

Strategies for Indonesia's Seaweed Aquaculture Policy to Enhance an Established Industry

POLICY RECOMMENDATIONS

1. **Streamline licensing processes:** Simplify the licensing process for seaweed farming to lower entry barriers and provide free assistance and support through extension officers to facilitate application procedure and compliance for small-scale farmers.
2. **Promote cooperative development:** Promote the formation and empower cooperative farmer groups through targeted capacity building initiatives to increase market bargaining power and ensure equitable benefits.
3. **Enhance infrastructure investment:** Invest in infrastructure development and enhance stakeholder coordination across the supply chain (seed banks, nursery networks, value added processing) and promote transparency, reliability, and quality in supply chains, thereby enhancing the global competitiveness of Indonesian seaweed products.
4. **Increase funding for research and innovation:** Enhance government funding and support for seaweed-specific research and innovation, encouraging collaboration between private sector entities and academic institutions to address practical farming challenges and drive industry advancements (e.g. breeding high quality, climate resilient strains).
5. **Empower women and youth in seaweed farming:** Develop and implement supportive programs aimed at increasing the participation of women and next generation in the seaweed farming sector, including providing incentives for business startups and promoting inclusiveness within cooperatives.
6. **Enhance training on best seaweed farming practices:** Implement comprehensive training programs on best farming and post-harvest practices, focusing on the effective utilization of equipment and improving organizational skills to enhance productivity and sustainability.
7. **Promote sustainable seaweed farming practices:** Encourage and support the adoption of environmentally friendly cultivation practices, including the use of biodegradable alternatives to plastic bottles, to address plastic pollution and promote sustainable farming methods.

An Established Seaweed Industry

Indonesia, an archipelagic nation with extensive coastal areas, is a leading player in the global seaweed aquaculture industry, benefiting from its diverse marine environment which provides ideal conditions for seaweed farming. The industry significantly contributes to the livelihoods of 90,000 to 120,000 families, cultivating on average 0.25 hectares, producing 2-6 tons of dried seaweed annually¹. Key species cultivated include Cottonii (*Kappaphycus alvarezii*), Spinosum (*Eucheuma denticulatum*), and Gracilaria ssp. Most of Indonesia's seaweed production is destined for the hydrocolloids market, deriving carrageenan and agar.

The cultivation methods vary significantly across regions, with most employing the long line method, while fixed off-bottom techniques are mainly used in Nusa Tenggara Timur (NTT) and Lembongan¹. The remote locations of many farm regions require a robust network of local collectors and traders, facilitating logistics but also presenting challenges. Seasonality and infrastructure limitations, such as a lack of drying platforms, hinder production and reduce the quality of raw dried seaweed.

Indonesia's Seaweed Farming Industry - A Mature Sector

Seaweed Production (Tonnes Wet Weight)

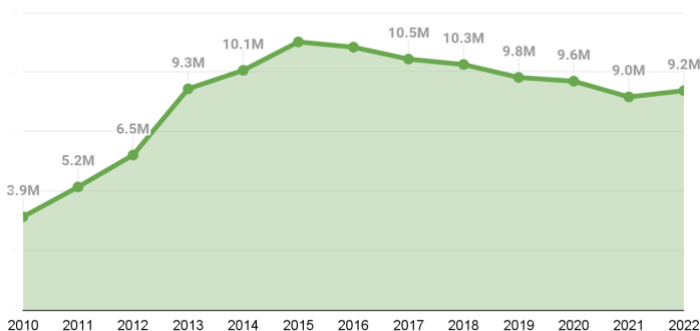


Figure: Seaweed aquaculture production data for Indonesia. Graph is based on FAO data.

There is a significant lack of research on seaweed cultivars and no commercial hatcheries, hindering the development of more resilient and productive strains.

Despite these challenges, Indonesia's seaweed aquaculture holds vast unrealized potential, particularly in the Coral Triangle. Efforts to improve infrastructure, market access, and sustainable farming practices, coupled with increased research and development, could unlock further growth and economic benefits for the country's coastal communities.

Areas For Improvement & Opportunities for Indonesia's Seaweed Farming Policy

A thorough review of relevant literature and policies, combined with insights from expert interviews, was conducted to identify key areas for improving policies. The analysis focused on the regulatory framework, supportive infrastructure, research & innovation, and best management practices. Examining these four areas allowed for identification of the most important gaps and opportunities for policy development.

Regulatory Framework

Indonesia's Blue Economy Roadmap 2023² emphasizes the sustainable use of marine resources, including seaweed, for economic growth and social benefits, targeting a transition to a modern economy by 2045. The roadmap highlights seaweed as a key export commodity, focusing on enhancing its production, investment, and processing while promoting good manufacturing practices. The policy landscape for seaweed farming involves multiple regulations across national, provincial, and local levels³, with recent efforts to improve licensing, environmental management, and farmer support to ensure sustainable industry growth.

Areas for Improvement	Gain	Potential Barriers	Opportunities
Streamlining of the legal process	Promoting a simplified licensing system for seaweed farming activities will lead to more efficient processes and therefore potentially reduce the barrier of entry into the seaweed farming industry.	Limited awareness among farmers about the regulatory framework and its benefits can result in low acceptance from (particularly small-scale) farmers.	Enhancing dissemination and education on licensing benefits will encourage more small-scale seaweed farmers to obtain a permit. Streamlining the legal process and providing licensing assistance through extension officers and support on associated costs will further boost registrations and compliance.
Seaweed specific environmental regulations <i>(TNC's MEL framework¹ can be a valuable tool to guide government)</i>	A standardized seaweed farming monitoring system would enable the government to better advise farmers on optimal management practices, benefiting both the farmers and the environment.	Small-scale farmers might perceive new regulations as a burden (time / costs) and potentially as a barrier to entering the industry.	Future environmental regulations for seaweed farming will be essential for monitoring biodiversity (impact on seagrass beds and coral reefs) and ensuring biosecurity (water quality, contaminants). Additionally, these regulations will support plastic waste management efforts.

Supportive Infrastructure

The Blue Economy Roadmap² highlights the potential for Indonesia to enhance its marine product processing industry. Improving the efficiency and effectiveness of the seaweed supply chain in Indonesia requires streamlining processes, reducing bottlenecks, enhancing stakeholder coordination, improving infrastructure, and implementing fair and transparent policies.

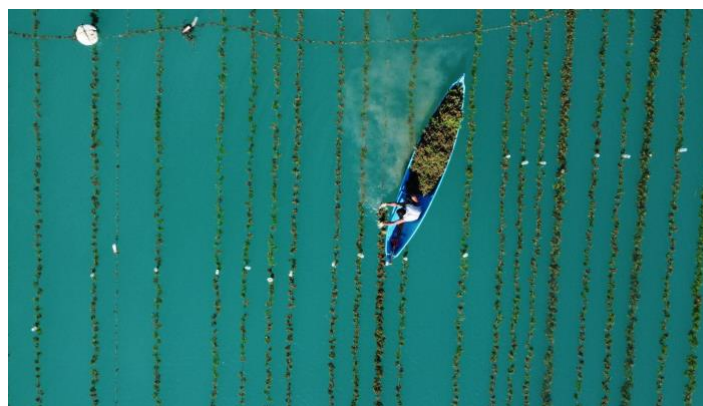
Areas for Improvement	Opportunities
Access to quality seed supply for farmers	Supporting the establishment of regional seed banks and nursery operations will ensure the availability of high-quality seed material throughout the year.
Strengthening of cooperative farmer groups	Promoting farmer groups through capacity building, especially for group leaders, will empower these groups and enhance farmers' bargaining power in the market.
Woman & youth support	Supportive programs for female /young farmers, including inclusiveness in farmer groups/cooperatives and business start-up incentives, can empower women in the seaweed farming industry.

¹ TNC's global monitoring, evaluation, and learning framework for regenerative and restorative aquaculture introduces a generic, data-driven method to understand the local environmental benefits of aquaculture practices as well as recommends practical, standardized approaches to measure and evaluate these benefits.

Research & Innovation

Indonesia has various institutions conducting seaweed-focused research and development, including universities, research centers, and governmental organizations like BRIN. The government has increased investments in seaweed-specific research initiatives, such as the launch of an International Tropical Seaweed Research Center and collaborates with international organizations to address challenges in seedling supply, environmental data monitoring, and sustainable practices.

Areas for Improvement	Opportunities
Forward-thinking government support for advancing seaweed research and innovation topics	Enduring public funding and investment into research and development agenda, as well as innovation ecosystems.
Increased collaboration between private and academic sector	Promoting applied research activities addressing concrete challenges at seaweed production levels, thereby mending the gap between research focus areas and the needs during practical farming application.



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Best Management Practices

Despite efforts from the government and organizations like UNIDO and TNC⁴ to develop guidelines and provide training for sustainable seaweed farming, there is a need to enhance dissemination of these materials and widen the reach of these capacity building activities as many farmers lack awareness of protocols and require more training on effective methods and equipment usage.

Areas for Improvement	Opportunities
Enhance dissemination of best practices guidelines & Standard Operating Procedures	Raising farmers' awareness of the available guidelines and their benefits (such as improved biosecurity and productivity) can encourage the adoption of best management practices.
Build out extension services	Increasing the number and providing specific training to enhance the expertise of extension workers will prompt the dissemination of best management practices in the sector.



SUPPORTIVE INFORMATION

General Policy Recommendations for the Different Stages of a Developing Seaweed Industry

Based on a thorough review of relevant case studies, enabling policies that facilitate and support the growth of seaweed aquaculture across various developmental stages — from emerging to growing and established sectors — were identified.



Emerging Industry

- Investment in innovation: Mandate funding for advanced R&D in seaweed farming and processing technologies.
- Establishment of sector leadership bodies: Form and support organizations to represent and advocate for the seaweed industry's interests.
- Incorporation of local knowledge: Integration of local knowledge systems into policymaking and sector research initiatives

Growing Industry

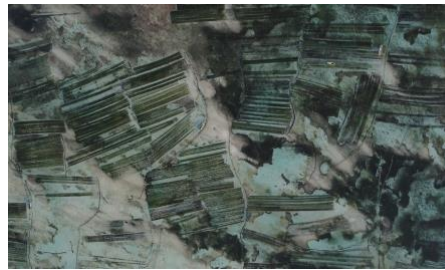
- Promotion of innovation: Policies to support the development and commercialization of new seaweed production methods
- Development of standards & regulatory frameworks: Enact regulations to standardize seaweed product quality & safety, ensuring consistency & market trust.
- Facilitation of market development & technology transfer: Develop strategies to explore market potentials and streamline the transfer of technological innovations from research to industry application

Established Industry

- Enhancement of Seed Quality: Develop and support policies that fund research aimed at improving the genetic quality of seaweed seed materials.
- Advancement of new farming methods: Promote and incentivize the development of scalable innovative seaweed cultivation technologies (e.g. land-based and off-shore).
- Continuous government support & infrastructure development: Ensure robust governmental backing through comprehensive regulatory frameworks, infrastructure investments, & dissemination of best management practices.



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FURTHER READING:

1. Hatch Innovation Services. Seaweed Insights. *Seaweed Insights* <https://seaweedinsights.com/> (2022).
2. The Ministry of National Development Planning & National Development Planning Agency. *Indonesia Blue Economy Roadmap*. (2023).
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4. The Nature Conservancy. *Coastal conservation and sustainable livelihoods through seaweed aquaculture in Indonesia: A Guide for Buyers, Conservation Practitioners, and Farmers*. (2019).
5. Hatch Innovation Services. *Viability Analysis for an International Tropical Seaweed Resilience Institute*. <https://hatchinnovationservices.com/tropical-resilience-center-report>. (2024).

CONTRIBUTION & ACKNOWLEDGMENT: This project was commissioned by The Nature Conservancy and delivered by Hatch Innovation Services to provide policy recommendations for Indonesia's seaweed farming policy. The authors would like to thank all stakeholders and experts interviewed for their invaluable insights on the current seaweed farming policy situation.

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