024.

Table 1: Activities of Supervising Marine and Fisheries Resources Results of Kaltara Province for Nunukan in last 4 years.

	2021	2022	2023	2024
1				
2				
3				
4				
5				
6	554,200,000	949,807,000	3,408,399,800	4,956,593,665

Final Report of KALTARA Marine and Fisheries Resources Supervising, in the year of 2021 to 2024 (processed).

Information :

1. Prevent IUU Fishery and Destructive Fishing.
2. To grow public awareness about fishery regulation.
3. Tighten cooperation among integrated team members
4. Increasing security due to piracy and conflict.
5. To maintain sustainability of fishery resources
6. Budget (IDR)

Based on the objectives of Provincial Marine and Fisheries Resources Supervising, especially for points 3 and 4 have not been done or very rarely done if associated with a very wide area of supervision, whereas to keep sustainable marine and fisheries resources, tighten cooperation among integrated team or between all stakeholders should be built, and it's hoped that supervisory whether by supervisory community group (POKMASWAS) or other stakeholders could be run effectively.

In all last 4 years annual report (2021- 2024) of Provincial Marine and Fisheries Servis (DKP Kaltara), points 1 (to prevent IUU fishing and destructive fishing) and 2 (to grow public awareness due to fishery regulation about sustainable utilization of marine and fisheries resources), has not been running effectively, because both are still rampant, still happen (stand many cases). It means that these activities haven't done effectively, and of course, it's difficult to keep sustainability of resources do to weakly supervisory, that can be explained as below :

Based on the 2021 Report of the North Kalimantan Provincial Marine and Fisheries Service regarding marine and fisheries resource monitoring activities, ships were frequently found carrying out IUU fishing and destructive fishing, as well as horizontal conflicts between seaweed trawlers and seaweed cultivators.

Specifically in Nunukan Regency, supervision has been carried out twice, consisting of supervision by Integrated Team I for supervision of seaweed passing through shipping lanes and Integrated Team III for supervision of trawlers and farmers.

With a budget that is almost double in 2022, (see Table 2.), IUU fishing and destructive fishing (e.g. poison and electric shock) activities are still rampant, as well as seaweed farmers who carry out their cultivation activities outside the designated zoning, causing conflicts with other stakeholders.

Likewise for 2023 with a budget is more than 3 times of 2022 (see Table 2) , and also 2024 budget, (increase of more than one and a half billion from 2023), it turns out that IUU fishing and destructive fishing are still rampant, violations of seaweed cultivation zones, and many fisheries business actors do not yet have permits.

From the above information regarding the supervision activities, although the budget from 2021 to 2024 continues to increase, the main objectives of the supervision of marine and fisheries resources as stated in Table 2. have not been achieved properly, this can be seen from the continued rampant IUU Fishing and Destructive Fishing, Violations of Seaweed Cultivation Zones, and the large number of business actors in the fisheries sector who do not yet have permits.

In my opinion, the failure of these supervision activities is due to the lack of strong and effective collaboration between stakeholders or in other words, weak collaborations between stakeholders as it should be as as a cause of ineffective supervision. One thing that needs to be improved is the role of one of the stakeholders who are daily actors, both seaweed farmers and fishermen, who have actually joined the community monitoring group (POKMASWAS).

Ineffectiveness is also caused by the longtime gap between the results of the coordination meeting followed by socialization to seaweed farmers regarding the results of the meeting, but the execution to follow up on it takes too long, taking months, so that farmers feel that the coordination meeting is just playing around, so that violations, especially zoning, remain rampant, increasingly covering other designated zones, and the seaweed harvest age is only 45 days. (this condition sometimes there is a term false hope giver/PHP). In addition, the concept of the closer the better it services is still

ignored, so that the distance between the office and the supervision location is too far. In addition, the technical implementation unit that has been formed has not been filled by the officials who should, so that the existing supervision is only incidental. This is in accordance with Ansell and gash's theory about collaborative governance that A governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets.

One of the stakeholders which has an important role, not only as a member of supervisory community group (POKMASWAS), but normally, they are also as a seaweed cultivator is cultivating society, and some of them are seaweed trawler.

In its development, seaweed farmers can be divided into three groups, namely pure seaweed cultivators, seaweed trawlers and a combination of the two, can be explained as follows : If seen from the perpetrators, initially between seaweed cultivators and seaweed trawlers were different actors. However, in its development, seaweed cultivators felt it was a shame if the seaweed they planted, the fall was taken by seaweed trawlers, so, some of the cultivators were also as seaweed trawlers. Theoretically, the price of seaweed from trawls (which age varies, normally still very young, lower carrageenan content), should be different from seaweed from pure cultivation which is harvested at 45 days. Based on several research results, the carrageenan content of seaweed will be maximum at 45 days. but this is not considered in the seaweed trade, the price is the same between the results of trawls and pure cultivation, which causes many seaweed trawlers, so that the potential for conflict between cultivators and trawlers is lurking at all times.

By empowering this community as a member of supervisory community group or (POKMASWAS), several advantages can be obtained such as If seaweed cultivators become members of the supervisory community group (POKMASWAS) in Nunukan, several positive outcomes can be expected:

• Enhanced Local Knowledge and Practical Oversight: Seaweed farmers have direct, hands-on experience with cultivation cycles, environmental conditions, and local challenges. Their involvement ensures that supervision is grounded in real-world practices, making monitoring and enforcement more effective.

• Stronger Community Ownership and Participation: When cultivators are part of POKMASWAS, they feel a sense of responsibility and ownership over resource management. This encourages compliance with regulations and collective action to protect the cultivation area, as seen in other community-based management models in Indonesia.

• Improved Conflict Resolution and Communication: Having cultivators in supervisory roles bridges the gap between farmers and authorities. It facilitates open communication, quick identification of problems (such as encroachment or disease outbreaks), and collaborative problem-solving.

• Integration of Traditional Knowledge: Seaweed farmers bring valuable traditional and local ecological knowledge to the group, which can inform better decision-making and adaptive management strategies for sustainable cultivation.

• Empowerment and Capacity Building: Membership in POKMASWAS offers cultivators opportunities for leadership, training, and skill development, strengthening both individual and group capacity to manage resources and advocate for their needs.

• Economic and Social Benefits: Active involvement in supervision can help ensure the sustainability of the seaweed industry, which is the economic backbone of villages like Tanjung Harapan. This supports stable incomes and job opportunities for the wider community.

On the other word, integrating seaweed cultivators into POKMASWAS leads to more effective, participatory, and sustainable management of seaweed cultivation areas, benefiting both the community and the environment.

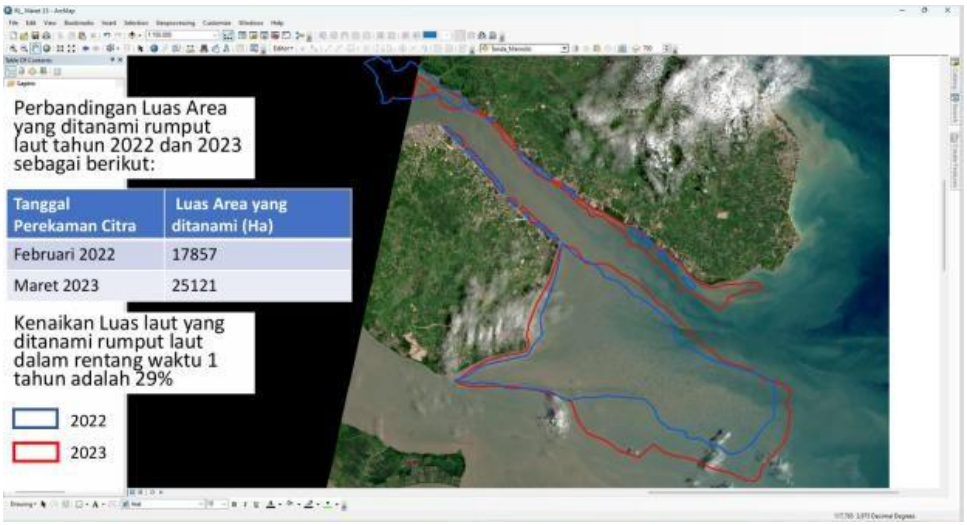

Figure 2: Comparison of Seaweed Cultivation Area of 2022 dan 2023.

From the Fig.2 above, Rising sea area Planted with seaweed within a span of 1 year is 29%. This is only 1 year gap, from 2022 to 2023. Please look at the other picture below :

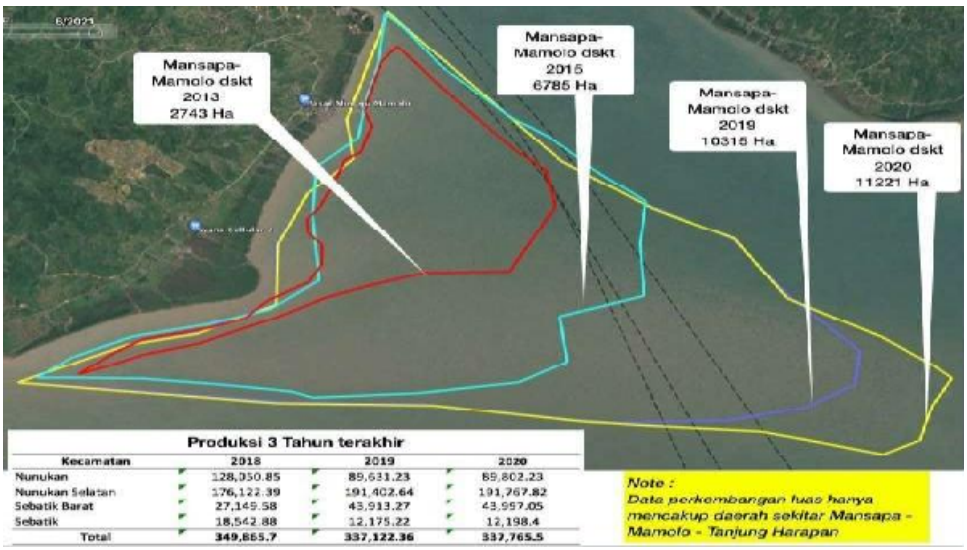

Figure 3: The Raising of Seaweed Cultivation Area in Nunukan, between 2013 till 2020.

It's clear that the extension of seaweed area is very massive. This is because of not any action especially in zone regulation supervising, as if all investors (mostly private) can cultivate seaweed wherever possible and they want.

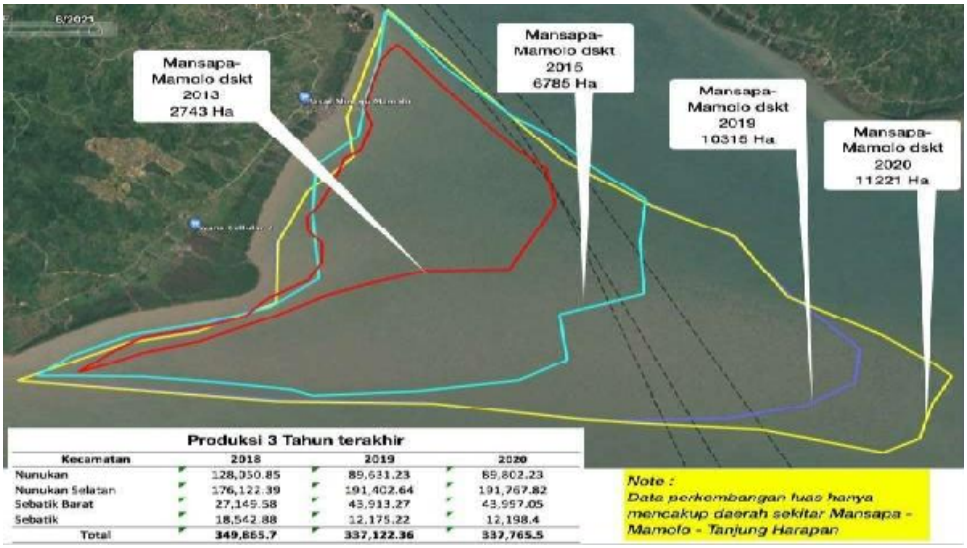

Figure 4: Seaweed Cultivation Area is Overlaid with cruise limit and buoy.

Figure 4 explains that part of cruise channel has been covered by seaweed cultivation area. It makes costly, especially for speedboat, need more fuel, because of their track become longer dan narrow.

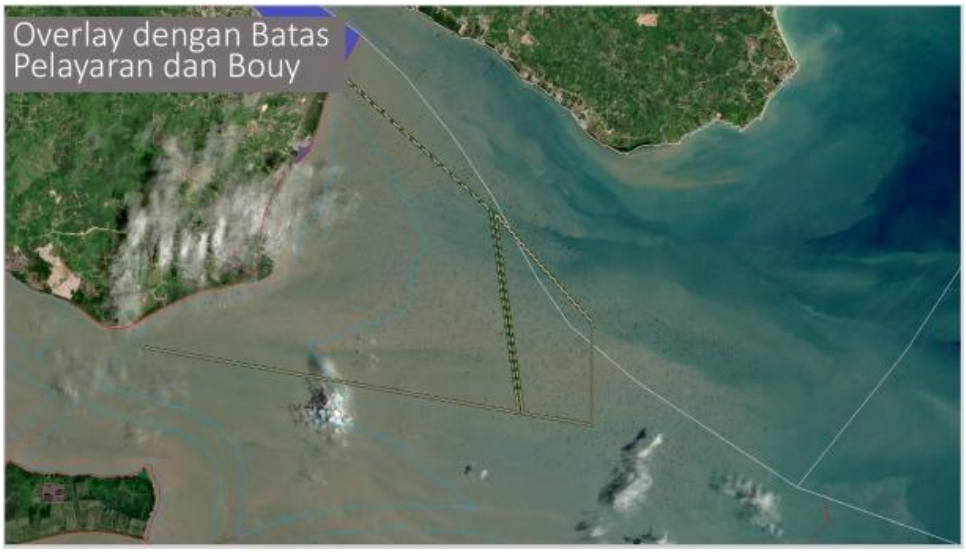

Figure 5: Seaweed Cultivation Area is overlaid with Zone Area Map of Kaltara.

Figure 6: Seaweed Cultivation Area is overlaid with Zone Area Map of Kaltara.

Figure 5 above is very important map, which explains the area of seaweed cultivation, the area of captures fisheries, port, settlement, and of course the cruise channel.

From Figure 5, it's visible that the area occupied by seaweed cultivation is already outside the zone, including taking capture fisheries zones, the longer the wider. In that Fig 5, it happened in 2022 till 2023, based on Satellite Image Santinel 2A.

It can be predictable after looking at that image, conflict between stakeholders often happen, especially between seaweed cultivators with others (with fisherman caught, and with other marine users). This can be explained as follow : The occurrence of violations of the RZWP3K can be explained as follows:

In fact, the initial condition of seaweed farmers is a group that obeys the rules. This can be proven during the socialization of the RZWP3K, the 2-way dialogue went very well, and the farmers also understood that there were rules that limited them from cultivating seaweed. However, since the enactment of Law no. 23 of 2014 concerning regional government, where the authority of the sea from 0 to 12 nautical miles is the authority of the province, the frequency of supervision at sea by the provincial fisheries and maritime service is very limited or very rare. The farmers finally tried to plant seaweed outside the designated zone and it turned out to be safe because they felt that no one was supervising, so they did it repeatedly so that the cultivation location was far from the designated one, getting further and further away.

In addition to zoning issues, the plastic waste problem is also as an impact of a lack of supervision. The amount of plastic waste reach approximately 20 tons per month. This unrenewable waste is very dangerous not only in the short term but will be more dangerous also in the long term, like picture below :

Figure 7: Plastic bottles of mineral water and the like before they're used as buoy.

In Figure 6, the length of seaweed rope is 20 to 25 meters, it needs 6 used plastic bottles of mineral water or the like, and they will last for as long as 2 times harvest, or less then 1 year.

The problem of used plastic water bottles used as buoys is one of the failures of supervision activities to achieve the second objective and fifth objectives as in Table 1. Using discarded plastic water bottles as buoys is a problem because it shows

Figure 8: Used plastic bottles of mineral water and the like before they're used.

that oversight efforts are failing in two key areas outlined in "Table 1" (presumably a document detailing objectives and goals):

• Second objective is Failure to raise awareness : Fisheries businesses are not aware enough of laws and regulations regarding responsible use of marine resources. They aren't understanding or following rules about what materials are acceptable to use in the ocean.

• Fifth objective is Failure to protect sustainability : This practice directly undermines the goal of preserving the long-term health and availability of fish stocks and the marine environment. Plastic pollution harms the ecosystem.

Essentially, people are using plastic bottles as buoys because they don't know (or don't care) that it's illegal and harmful to the ocean, and current oversight isn't correcting this behavior or preventing the pollution.

they are looking for items that can be used as seaweed cultivation buoys at a low price, easy to get and easy to operate.

Initially they used used oil bottles, used mineral water bottles and others. So the buoys vary in size and color, until later they prefer to use used plastic bottles of mineral water or energy drinks (carbonated, easily obtained illegally from neighboring countries by small ship). These two types of plastic bottles are the ones used until now.

Beside the failure of supervising to reach the second and fifth objectives like in the Table 1, Generally plastic bottle waste from seaweed cultivation, which commonly used

as floats, has significant environmental impacts in both the short and long term, for short term impact :

• Immediate Litter and Visual Pollution: Discarded or damaged plastic bottles quickly accumulate in cultivation areas, creating unsightly litter and harming the aesthetic value of coastal zones.

• Marine Life Hazards: Floating plastic waste can entangle marine animals or be ingested by fish and other organisms, causing injury or death.

• Water Quality Degradation: As bottles degrade or leak, they may release microplastics and chemical additives into the water, impacting seaweed growth and reducing the quality and quantity of the harvest.

For Long-Term Impacts:

• Microplastic Accumulation: Over time, plastic bottles break down into microplastics and nanoplastics, which are nearly impossible to remove from the environment. These particles accumulate in seaweed tissues and enter the food chain, posing risks to marine life and human health.

• Ecosystem Degradation: Persistent plastic pollution disrupts ecosystem functions, alters nutrient cycles, and can degrade coastal habitats, leading to loss of biodiversity and ecosystem services.

• Economic Losses: Microplastic contamination can reduce the market value of seaweed and related products, harm tourism, and increase the cost of environmental remediation.

• Socio-Economic Effects: The presence of plastic waste affects fisheries, shipping, and the reputation of seaweed farming communities, potentially reducing income and job opportunities in the long run.

According to Ansell and Gash, A governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets.

This definition stresses six important criteria: (1) the forum is initiated by public agencies or institutions, (2) participants in the forum include nonstate actors, (3) participants engage directly in decision making and are not merely “consulted” by public agencies, (4) The forum is formally organized and meets collectively, (5) the forum aims to make decisions by consensus (even if consensus is not achieved in practice), and (6) the focus of collaboration is on public policy or public management. This is a more restrictive

definition than is sometimes found in the literature. However, the wide-ranging use of the term has, as Imperial notes, been a barrier to theory building (Imperial 2005, 286). Since our goal is to compare apples with apples (to the extent possible), we have defined the term restrictively so as to increase the comparability of our cases.

From the Ansell and Gash definition which stresses six important criteria, collaborative governance is one way to improve the communication between members of provincial marine and fisheries service, and other stakeholders, include seaweed cultivators. So that, all stakeholders will play as their role in the seaweed cultivation stage, as can be seen in the Figure 8, and Figure 8 below.

Figure 1
A Model of Collaborative Governance

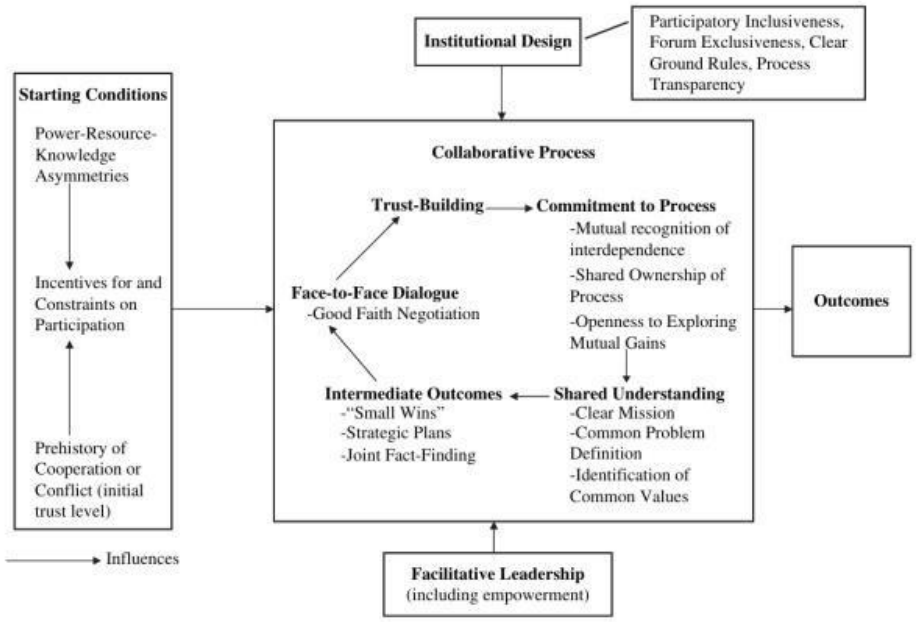

Figure 9: A Model of Collaborative Governance (Ansell and Gash, 2007).

Figure 8 provides a visual representation of our central findings. The model has four broad variables—starting conditions, institutional design, leadership, and collaborative process. Each of these broad variables can be disaggregated into more fine-grained variables. Collaborative process variables are treated as the core of our model, with starting conditions, institutional design, and leadership variables represented as either critical contributions to or context for the collaborative process. Starting conditions set the basic level of trust, conflict, and social capital that become resources or liabilities during collaboration. Institutional design sets the basic ground rules under which collaboration takes place. And, leadership provides essential mediation and facilitation for the collaborative process. The collaborative process itself is highly iterative and nonlinear,

and thus, we represent it (with considerable simplification) as a cycle (ansell and Gash, 2007).

Figure 10: The Role of Stakeholder in Developing Seaweed Cultivation in Nunukan.

Figure 9. above, and also look at to the Figure 1, explains that Broadly speaking, there are 3 stages in the development of seaweed cultivation. First stage is Pre Production, Second stage is Production and the final stage is Post Production. In that figure is also explained about the task of each institution.

In the Figure 9, at the Pra Production Stage talks about determination/location arrangement, zoning, permits, institutional of Cultivation, HRD of Cultivators, and capital.

The problem is that initially, seaweed farming in Nunukan started as early as 2008, undertaken by farmers who were previously fishermen, fish catchers, and only a small portion who were neither, with an education background that is mostly limited to primary and secondary education. Therefore, their knowledge about resource sustainability is limited, there was no collaboration, and even minor issues in the field could trigger larger conflicts due to ethnic differences. For example, seaweed farmers generally belong to ethnic groups from Sulawesi, while the initial seaweed catchers mostly belong to the indigenous people of Nunukan.

At that time, there were no plans as seen in Stage 1 pre-production, so at this stage, collaboration among stakeholders is needed, starting with facilitating the establishment of cultivation institutions, followed by enhancing human resources to improve communication with other stakeholders and improvement of cultivation techniques. The benefits of the two activities above are that with good communication, conflicts which initially often happen in the field can be minimized, and with the improvement of

knowledge in cultivation techniques, the production achieved is expected to increase, thereby improving the level of welfare. In addition, it can reduce the knowledge gap with government institutions, which results in making it easier for the government to collaborate.

In the production stage, if collaborative governance through supervisory community group (POKMASWAS) in the supervising of seaweed cultivation among all stakeholders could be done, some problems if don't say negative impact of seaweed cultivation like overlapping zones as in the fig 3 where others zone are occupied by seaweed cultivation, plastic waste (approximately 20 tons per month) and security of the area from pirates (normally operates in the night, because of seaweed trawler), will be minimized. It means that seaweed cultivation will run smoothly, and the sustainability of resources will last longer. This is the real role of Supervisory Community Group (POKMASWAS).

Based on our experiences, previous conflicts that often occurred specifically between seaweed trawlers and seaweed cultivators can be minimized by strengthening the institutions between them, namely by facilitating the establishment of associations for both seaweed cultivators and seaweed trawlers. The advantage of forming associations is that it not only facilitates the dissemination of regulations but also eases communication in case conflicts arise in the field. Each association deliberates and the results of that deliberation become the material for negotiation in discussions with other associations. In this case, the government, represented by the fisheries service, acts as a facilitator to resolve those conflicts. At the beginning of the deliberations, what is always emphasized to all participants is that there should be no lies among us.

It's easier when we're open dan honest in the discussion, so that it can help and fasten to find the best solution, that at least no one is disadvantage and of course, the result will be gained. Furthermore after obtaining the final result, we can make further step by building commitment to manage seaweed cultivation better in the future.

If it's seen closer, some of the participants in the deliberation are also members of POKMASWAS, which means that this is where the role of POKMASWAS is not only to carry out self-supervision by the community but also to participate in conflict resolution.

After zoning problem have been resolved by building the agreement which tight all stakeholders, further step is how to overcome plastic waste at least to ease water pollution.

Regarding the issues of used plastic waste from buoys, collaboration among all stakeholders must be carried out, starting from licensing and license extensions, so

that if the handling of used plastic bottle waste from seaweed buoys is not good, then the extension cannot be carried out until there is an improvement in handling the used plastic bottle waste.

Efforts such as recycling, converting plastic waste to fuel via pyrolysis, or switching to biodegradable materials like bamboo for floats are being explored to reduce these impacts, or more durable materials should be used for floats, which can reduce the rate of pollution in the waters, and it has been tried.

References

[1] Nuryadi AM, Rosmalah S, Muthalib ZA, Hartati WO. Zarliani, Syahria Rizka, Muh I. Zulkarnain, Dewa A. Rijanto. "A management design for cooperative- based seaweed cultivation business in Southeast Sulawesi Province. Indonesia: AACL Bioffux; 2023. pp. 1878–86.

[2] Ansell C. No. 4. C Alison Gash, 2007, Collaborative Governance in Theory and Practice. Journal of Public Administration Research and Theory. Volume 18. Berkeley, USA: University of California; 2007. pp. 543–71.

[3] Decree of the Regent of Nunukan No. 188.45/486/X/2021 concerning the Determination of Superior Products, Mainstay Products and Potential Products for2001-2026:

[4] Emerson K, Nabatchi T, Balogh S. ' Integrated Framework for Collaborative Governance. J Public Adm Res Theory. 2012;22(1):1–29.

[5] Thushari GG. 1, J D M Senevi rathna, Plastic pollution in the marine environment, 2020, Affiliations collapse Affiliation, Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka. PMID: 32923712 PMCID: PMC7475234 DOI: https://doi.org/10.1016/j.heliyon.2020.. e04709. National Library of Medicine

[6] Indonesia's Blue Economy Roadmap 2023.

[7] Investment Coordinating Board (BKPM) regulations and guidelines.

[8] No MD. 16 of 2022 on Seaweed Cultivation Villages and Industrialization Zones. Jakarta. 2022

[9] Alfian M. Pemberdayaan Petani Rumput Laut oleh Dinas Perikanan. IPDN; 2019.

[10] Peraturan Daerah (Perda) tentang Rencana Zonasi Wilayah Pesisir dan Pulau-Pulau Kecil (RZWP3K) di Provinsi Kalimantan Utara adalah Perda Provinsi Kalimantan Utara Nomor 4 Tahun 2018 tentang RZWP3K Tahun 2018-2038.

[11] Peraturan Gubernur Kalimantan Utara No. 26 Tahun 2024 tentang Pengelolaan Rumput Laut.

[12] Seaweed processing industry development in Nunukan, Indonesia Business Post, 2022.

[13] Seaweed processing industry development in Nunukan. Indonesia Business Post, 2022-09-07..

[14] Setia Usaha Group Business and Seaweed Cultivation. Yayasan Konservasi Alam Nusantara (YKAN).

[15] Strategies for Indonesia's Seaweed Aquaculture Policy to Enhance Competitiveness and Sustainability, The Nature Conservancy, 20232.

[16] World Bank Team Review Potential Seaweed In Nunukan. VOI, 2023-11-02.

[17] Tri YY. Ananda1, *, Gabriela Elsandika, Post Seaweed Cultivation Bottled Utilization for Fuel Alternative Production by Pyrolysis Method: A Review.,Fish Processing Technology Department, Politeknik Negeri Nunukan, PNN, Nunukan, Indonesia, 2Physic Department, Universitas Palangka Raya, UPR, Palangkaraya, Indonesia. *Corresponding author. Email: yosepytananda@pnn.ac.id. Corresponding Author Yosep Yuswanto Tri Ananda. Available Online 17 February 2024 dalam Proceedings of the International Conference on Applied Science and Technology on Engineering Science 2023 (iCAST-ES 2023), atlanta press.