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POLICY BRIEF

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# Towards a More Inclusive and Sustainable Red Seaweed Industry



A researcher scrutinises seaweed for disease and infestation, Palawan, Philippines. | © Anicia Hurtado

## Highlights

- Smallholder seaweed farmers in low and middle-income countries produce a large proportion of the global produce of red seaweed (also called *eucheumatoid* seaweed) to feed the global market for carrageenan, an important gelling agent in many industries. However, they face major challenges linked to climate and environmental changes and economic pressures.
- The income smallholder farmers receive from red seaweed is often lower than income from other forms of aquaculture such as fishing or shellfish farming. It can also be more unstable in response to volatility in the global market for carrageenan.
- Some smallholder farmers rely on cultivating red seaweed for their livelihoods, but many grow it as part of a mixed short-term income generation strategy, combining seaweed production with other forms of work such as fishing and onshore farming.
- Men are more likely to be officially recognised as ‘the seaweed farmer’ and targeted with support packages. However, women play crucial roles in red seaweed cultivation and may well take on overall responsibility for its production. Support to the smallholder seaweed industry therefore needs to be designed to address the different needs of women and men seaweed farmers, based on gender-disaggregated evidence.
- Messages about biosecurity, genetic diversity and sustainable management practices in red seaweed production often fail to reach people who are farming seaweed on contract to larger farmers. This affects seaweed quality, production volumes and the overall stability of production, with implications for the seaweed industry as a whole and its potential for expansion.
- The commercially produced red seaweed value chain is complex and any efforts to develop it further requires an in-depth appreciation of the economic and environmental risks seaweed farmers face, how these risks intersect, and the risk management strategies men and women farmers develop.
- Promoting an inclusive and sustainable red seaweed industry requires a detailed and comprehensive understanding of the level, nature, and extent of different stakeholders’ involvement along the value chain, particularly the roles of women and those from marginalised groups in supporting or constraining growth.

In collaboration with



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## Background and Context

This brief provides a set of suggestions for improving consideration of gender and social inclusion in national and regional policies for red seaweed production. It draws on evidence from the four-year GlobalSeaweedSTAR research collaboration which collected and analysed evidence from red seaweed farmers in Malaysia, the Philippines and Tanzania (see 'Further Reading').

The red seaweed industry is expanding rapidly, particularly in countries in the global South. It is important to nudge the industry towards pathways for sustainable growth, ensuring it contributes to meeting Sustainable Development Goals 5 (gender equality), 8 (decent work and economic growth), 13 (climate change) and 14 (life below water). We outline a series of recommendations for national, regional, and global policymakers, for the global seaweed industry and for researchers. We follow this with suggestions for a collaborative research agenda that would make best use of expertise in academia, government, and the private sector to ensure that future seaweed policies promote both sustainability and equity.

For coastal communities in low and middle-income countries, seaweed farming can be an important part of a mixed income generation strategy. Crops of red seaweed (*Kappaphycus*

spp., *Eucheuma* spp.), which are used to produce carrageenan, grow rapidly, and require minimal inputs. This makes it suitable for a family enterprise as different members of the household can contribute to the activities required to farm and harvest seaweed and to post-harvest operations such as drying. Seaweed production can therefore be relatively easily combined with other forms of income generation.

However, small-scale seaweed farmers in the global South face two major challenges, the consequences of which vary according to geographical and socio-economic settings.

These include:

**Climate change and weather extremes.** Fast-onset hazards, such as typhoons, floods and El Niño/La Niña events can cause immediate damage to seaweed farms resulting in almost total production loss. Slow-onset changes to the farming environment can, over time, be equally significant. Msuya et al (2022) note that in Tanzania, for example, maximum sea water surface temperatures have increased from 31°C to 38°C in the past thirty years. Some seaweed farmers have been forced to move their production into deeper (and therefore cooler) water, but this requires a boat which many resource-poor producers cannot afford. And this rise in sea surface temperatures has been accompanied by a widespread worsening

occurrence of diseases such as ice-ice syndrome, or of infestations of epiphytes. These can reduce seaweed yields to a point where in some areas farmers have stopped growing seaweed altogether.

**Price volatility.** International prices for carrageenan are volatile because of the types of production risk outlined above and fluctuation in production volumes. This volatility is passed down the value chain to small-scale seaweed farmers, who generally have limited information on seaweed prices beyond those they are offered by collectors and traders and are unaware of why seaweed prices fluctuate. As noted in Lim et al (2021), this volatility reduces farmers' incentives to invest in seaweed production for the long term, which they could do by improving their cultivation strategies to mitigate environmental challenges such as changes in seawater temperature and increases in pests and diseases.

The net effect is that smallholder seaweed farmers in coastal communities tend to use seaweed farming as part of a mix of short-term income generation strategies, not as a long-term strategy to develop resilient livelihoods. This opportunistic approach affects seaweed quality, total production volumes and the overall stability of production, with implications for the seaweed industry as a whole and its potential for expansion.

## Gender and Social Inclusion in Seaweed Farming

There is considerable diversity in who is a seaweed farmer. This has implications for who is eligible to access support provided by local and national government agencies, by the seaweed industry, or by financial organisations. Key elements of this are listed below with the aim of enhancing our understanding of knowledge gaps and needs for further evidence.



A seaweed farmer inspecting her crop in Zanzibar, Tanzania.  
© Virginie Le Masson

**Gender roles in red seaweed production systems are context and location specific.** The nature of seaweed farming depends on its physical location, whether inshore or in deep water, with implications for gender roles in seaweed production. Hurtado et al (2021) and Suyo et al (2020) note that in some families, women make specific contributions to the family seaweed farm, such as tying plants to the lines,

cleaning or drying the harvested crop; combining these with childcare or other work to support the family. In others, women can perform most, if not all the activities related to seaweed farming. However, in some countries (such as Tanzania), women’s social status may mean that they are less likely to own boats or to know how to swim - which limits their ability to fully participate and to implement improved farming practices. Understanding women’s specific contributions to seaweed farming requires a nuanced and contextualised appreciation of the gendered division of labour, and of women’s collective work. Without this, women may not be officially recognised as seaweed farmers, and their specific needs and interests will be overlooked.

**Eligibility criteria for formal support systems.**

The criteria for who is eligible for government

support has led to a complex mix of formal and informal mechanisms in the seaweed sector, which is often influenced by local power politics. For instance, Asri et al (2021) note how Malaysian small-scale seaweed farmers might supply seaweed to larger farmers, either via contract-based relationships or on an ad-hoc basis. Some farmers might develop direct relationships with collectors, who aggregate production before selling it into the national, regional, or global markets. In the Philippines, Suyo et al (2020) show how some farmers collaborate in extended-family groups or through other social networks before selling to traders. Suyo et al (2021) describe how other farmers may form formal co-operatives to help share costs of inputs and aggregation, with or without government support. This complexity means that the balance between formal and



**Figure 1.** The basis of a sustainable, resilient, profitable, equitable and inclusive red seaweed industry. Source: Authors

informal trade can often be unclear: it is challenging to determine who exactly is farming seaweed and how they relate to others along the seaweed value chain. This in turn makes it difficult to encourage the development and spread of new farming practices or to design and roll out appropriate credit and insurance facilities for smallholder seaweed farmers.

These issues also have implications for how the red seaweed industry can ensure that it is environmentally sustainable in the long term,



A researcher interviews a seaweed farmer in Sabah, Malaysia.  
© Nurmaisyamimi Ramli

that its contribution to equitable economic growth in coastal communities is valued, and that it helps advance the global sustainability agenda. In Figure 1 we summarise four sets of actions to help the industry address SDGs 5 (gender equality), 8 (decent work and economic growth), 13 (climate change) and 14 (life below water). We suggest a set of focused actions for the global seaweed industry and for national, regional, and global policymakers; and a

collaborative research agenda to provide the appropriate evidence for decision making.

## Recommendations

While the focus of this policy brief is on *eucheumatoid* seaweeds, many of its messages are applicable to wider seaweed production.

**For national policymakers:** Seaweed production could make major contributions to economic growth in coastal communities, to regenerative aquaculture and to reducing the global carbon footprint. The discovery of novel applications of the compounds found in seaweed holds potential for newer markets, but this will require significant investment in improving quality standards and consistency across all production systems, and in strengthening traceability along different value chains. Six key actions are:

- *Collaboration and collaborative planning.* Working with industry and academia to develop a clear picture of all seaweed resources available and their potential uses in different value chains, to map needs and identify the scale of strategic investments in key areas such as biobanking of seaweed genetic resources to ensure a steady supply of bio secure seaweed seedlings.
- *Acknowledging and addressing equity issues.* Recognising that gender and social

inclusion are critical to ensuring the development of an equitable seaweed industry and that decisions are based on appropriately disaggregated data so that decisions and support systems are fair and inclusive.

- *Mapping seaweed farmers' risks and vulnerabilities.* Understanding the needs of all small-scale seaweed farmers—men and women and to introduce stability through mechanisms that reduce profit volatility in seaweed production (such as insurance), to encourage farmers to invest over the longer-term in environmentally sound production processes that do not disadvantage their own health. This will help farmers avoid entering economically disadvantageous relationships with traders and contribute to local economic growth in coastal regions.
- *Implementing and communicating national quality standards for raw and semi-processed seaweed* to raise overall quality and bring clarity to farm-level pricing. This could encompass programmes to develop networks of collection centres to help ensure standards are met and damp down local price volatility. Developing national biobanks would help ensure that bio secure, high quality seaweed seedlings are routinely made available to all seaweed farmers.

- *Encouraging the seaweed industry to build up long-term relationships with seaweed farmers,* so that those farmers can invest in more sustainable production techniques. This might involve regularising permissions to operate seaweed farms, encouraging the formation of co-operatives and/or formalising rights to seaweed farming locations.
- *Emphasising value creation as close to the farm as possible to retain that value locally and contribute to local economic growth.* This could include supporting efforts to diversify the range of products from seaweed or developing local seaweed biorefineries which could supply different global value chains.

**For the global seaweed industry:** The challenge is to build local seaweed-based industries that are resilient to global price volatility for seaweed derivatives and that pass on sufficient price stability to farmers to encourage them to consider sustainable seaweed production as a long-term livelihood strategy. Suggestions include:

- *Working with policymakers to promote seaweed genetic diversity and biosecurity,* contributing to the development of national and regional biobanks, and ensuring that all farmers can access bio secure seaweed seedlings.

- *Acknowledging gender and social inclusion as important contributors to the development of a sustainable and equitable seaweed industry*, understanding how seaweed cultivation fits within broader livelihood strategies so that farmers' varied risk management strategies can be incorporated into industry's relationships with farmers and with governments.
- *Emphasising and incentivising the use of environmentally sustainable and equitable techniques throughout the industry*, including investigating how digital technologies could strengthen traceability for seaweed quality, production sustainability and for gender equity and social inclusion.

**For researchers:** The research community has shown a keen interest in providing evidence-based advice to the rapidly growing seaweed industry around issues such as climate change mitigation and adaptation, biosecurity and conservation of genetic diversity, gender and other social issues associated with seaweed production. There are good opportunities for interdisciplinary research with real-world applications. Suggestions include:

- *Building appropriately disaggregated datasets at local, national, and global levels* to establish production and performance benchmarks that can guide research, policy,

and investment decisions and to develop a detailed understanding of risks and risk management throughout the seaweed industry. This will help develop metrics to show how seaweed cultivation is contributing to achieving SDGs 4, 5, 8 and 13.

- *Combining long-term interdisciplinary research on seaweed production with shorter-term, 'sprint' projects* to address critical issues identified by governments and industry. These would be well placed to understand (for example) the contribution seaweed cultivation could make to carbon sequestration and ocean health, the 'ridge to reef' relationships between terrestrial agriculture and seaweed cultivation or whether digitally enabled techniques for traceability can include issues such as gender, health, and equity.
- *Building relationships throughout the seaweed sector* to ensure that research findings are appropriately communicated to a range of audiences.

**For regional and global policymakers:** As countries and companies devise their own approaches to stimulating seaweed cultivation, there is a role for regional and global bodies to share information from multiple perspectives. This could include:

- *Channelling evidence and information along knowledge pathways.* Building knowledge sharing networks to bring together countries with extensive experience of seaweed farming and those interested in building a fledgling industry, ensuring that the private sector is represented in these debates.
- *Improving alignment with the sustainability agenda.* Sending out strong signals about the need for the seaweed industry to address issues of sustainability and inclusion under the banner of the Sustainable Development Goals. This could include defining seaweed's contribution to achieving Nationally Determined Contributions.
- *Co-creation, co-operation, and collective action.* Co-ordinating programmes of

research that respond to the needs of the aforementioned knowledge networks, both addressing long-term challenges and resolving immediate issues.

## Proposals for a Collaborative Research Agenda

Recommendations for improving biosecurity throughout the seaweed industry are highlighted in the global, regional, and national syntheses in Hurtado et al (2021), Lim et al (2021) and Msuya et al (2022). This section sets out four key issues that still require research so that governments can develop policies and practices which minimise the risks inherent in seaweed production, and so that all seaweed farmers are able to meet their basic needs, stabilise their income, and protect their farming assets:



A healthy seaweed farm in Zanzibar. | © Flower Msuya

## 1. Understanding who is really doing the seaweed farming.

Understanding the structure of seaweed farming in detail means knowing who is undertaking which tasks, the effects different tasks have on their physical and mental health, the formal and informal relationships seaweed farmers rely on, and how they respond to the mix of slow- and fast-onset hazards they face. Developing this detailed knowledge will help devise appropriate ways of incentivising actions that contribute to a sustainable, resilient, equitable, inclusive, and profitable industry. This means:

- a. Using disaggregated data to understand the specific contributions made by women, informal sector workers and other marginalised groups. This will help assess where, how & why their potential to make greater contributions to seaweed production is being reduced or blocked.

**Benefits:** A better and more detailed understanding of the structure of the seaweed industry helps forecast the likely impact of policies or support measures and to understand likely resource requirements. In addition, developing a better understanding the relationships between formal and informal farmers will help improve traceability in the seaweed value chain and, in the long run, to the spread of sustainable and profitable farming

practices.

## 2. Understanding what risks seaweed farmers face, how they intersect, and what coping strategies farmers can develop.

Data that is better disaggregated by gender and social group will help develop a more nuanced understanding of how different farmers respond to different economic, environmental and health risks, including climate change. This means:

- a. Recognising and building on farmers' existing knowledge about seaweed health and farming techniques, including their effects on farmers' physical health.
- b. Developing a better understanding of the specific risks faced by different groups of seaweed farmers and their attitudes to risk - including all forms of slow- and fast-onset hazards affecting production, recurrent and future risks of crop loss and/or insufficient crop quality.
- c. Researching the different attitudes, responses to risk and coping strategies; differentiating between those who are formally recognised as 'seaweed farmers' and those who are not, whether because of their gender, social group, or other factors. Combining this with emerging scientific understanding of biosecurity and environmental change to co-develop gender-sensitive and inclusive approaches

to seaweed production that better support farmers' diverse needs.

- d. Understanding how price volatility is transmitted down seaweed value chains, the effects it has on seaweed farming and whether a focus on product diversification could bring more price stability to seaweed farmers.

**Benefits:** More detailed and gender-sensitive research that builds on local knowledge will help ensure that both women and men seaweed farmers have equitable access to the resources they need to implement bio secure, sustainable seaweed production techniques. These could include better targeted credit and insurance and training, or cooperative models which increase farmers' control over seaweed resources, their market access, and their negotiating power.

### **3. Understanding how seaweed production could become a more reliable source of income on which poor families in coastal communities could secure their livelihoods.** This means:

- a. Researching how farmers can balance seaweed farming with other opportunities for income generation and what this implies for how they could invest in long-term strategies to improve biosecurity and increase sustainable seaweed production.

- b. Anticipating likely resource conflicts as the seaweed industry expands, identifying who is mostly likely to suffer and how best to implement reconciliation activities.

**Benefits:** greater awareness of how seaweed farming fits into family and community livelihood strategies will help provincial and national governments understand how to develop policies and regulations for coastal and marine environments which provide equitable benefits to all users.

### **4. Understanding how to reach farmers effectively with messages that resonate with their individual circumstances and knowledge.**

This means:

- a. Studying how gender and informality in the seaweed industry influence how messages around biosecurity, environmental sustainability and other forms of risk management could be most effectively co-produced and communicated to all farmers.
- b. Understanding the roles played by intermediaries, such as collectors and traders and how they can be involved in improved communication strategies.
- c. Paying careful attention to language and the four-way communication between seaweed.

**Benefits:** there are complex relationships between seaweed farmers, traders, and processors. If each group understands their specific role in improving biosecurity and environmental sustainability—and how their role relates to others—this will result in mutually reinforcing actions all the way along the seaweed value chain.



Seaweed farmers in Paje, Zanzibar | © Virginie Le Masson

## Further Reading

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