

SEAWEED POWER

UNLOCKING TANZANIA'S POTENTIAL FOR SUSTAINABLE GROWTH AND CLIMATE ACTION



PROBLUE



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ACKNOWLEDGMENTS

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The report benefited from contributions from the Ministry of Livestock and Fisheries (Tanzania Mainland), the Ministry of Blue Economy and Fisheries (Zanzibar), the Ministry of Trade and Industrial Development (Zanzibar), as well as various stakeholders involved in the seaweed sector from academia, non-governmental organizations, and the private sector.

The team would also like to thank colleagues who provided valuable input and guidance, including Christopher Ian Brett (Lead Agribusiness Specialist), Emma Isinika Modamba (Senior Agriculture Economist), Francisco Obrequé (Lead Rural Development Specialist), Frauke Jungbluth (Practice Manager), Harrison Charo Karisa (Senior Fisheries Specialist), Isabel Saldarriaga Arango (External Affairs Officer), Milena Stefanova (Operations Manager), Nathan Belete (Division Director), Robert Peck (Senior Operations Officer, IFC), and Sarah Ruth Ochieng (Operations Officer, IFC). The team extends its special appreciation to Clarity Global (editing) and Mariaan Zyl (Graphic Designer).

This publication was made possible thanks to the PROBLUE Multi-Donor Trust Fund.

EXECUTIVE SUMMARY



EXECUTIVE SUMMARY

This report provides an analysis of the seaweed sector in Tanzania, examining its historical evolution, current dynamics, and vast potential to drive sustainable economic growth, climate resilience, and socioeconomic development.



Introduced in 1989, seaweed farming now supports around 30,000 farmers in Tanzania, 80 percent of whom are women. The sector primarily cultivates *Eucheuma denticulatum* (spinosum) and *Kappaphycus alvarezii* (cottonii). These species are used to produce carrageenan, an additive used to thicken, emulsify, and stabilize foods and drinks. In Tanzania, production peaked at 17,900 metric tons (MT) in 2015 and fell to 11,223 MT in 2020 primarily due to challenges such as climate change. Production rebounded to 25,426 MT in 2023. The sector generates over \$6 million in annual export revenue, but it primarily relies on raw seaweed exports. Despite emerging value-addition initiatives, only 1 percent of seaweed is processed domestically, limiting the sector's potential for higher-value market entry.

The Tanzanian seaweed value chain involves many stakeholders, each segment facing unique challenges and opportunities.

The majority of Tanzania's farmers are concentrated in Zanzibar, which accounts for 70 percent of the nation's production. They predominantly cultivate *Eucheuma denticulatum* (spinosum) due to its higher resilience to climate variability. The average income for farmers is \$20–40 per month. This is far below the earnings of their counterparts in Southeast Asia, where incomes average three times higher due to advanced farming techniques and better pricing structures. Aggregators and buyers face logistical inefficiencies, with post-harvest losses reaching up to 20 percent due to inadequate drying techniques and poor storage conditions. Processing remains nascent, with about 40 small-scale processors producing items like seaweed soap, body creams, and oils. Exporters handling shipments to markets in Europe, North America, and Asia are constrained by pricing challenges.

Tanzania's raw seaweed sells for an average of \$386 per MT, significantly lower than the \$1,236 per MT in Malaysia and \$3,000 per MT in Taiwan.

Coordination mechanisms within the sector remain fragmented, but emerging initiatives highlight the potential for transformative governance.

There is no dedicated seaweed industry association in the country. However, the Zanzibar Seaweed Cluster Initiative has taken steps to unify stakeholders, promote value addition, and foster innovation. Despite this, the absence of a dedicated coordinating bureau limits the sector's ability to address critical needs such as seed production, quality assurance, and market links. Establishing a centralized governance structure could optimize resource allocation, enhance collaboration among actors, and streamline policy implementation. The report highlights the need to establish a dedicated coordinating unit to oversee seaweed development, improve sectoral governance, and ensure harmonized support for farmers and processors. The proposed multi-stakeholder platform would help align public and private sector efforts, reduce redundancies, and ensure that farmers and cooperatives receive consistent support.

The report identifies investment opportunities to address systemic bottlenecks and unlock the sector's full potential.

Transitioning to low-capital deep-water farming methods could increase yields by 30–50 percent while reducing vulnerability to rising sea temperatures. Public investment in proper drying areas; storage warehouses; water, sanitation, and hygiene facilities; and improved transport facilities at landing sites could minimize post-

harvest losses and improve seaweed quality. Early warning systems should also be developed to monitor environmental conditions, disease outbreaks, and market trends, providing timely alerts to farmers. Integrated multi-trophic aquaculture, which combines seaweed cultivation with fish and shellfish farming, offers the dual benefits of improved ecosystem health and diversified income streams for farmers. Spatial planning through marine zonation strategies is also recommended to optimize the use of coastal areas for tourism, aquaculture, and conservation while minimizing conflicts. Investments in solar drying technology can reduce the moisture content of red seaweed from 90 percent to 10 percent within 15 hours. Establishing centralized processing units for carrageenan and seaweed derivatives could increase domestic value addition from 1 percent to 10 percent of total production. The establishment of Zanzibar Seaweed Company's carrageenan processing facility is expected to generate over 300 direct jobs and indirectly benefit 50,000 farmers.

Expanding global demand for seaweed-derived products presents significant opportunities for Tanzania to diversify its exports and establish a competitive edge.

The global seaweed market was valued at \$17 billion in 2021. It is projected to grow to \$85 billion by 2026. Carrageenan, which accounts for 40 percent of seaweed-based product demand, is used extensively in food stabilizers and cosmetics. Other high-potential market segments include biofertilizers, animal feed, biodegradable plastics, cosmetics, and nutraceuticals. Demand for seaweed-based biofertilizers is growing rapidly, with the market expected to reach \$17 million by 2025. Alternative proteins, nutraceuticals, and sustainable packaging solutions represent additional high-growth segments. Demand in these segments is driven by increasing consumer preferences for eco-friendly and health-conscious products. They offer opportunities for Tanzanian seaweed to be incorporated into diverse value-added industries. Domestically, Tanzania's growing tourism industry presents an untapped market for seaweed-based goods, particularly in Zanzibar. However, capturing these opportunities requires targeted investments in branding, quality assurance, and certification to meet international standards.

Seaweed farming in Tanzania has profound socioeconomic and environmental benefits.

Beyond providing livelihoods for thousands of rural households, the sector is a significant driver of gender empowerment, with women leading most farming and processing activities. Environmentally, seaweed farming contributes to carbon sequestration, with studies estimating that 1 hectare of seaweed absorbs up to 10 MT of carbon dioxide annually. It also improves marine biodiversity by creating habitats for aquatic species. However, persistent challenges such as limited access to financing, lack of technical training, and conflicts with other coastal activities like tourism threaten to undermine its full potential. Addressing these systemic issues requires a holistic approach that integrates policy reforms, stakeholder engagement, and strategic investments.

The report recommends reforms to catalyze the sector's growth and maximize its economic and social impact.

Developing a dedicated national seaweed policy would provide a robust framework for addressing current inefficiencies and promoting sustainable growth. Training programs focused on modern farming techniques, quality control, and product development would empower farmers and cooperatives to compete effectively in global markets. Public investment in extension services is also recommended, particularly to strengthen farmer training, equip extension officers with the necessary technical expertise, and improve service delivery for post-harvest handling and marketing. Public-private partnerships, combined with research into disease-resistant seed varieties and innovative processing technologies, would further enhance the sector's productivity and competitiveness.

With targeted investments in quality improvement, value addition, and market expansion, Tanzania has the potential to strengthen its position in the global seaweed industry over time. However, addressing existing challenges, including improving access to finance, investing in domestic processing and branding, fostering better market links with international buyers, and ensuring gender-inclusive infrastructure in the sector, will be critical to achieving this goal. These interventions will help Tanzania's sector not only contribute to the blue economy framework but also become a driver of sustainable economic transformation and coastal community resilience.

TABLE OF CONTENTS

Acknowledgements	i
Executive Summary	ii
Table of Contents	v
List of Tables	vi
List of Boxes	vi
List of Figures	vii
Abbreviations	viii
1.Introduction	1
1.1 Background	2
1.2 Methodology	2
2.Overview of the Seaweed Sector	5
2.1 Global Overview	6
2.2 Regional Overview	8
2.3 Applications of Seaweed	9
2.4 Application of Spinosum and Cottonii	11
3. Value Chain Analysis of Seaweed in Tanzania	13
3.1 Value Chain Mapping	14
3.2 Core Value Chain	14
3.3 Enabling Environment	29
3.4 Natural Environment	32
3.5 Governance Analysis	33
3.6 Support Services	34
3.7 SWOT	36
3.8 Seaweed Climate Adaption and Mitigation Measures	37
4. Potential Market Sectors	43
4.1 Cooperative/Community Group Model	44
4.2 Medium- to Large-Scale Industries	46
5. Seaweed Adaptation and Mitigation Measures	59
5.1 Recommendations	60
5.2 Coordination Mechanism	64
Bibliography	70
Annex 1. Examples of existing processors in Tanzania	78
Annex 2. Potential investors for the seaweed sector	80
Annex 3. Case studies	82

LIST OF TABLES

Table 1:	Production and CAGR of Top 4 Seaweed Producing Countries	7
Table 2:	Perceptual Ranking of Products	12
Table 3:	Seaweed Prices on International Market (\$/MT)	25
Table 4:	Key Export Companies	27
Table 5:	Frameworks/Authorities related to the seaweed sector	30
Table 6:	Different Types of Protein Use and Price	49
Table 7:	Price of Protein	50
Table 8:	Perceptual Ranking of Carrageenan Products	57
Table 9:	Recommendations	60
Table 10:	Action Plan For A Multi-Stakeholder Platform	65
Table 11:	List of Stakeholders	68

LIST OF BOXES

Box 1:	Competitive Analysis of ZASCO	22
Box 2:	Examples of existing processors in Tanzania	23
Box 3:	Some exporters in Tanzania	28

LIST OF FIGURES

Figure 1:	Global Seaweed Production, 2019	6
Figure 2:	Global Trend of Seaweed sector, 2000–2021	7
Figure 3:	Volume Growth of Seaweed Production, 2000–2020 (MT wet weight)	8
Figure 4:	Proportion of Seaweed Production in Africa, 2018	8
Figure 5:	Overview of the Global state of Farming, Extraction, and Applications of Seaweeds	10
Figure 6:	Demand- Feasibility Metrix for <i>Spinosum</i> and <i>Cottonii</i> Products	12
Figure 7:	Seaweed Value Chain Map in Tanzania	14
Figure 8:	Activities of Core Value Chain Actor	14
Figure 9:	Seaweed Production Trend	15
Figure 10:	Seaweed Production Zanzibar and Mainland (MT)	15
Figure 11:	Trend of seaweed prices, 1993–2023	15
Figure 12:	Production Value (US dollar)	15
Figure 13:	China's Seaweed Production, 2011–2020	16
Figure 14:	Seaweed species <i>Eucheuma denticulatum</i> , <i>Kappaphycus alvarezii</i> , <i>Kappaphycus striatus</i> (L–R)	16
Figure 15:	Ice-Ice Symptoms: The Whitening of the Thallus	17
Figure 16:	Map of seaweed cultivation areas (highlighted in green)	29
Figure 17:	Commercial Seaweed Farming	38
Figure 18:	Integrated Multi-trophic Aquaculture	39
Figure 19:	Seasonal Dynamics of Seaweed Production at a Commercial Farm	40
Figure 20:	Potential Market Size of Seaweed Products	47
Figure 21:	Alternative Protein Market Size	51
Figure 22:	Capital Investment in Alternative Protein	51
Figure 23:	Types of Seaweed Bioplastic	53
Figure 24:	Europe's Bioplastic Market Size	54
Figure 25:	Market Share by Application	54
Figure 26:	Top 10 Importers of Carrageenan by Value, \$ Million, 2023	55
Figure 27:	Market Share by Application, 2023	56
Figure 28:	Capital Investment and Profitability Matrix for Carrageenan Products	56

ABBREVIATIONS

DW	Dry Weight
FAO	Food and Agriculture Organization
FW	Fresh Weight
GoT	Government of (the United Republic) of Tanzania
IFAD	International Fund for Agricultural Development
IMTA	Integrate Multi-Trophic Aquaculture
IUCN	International Union for Conservation of Nature
JUWAMWAZA	Jumuiya ya Wakulima wa Mwani Zanzibar
KOICA	Korea International Cooperation Agency
MZF	Milele Zanzibar Foundation
MRIC	Mauritius Research and Innovation Council
NGO	Non-governmental Organization
RDS	Raw Dried Seaweed
RGoZ	Revolutionary Government of Zanzibar
SEA	South East Asia
TAFIRI	Tanzania Fisheries Research Institute
TIRDO	Tanzania Industrial Research Development Organization
TNC	The Nature Conservancy
UNIDO	United Nations Industrial Development Organization
VAT	Value Added Tax
WB	World Bank
WFP	World Food Programme
WIO	Western Indian Ocean
ZAFIRI	Zanzibar Fisheries and Marine Resources Research Institute
ZaSCI	Zanzibar Seaweed Cluster Initiative
ZASCO	Zanzibar Seaweed Company



An underwater photograph showing a dense thicket of brown and orange seaweed or kelp. The water is a deep, clear blue. Numerous bright, circular reflections of light are visible on the surfaces of the seaweed and the water, creating a shimmering effect. The perspective is from within the seaweed, looking slightly upwards and outwards.

1. INTRODUCTION

1. INTRODUCTION

1.1 Background

The global seaweed market is growing rapidly, particularly the cultivation of seaweed for animal feed production. A recent World Bank report estimates that 10 emerging global seaweed markets could grow to a combined value of up to \$11.8 billion by 2030. Seaweed has the potential to transform the animal protein industry by enhancing the nutritional value of livestock diets, improving productivity, and reducing methane emissions, making it a more sustainable and environmentally friendly solution.

In Zanzibar, seaweed is a source of revenue and employment, accounting for 17.8 percent of total export value in 2020. In 2024, the sector provided jobs for about 20,000 people, 80 percent of whom are women. Expanding job opportunities in seaweed production and processing is, therefore, crucial for the development of coastal communities.¹

Recognizing the global potential of the seaweed sector, the World Bank published the *Global Seaweed New and Emerging Markets Report 2023*. Building on this foundation, this market study aims to provide valuable insights into Tanzania's seaweed sector and outline pathways for the country to harness its full potential. The objective is to enhance understanding of the sector and offer strategic recommendations for tapping into emerging opportunities. Additionally, the World Bank is supporting this study through a program funded by the Korea-World Bank Partnership Facility and AqualInvest that facilitates knowledge transfer from the Republic of Korea to Asian and African countries, including Tanzania, to accelerate the transformation of the seaweed value chain.

This study aims to assess the performance, opportunities, and challenges within the seaweed value chain in Tanzania; map key stakeholders; and identify strategies for its development and competitiveness.

1.2 Methodology

The report provides a comprehensive analysis of the sector, focusing on key aspects of the market and value chain. This study employs a structured methodology that includes desk research, field visits, and virtual interviews to collect extensive data and insights. Through an in-depth literature review and engagement with industry stakeholders, the report aims to present a detailed overview of the seaweed market along the value chain, highlighting critical areas for consideration and potential opportunities for growth.

Desk research: The desk research phase delved into understanding the current state of the seaweed sector in Tanzania. This included examining its status, challenges, policy barriers, and potential for scalability. A comprehensive literature review was conducted to gather insights from studies and reports.

Field research: The field research was conducted across Zanzibar and Pemba Island from June 13 to 20, 2024. Over nine days, the research team engaged with diverse stakeholders throughout the seaweed value chain. Research locations were strategically selected based on their significance in Tanzania's seaweed production landscape, including key areas such as Buyu, Kijito Upele, Maisara, Bweleo, Mbweni, Malindi, and Paje in Zanzibar, and Wete, Limbani, Micheweni, Chokocho, and Mkoani-Kendwa in Pemba. The methodology incorporated key informant interviews with government agencies, including the Ministry of Blue Economy and Fisheries; structured interviews with exporters and processors such as C-Weed Corporation and Wete-Yusuf Omar Hamad; focus group discussions with farmers' associations including JUWAMPE and Furahia Wanawake Group; and technical site visits to research institutions such as the Institute of Marine Sciences.

¹ Reef Resilience Network 2022.

Workshop: Following the field research, a validation workshop was convened in Zanzibar on November 6, 2024, in collaboration with the Ministry of Blue Economy and Fisheries. The workshop encouraged participation, starting with an opening session featuring technical presentations on the seaweed sector overview, market dynamics, challenges, and strategic recommendations. This was followed by a structured discussion session where participants provided critical feedback and contextual insights. It concluded with a strategy development session focused on potential interventions supported by the World Bank's Tanzania Scaling-up Sustainable Marine Fisheries and Aquaculture Management Project. The workshop gathered 17 key stakeholders from diverse organizations in the seaweed sector.

Follow-up stakeholder consultations: To gather specialized technical information from key institutions, targeted stakeholder consultations were conducted on November 7, 2024. These consultations included meetings with the Ministry of Trade and Industrial Development, which focused on collaborative efforts with the United Nations Industrial Development Organization (UNIDO) to support the commercialization of seaweed products. Discussions with Coastal BioTech explored the development and market potential of seaweed-based biostimulants. At the Karume Institute of Science and Technology, consultations centered on technological innovations in seaweed processing equipment. Engagements with the Zanzibar Maisha Bora Foundation examined community-based support mechanisms for seaweed farmers. Together, these consultations provided valuable insights into institutional support structures, emerging technologies, and potential policy interventions aimed at addressing structural challenges within Tanzania's seaweed value chain.



2. OVERVIEW OF THE SEAWEED SECTOR



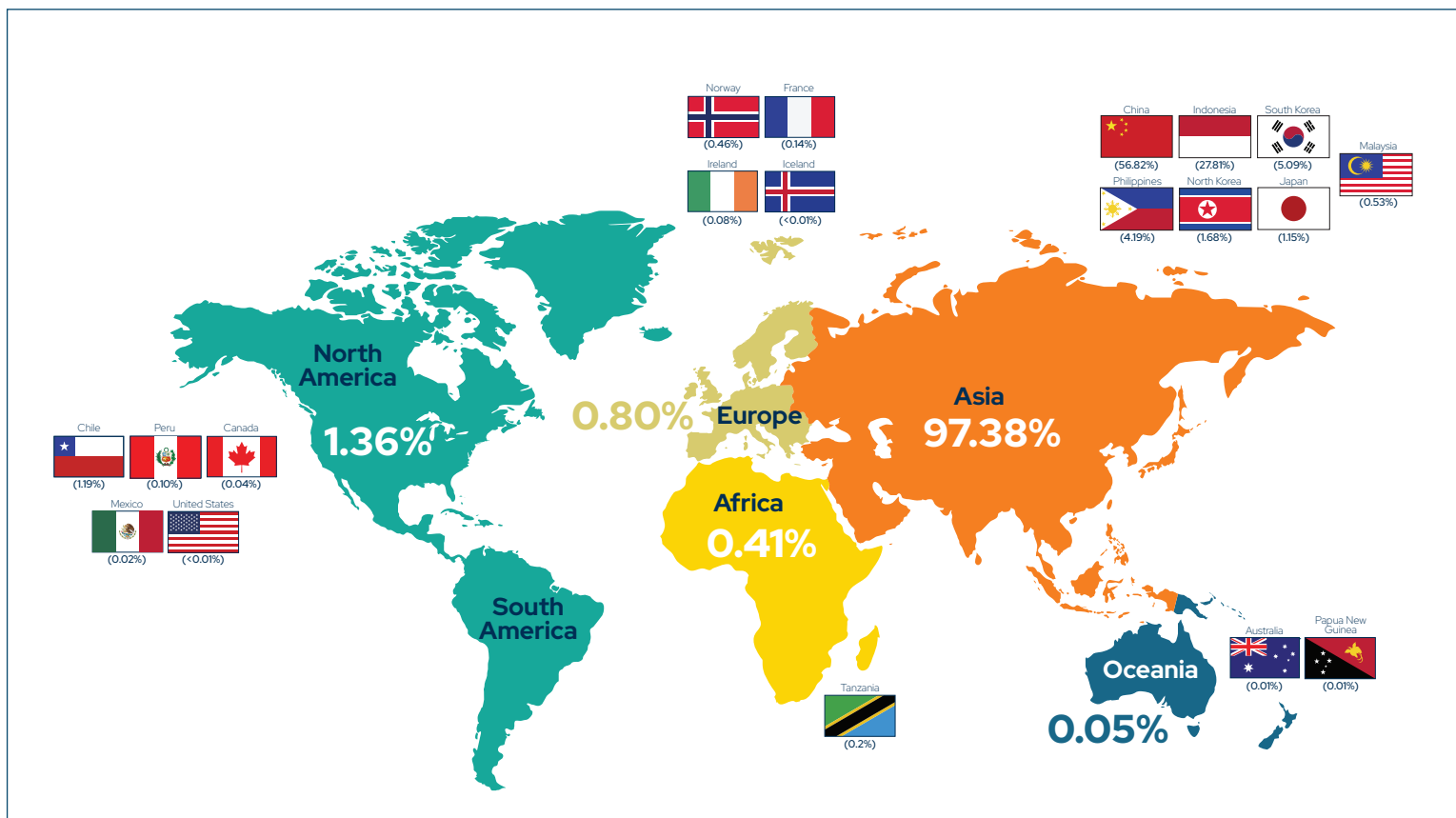
2. OVERVIEW OF THE SEAWEED SECTOR

2.1 Global Overview

Seaweed farming originated in East Asia, with documented cultivation in Korea between 1623 and 1649 and in Japan around 1670. By the early 1970s, the demand for seaweed and its products had surged, surpassing the available supply. Consequently, cultivation emerged as the optimal strategy for boosting production. Today, seaweed farming is the second-largest aquaculture sector globally, valued at \$14.7 billion in 2019 and producing 35 million metric tons (MT). It ranks second only to freshwater fish farming, which was valued at \$241 billion in 2023.²

Global seaweed production is heavily concentrated in East and Southeast Asia, where commercial farming has been established for over 50 years. Asian countries dominate both in terms of production volume and market value, holding over 98 percent of the global market share (Figure 1). China and Indonesia are the leading producers, accounting for 56 percent and 27 percent of the total volume of farmed seaweed, respectively. Korea and the Philippines follow, each contributing 4 percent to global production. In contrast, countries outside of Asia collectively produced less than 3 percent of the total volume of farmed seaweed in 2020 (Table 1).

Figure 1: Global Seaweed Production, 2019



Source: Zhang et al. 2022.

2. Cai et al. 2021.

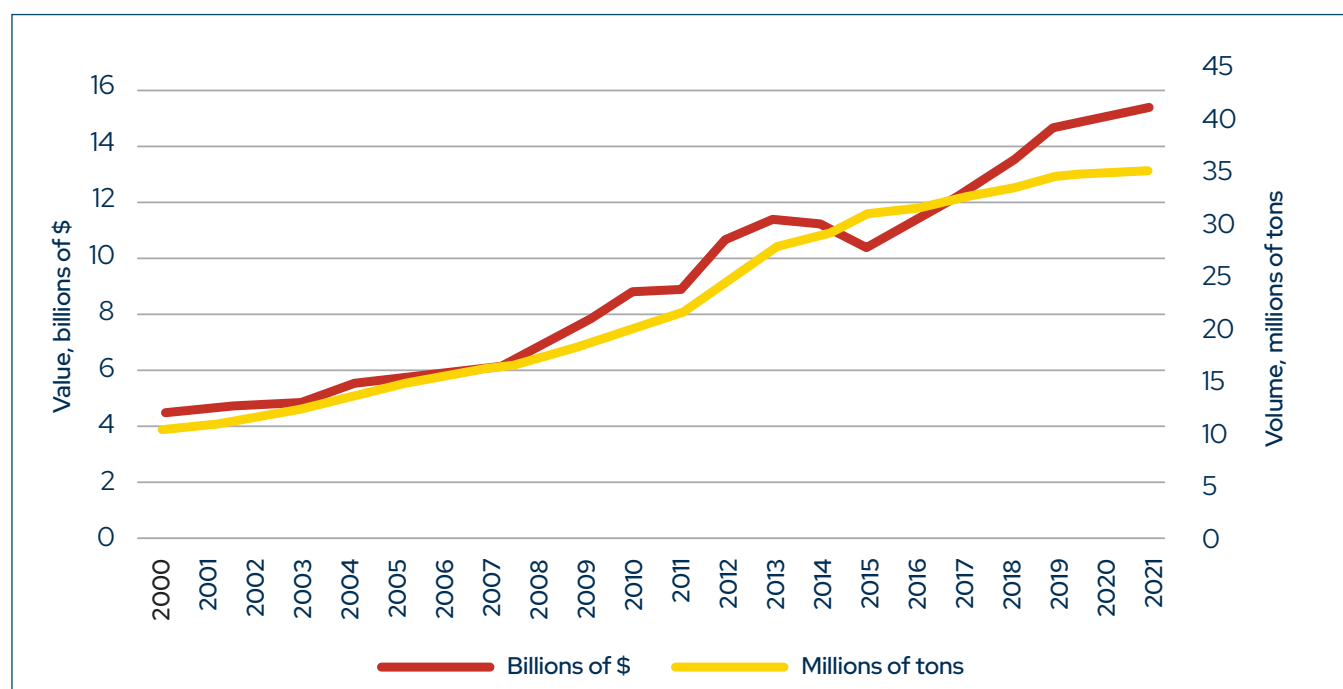
Table 1: Production and Compound Annual Growth Rate of Top Seaweed-Producing Countries

COUNTRY	PRODUCTION (1,000 MT)		COMPOUND ANNUAL GROWTH RATE
	2010	2020	
China	9,100	19,400	7.9%
Indonesia	3,900	9,500	9.3%
Philippines	1,800	1,500	-2%
Korea, Rep.	870	1,700	7%
Japan	420	370	-1.3%
Chile	12	18	4.2%
AFRICA			
Tanzania	125	90	-3.3%
Madagascar	4	8.1	7.3%
Kenya	0.04	0.85	35.8%

Source: Seaweed Insights n.d.

The total global algae production was 36 million MT of wet weight in 2020.³ This includes wild-harvested and farmed seaweed and microalgae, although the microalgae volumes are under 100,000 MT of wet weight and, therefore, less relevant. Commercial seaweed aquaculture started only about half a century ago, yet production volumes have grown rapidly and tripled in the last 20 years.

Figure 2: Global Trend of Seaweed Sector, 2000–2021



Source: UNCTAD 2024.

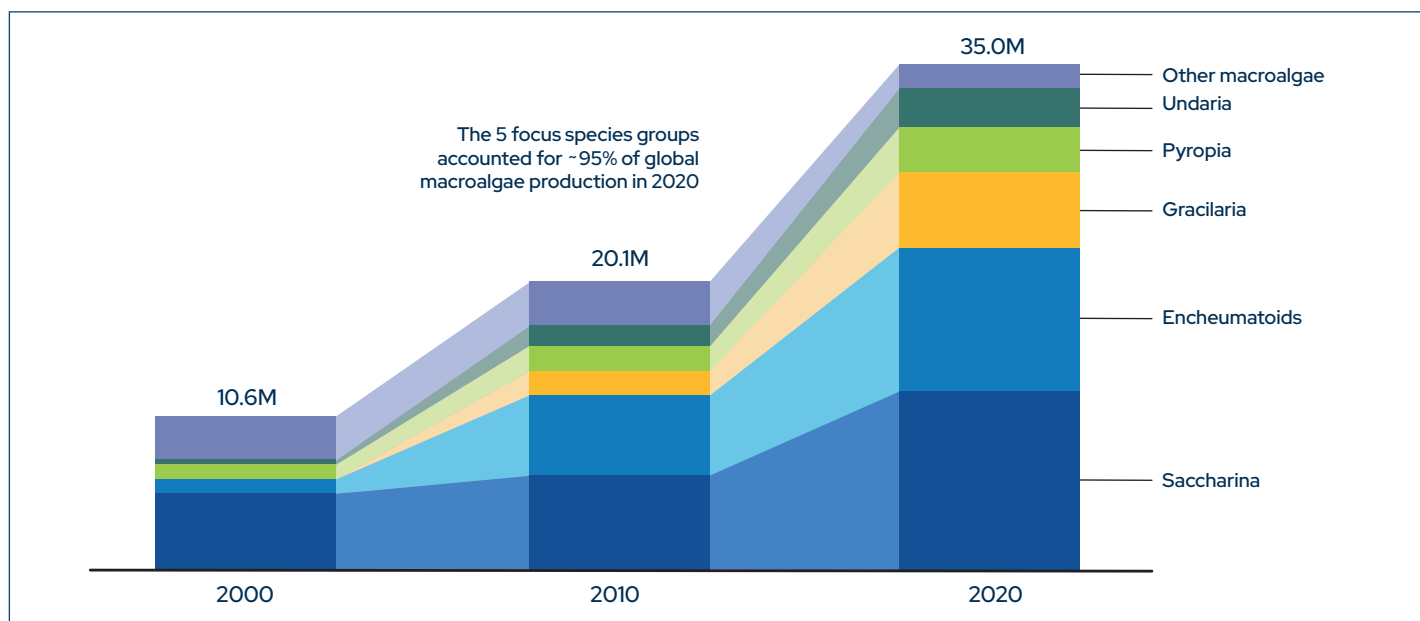
In 2021, global seaweed farming reached a production volume of 35.2 million MT (live weight), highlighting the rapid expansion of the industry. The market value of seaweed farming has experienced significant growth, increasing from \$5 billion in 2000 to \$17 billion in 2021. Projections suggest that this upward trajectory will continue, with the industry's market value expected to reach \$85 billion by 2026.⁴

3. FAO 2022.

4. United Nations Conference on Trade and Development 2024.

With wild seaweed resources reaching their limits for sustainable harvesting volumes, the future growth of the industry will depend on farming. There are more than 12,000 seaweed species worldwide;⁵ however, only 1 percent of them are used for commercial purposes. This highlights that there are many more wild species than cultivated ones. Natural business inclination leans toward cultivating a few species with established market demand and industrial applications. Ninety-five percent of current seaweed volumes come from the *Saccharina*, *Eucaumatoid*, *Gracilaria*, *Pyropia*, and *Undaria* species groups. The dependence on these groups has gradually increased in the past 20 years (Figure 3).

Figure 3: Volume Growth of Seaweed Production, 2000–2020 (MT wet weight)

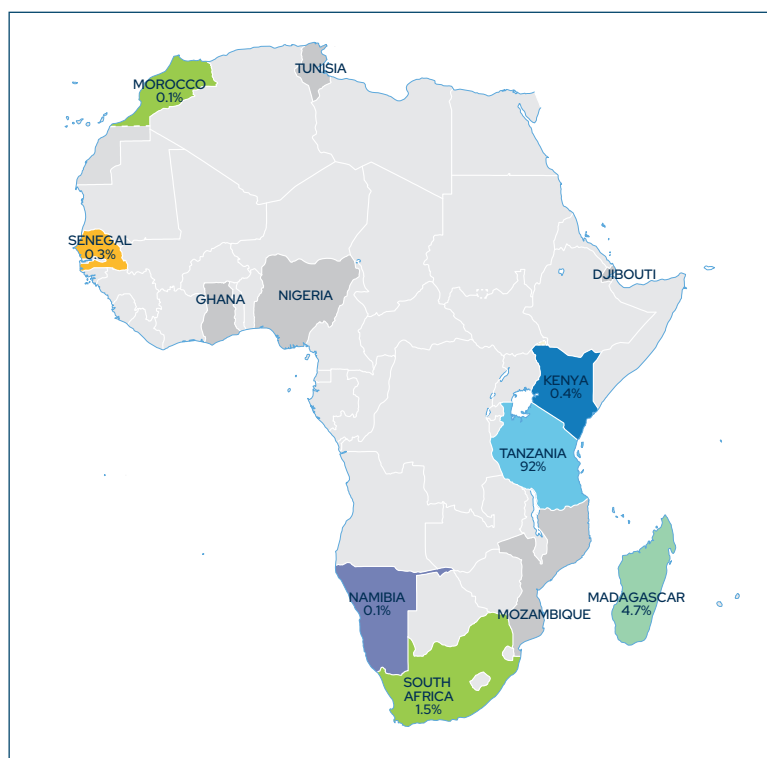


Source: World Bank 2023.

Figure 4: Proportion of Seaweed Production in Africa, 2018

2.2 Regional Overview

In terms of global production, Africa ranks second for aquatic plant production, producing 11,281 MT dry weight,⁶ which is only a fraction of the 3.2 million MT produced by Asia in 2018.⁷ Excluding Asia, Africa has significantly outperformed other continents since 2002, particularly with the production of the carrageen-producing red algae. To date, 13 African countries are involved in commercial seaweed farming and harvesting. Tanzania accounts for 92 percent of Africa's total seaweed production (*Eucauma* spp. and *Kappaphycus* spp.), with Madagascar (4.7 percent) and South Africa (1.5 percent) being distant runners-up.



5. Jayasankar 2024.

6. Note: Conversion factor from fresh weight to dry weight of 1:10.

7. FAO 2020.

Source: FAO 2020.

The East African Community (EAC) provides a common market framework that facilitates trade among member states. However, its relevance to Tanzania's seaweed industry remains limited due to low regional demand and consumption of seaweed in Africa. Unlike staple crops such as rice, seaweed is not traditionally part of local diets. Most of the seaweed produced in the region is exported to markets in Southeast Asia, Europe, and the United States. Similarly, while the African Continental Free Trade Area presents future opportunities, it will only become a viable market if local industries for processing and value addition are established in the region. As such, the role of the EAC and the African Continental Free Trade Area in the seaweed sector remains minimal in the short term.

2.3 Applications of Seaweed

Food industry: Today, seaweed is as widely used as vegetables. In many Asian countries, seaweed is an important part of human diets in its fresh, dried, flaky, and flour form. Commercial production of seaweed has been the focus of research in the past, but recently research has shifted toward high-value products with health benefits.⁸

Agriculture: The natural ecology of farmland is deteriorating due to excessive use of synthetic fertilizers and pesticides. Seaweed is abundant in unique mineral elements, nutrients, and biologically active chemicals. In recent years, agricultural output has played an increasingly vital role. Seaweed can be used as a protectant for diseases and as a stimulant in horticulture, promoting and enhancing all aspects of plant growth and development.⁹ For example, green seaweed ulva crude extracts and sulphated polysaccharides can combat common bean (*Phaseolus vulgaris* L.) anthracnose and considerably promote soybean growth.¹⁰ Furthermore, seaweed can boost a plant's ability to absorb nutrients, so improving plant quality. A new study showed that leaf spraying and seed soaking can significantly improve the yield and nutritional quality of carrots treated with seaweed (*Sargassum vulgare*) extract.¹¹

Seaweed is a valuable source of animal feed and agricultural chemicals. A variety of algal diets have been used to grow a range of fish, shrimp, crabs, and shellfish throughout the last two decades.¹² Many minerals remain in the waste biomass after cyanobacteria recover oil and carbohydrate, which can be used as fertilizers to improve various physical and chemical properties of soil while boosting yield and conserving fertilizer nitrogen. The Asia-Pacific region accounted for more than 15 percent of global seaweed fertilizer market revenue in 2017. By 2025, the global market for seaweed fertilizer is forecast to reach \$17.1 million. Organic agriculture is gaining traction, and the use of seaweed fertilizer is on the rise. As a result, seaweed processing is predicted to become a key resource guarantee in green and modern agriculture.¹³

Biological medicine: In medicine, seaweed has attracted a lot of attention as a potential source of various drug properties. In the last two decades, seaweed polysaccharides have been shown to have various promising biological activities, such as anti-tumor, immunomodulatory, antioxidant, anti-hyperglycemic, anti-cancer, antiviral, anti-fungal, anti-diabetic, anti-hypertensive, anti-inflammatory, ultraviolet-protective, and neuroprotection effects. Algal hydrogels and hydrocolloids are valuable components in the medical field, as they are widely used in wound healing, drug delivery, in vitro cell culture, and tissue engineering.¹⁴

8. Andrade et al. 2018; Batista et al. 2017; Martelli et al. 2020.

9. Battacharyya et al. 2015.

10. Paulert et al. 2009.

11. Mahmoud et al. 2019.

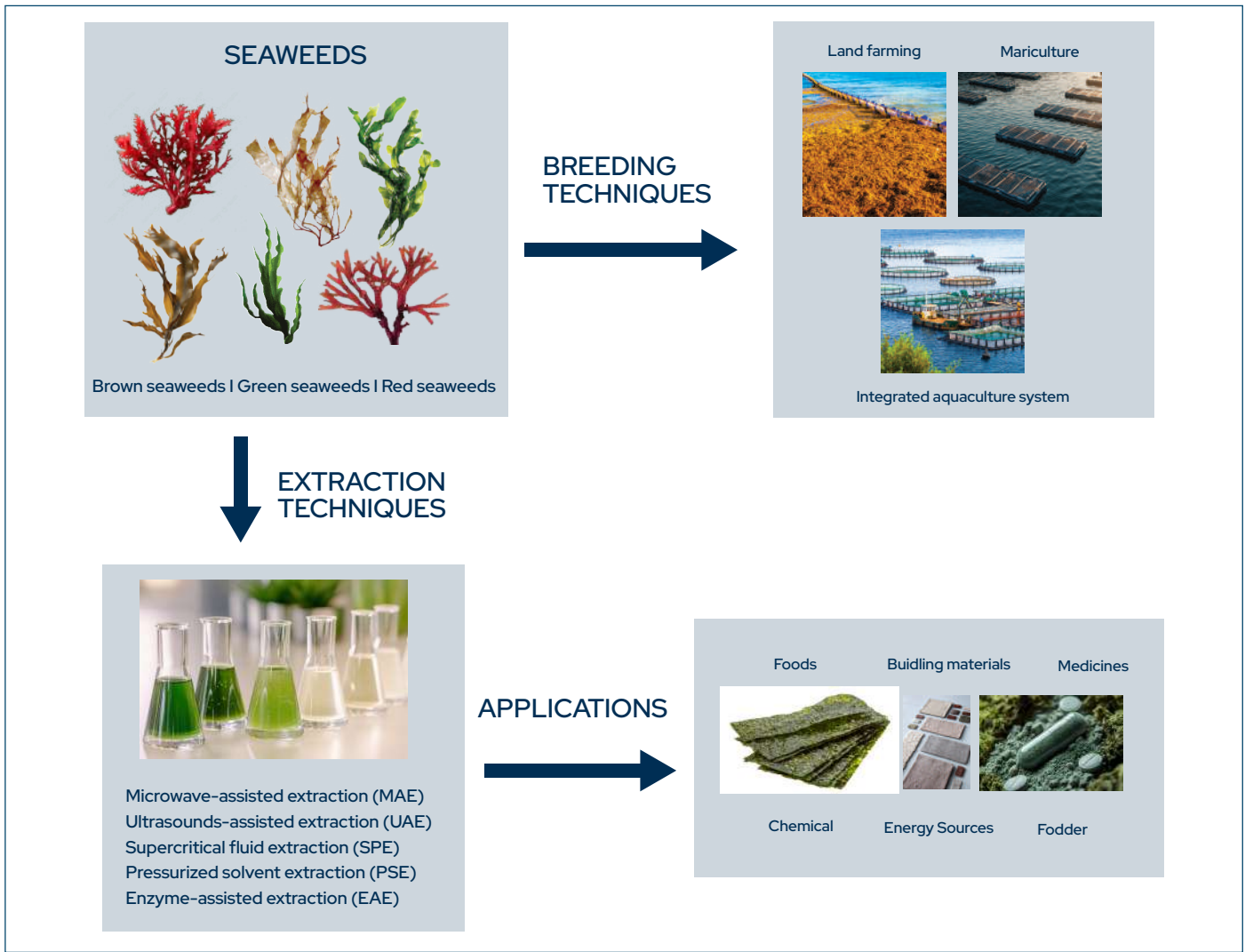
12. Kim et al. 2006.

13. Zhang et al. 2022.

14. Senthilkuma et al. 2017; Schepers et al. 2020.

Chemical industry: For nearly 20 years, the bioactive substances from macro and micro-algae have been popular in the cosmetic industry. Compared with terrestrial plants, algae contain many unique and novel bioactive ingredients such as polyphenol compounds, halogen, terpenoids, sterol compounds, unsaturated fatty acids, and polysaccharides in addition to vitamins, proteins, minerals, and trace elements. These ingredients are used as thickeners, water binders, antioxidants, and ultraviolet blockers in facial and skincare products (such as masks, eye creams, and sunscreens) to improve moisture balance, reduce wrinkles, and improve skin tone.

Figure 5: Overview of the Global State of Farming, Extraction, and Applications of Seaweeds



Source: Zhang et al. 2022.

Thus, seaweed could be a sustainable and profitable source of bioactive substances as the demand for cosmetics and cosmetic ingredients grows.¹⁵

15. López-Hortas et al. 2021.

2.4 Application of Spinosum and Cottonii

Carrageenan: This is a widely recognized hydrocolloid extracted from red seaweeds, particularly spinosum and cottonii. It is used extensively in the food industry as a thickening, gelling, and stabilizing agent. The strong demand for carrageenan is driven by its versatility and its application in dairy products, processed foods, and cosmetics.

Seaweed powder: Produced by drying and milling seaweed, seaweed powder is rich in vitamins, minerals, and antioxidants. Its demand is increasing, especially in health foods and supplements, owing to the growing consumer preference for natural and organic ingredients.

Nutraceutical: These dietary supplements derived from seaweed extracts are gaining popularity due to their potential health benefits, including anti-inflammatory and antioxidant properties. The demand for nutraceuticals is rising in response to a global shift toward preventive healthcare.

Cosmetics: Seaweed extracts are used in various cosmetic products for their moisturizing and anti-aging properties. The cosmetics market increasingly favors natural ingredients, leading to a high demand for seaweed-based formulations.

Food products: Seaweeds can be incorporated into a range of food products, including snacks, soups, and salads. The demand for healthy and sustainable food options is driving this trend, with growing consumer interest in functional foods.

Wastewater treatment: Seaweeds, including spinosum and cottonii, are being studied for their potential in bioremediation and wastewater treatment due to their ability to absorb nutrients and contaminants. The demand for sustainable wastewater treatment solutions is increasing, particularly in aquaculture and agriculture.

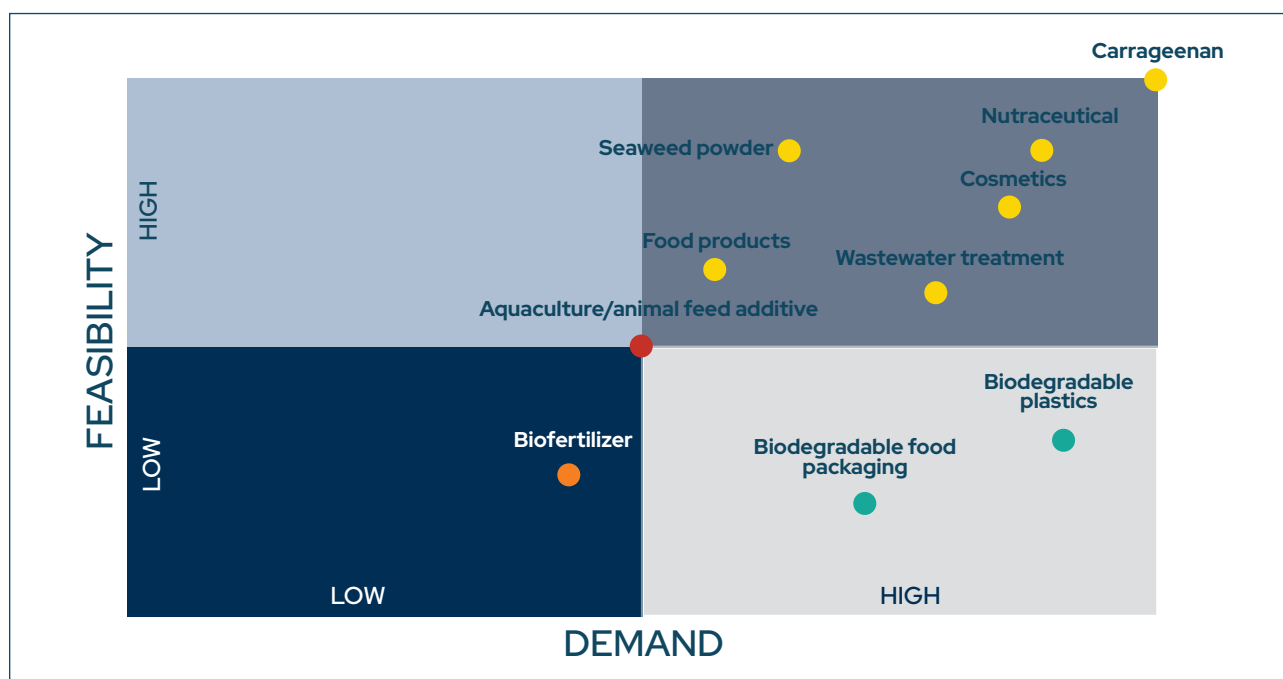
Aquaculture/animal feed additive: Seaweeds serve as a sustainable feed additive in aquaculture and agriculture, enhancing the nutrition of farmed fish, shellfish, and livestock. The growing global demand for seafood, sustainable aquaculture practices, and healthy livestock for food drives the feasibility of this application. Using seaweed as a natural supplement aligns with the increasing emphasis on eco-friendly farming and animal-husbandry techniques.

Biofertilizers: Seaweeds can be processed into biofertilizers, which improve soil health and promote plant growth through their nutrient content. The growing interest in organic farming and sustainable agricultural practices boosts the demand for biofertilizers.

Biodegradable food packaging: Biodegradable food packaging made of seaweed is becoming a viable alternative to traditional plastics. The global push for sustainable packaging solutions drives high demand for this innovation.

Biodegradable plastics: Similar to food packaging, biodegradable plastics derived from seaweed offer an eco-friendly alternative to conventional plastics.

Figure 6: Demand-Feasibility Matrix for *Spinosum* and *Cottonii* Products



Source: Based on author's analysis.

Note: Products derived from the processing or application of carrageenan are excluded.

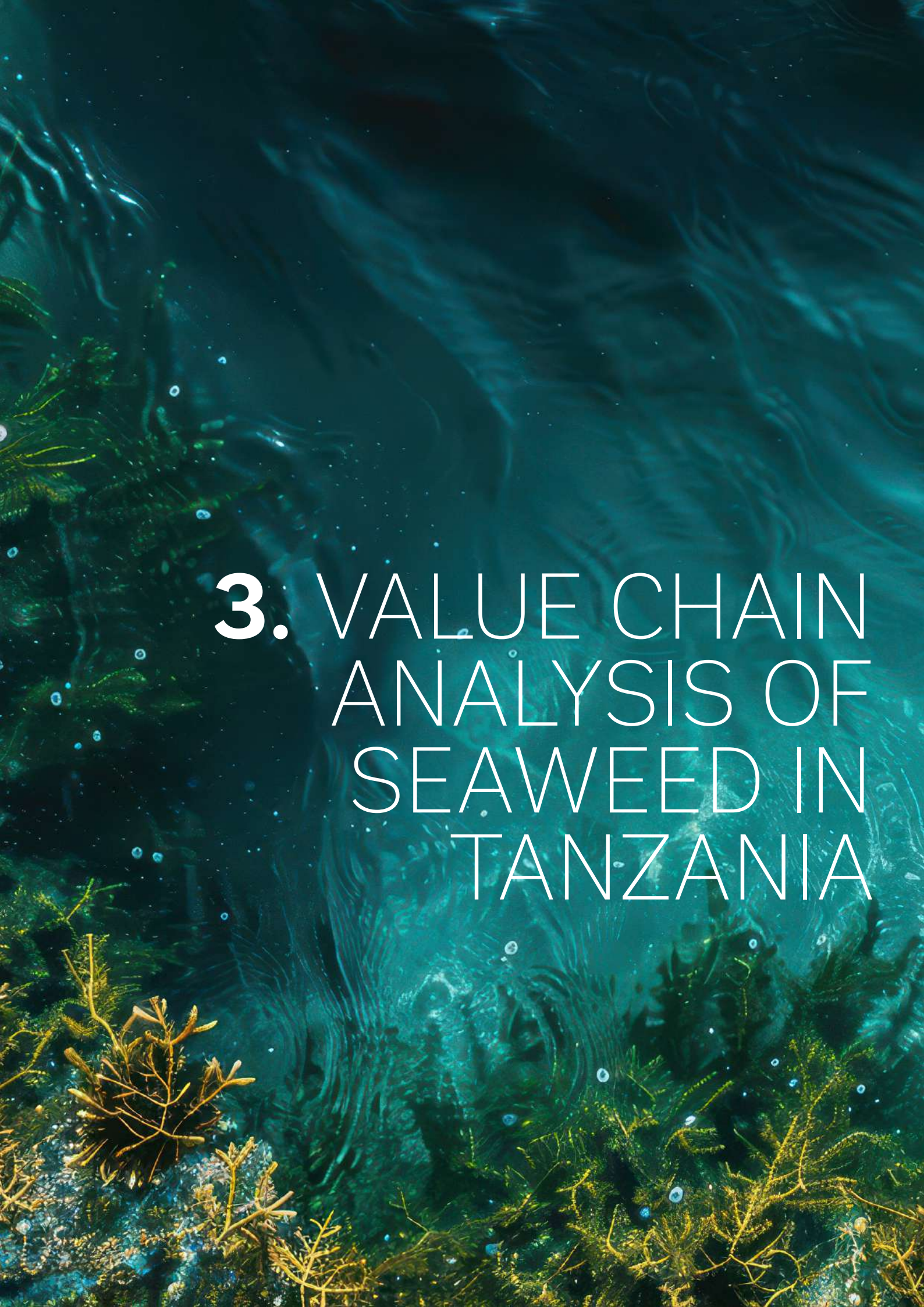
Seaweed products such as carrageenan, nutraceuticals, and cosmetics see particularly high demand due to their versatility in food, pharmaceuticals, and personal care, respectively. Growing environmental concerns boost the demand for biodegradable plastics and food packaging, while wastewater treatment solutions are becoming more essential due to regulatory pressures and the global need for clean water.

However, feasibility varies significantly across these products, influenced by factors such as technological maturity, capital requirements, and regulatory challenges. While seaweed powder and food products benefit from well-established production processes and relatively low capital investment, other products such as biodegradable plastics, food packaging, and wastewater treatment face higher feasibility challenges. These products require substantial infrastructure investment, advanced technology, and compliance with strict regulations, which can hinder their scalability.

Table 2: Perceptual Ranking of Products

PRODUCT	DEMAND (SCALE 1-16)	FEASIBILITY (SCALE 1-16)
Carrageenan	16	16
Nutraceutical	14	14
Cosmetics	13	13
Biodegradable plastics	15	10
Biodegradable food packaging	14	10
Wastewater treatment	12	12
Seaweed powder	10	14
Food products	9	12
Aquaculture feed additive	8	11
Biofertilizers	7	9

Source: Based on author's analysis.

An underwater photograph showing a dense field of green and yellow seaweed on the ocean floor. Numerous small, light-colored bubbles are rising from the bottom, creating a dynamic pattern against the dark, rippling water. The overall color palette is dominated by deep blues and greens, with some yellow highlights from the seaweed.

3. VALUE CHAIN ANALYSIS OF SEAWEED IN TANZANIA

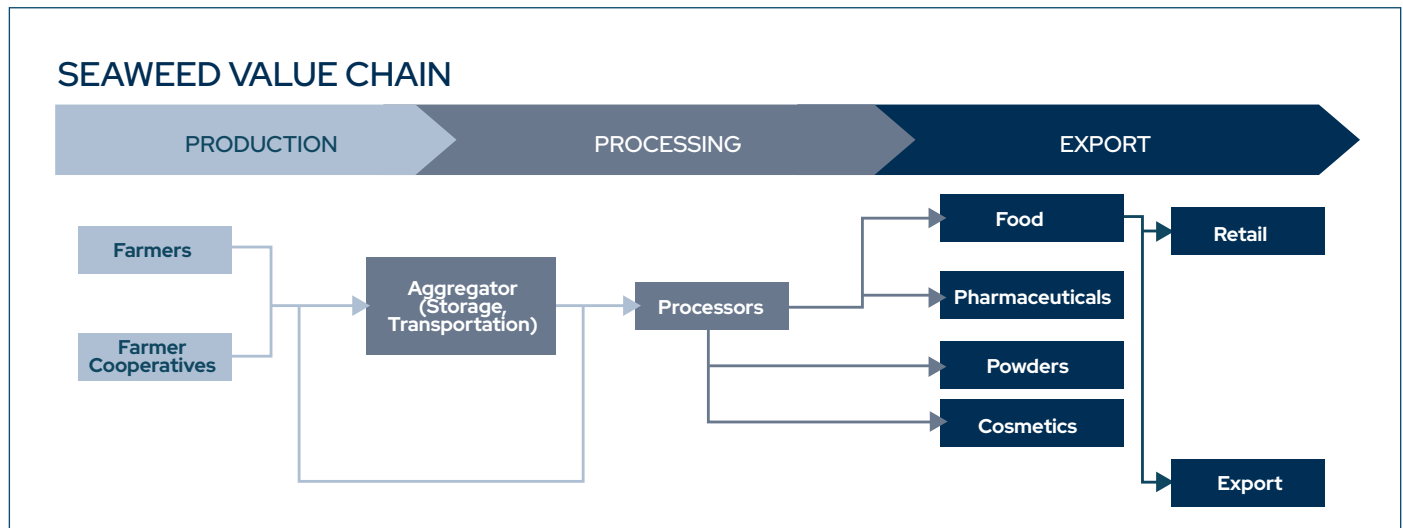
3. VALUE CHAIN ANALYSIS OF SEAWEED IN TANZANIA

3.1 Value Chain Mapping

The seaweed value chain in Tanzania begins at the farm level and extends to the end user, encompassing both the export market and domestic or regional consumers of raw seaweed and seaweed-based products.

The Tanzanian seaweed value chain is predominantly export-driven, with about 99 percent of production being sold to international markets. The remaining 1 percent is distributed through individual channels, primarily for small-scale processing by cooperatives and community groups. These cooperatives engage in value addition by transforming raw seaweed into products such as soaps, body lotions, and other cosmetics.

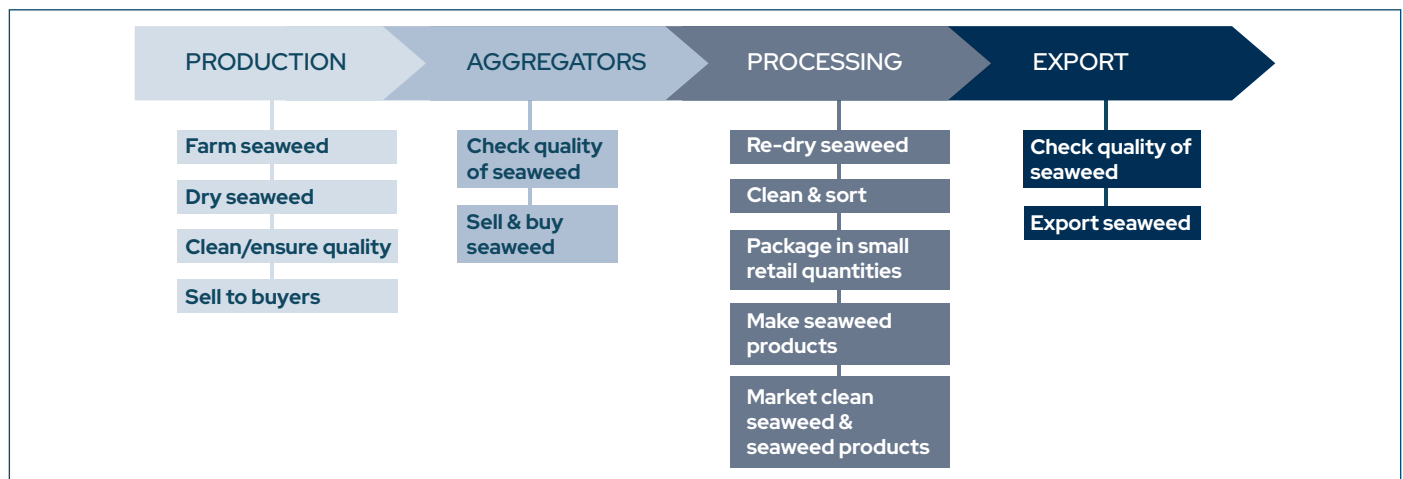
Figure 7: Seaweed Value Chain Map in Tanzania



Source: Based on author's analysis.

3.2 Core Value Chain

Figure 8: Activities of Core Value Chain Actors



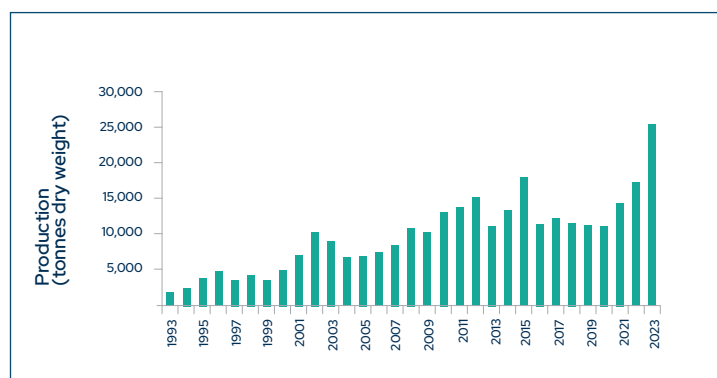
Source: Based on Author's analysis.

3.2.1 Production

Over the years, Tanzania's seaweed production has experienced significant fluctuations, primarily due to challenges from climate change, which have led to outbreaks of diseases and pests. Seaweed production reached a peak of 17,000 MT dry weight in 2015. Subsequently, production declined to less than 11,000 MT in 2016, a downward trend that continued until 2020 (Figure 9). This decline can be attributed to climate change—specifically increased ocean temperatures, which caused an outbreak of ice-ice, a disease that affects seaweed. Ice-ice is exacerbated by changes in salinity and light intensity, causing stress to seaweeds, making them produce a moist organic substance that attracts bacteria in the water and induces the characteristic whitening and hardening of the seaweed's tissues. Recent efforts¹⁶ by several stakeholders have led to an increase in production to 25,426 MT in 2023. The main commercial seaweed-producing countries have also been heavily affected by the ice-ice outbreak, leading to a significant decline in hydrocolloid production.

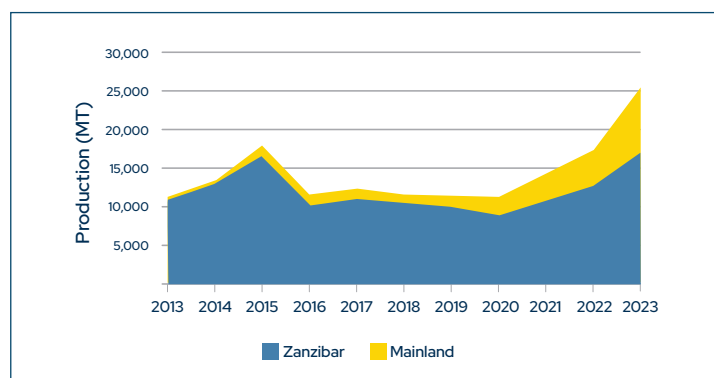
A total of 428 seaweed species from the Rhodophyta, Chlorophyta, and Phaeophyceae groups have been identified in Tanzania.¹⁷ Out of the total production of 25,426 MT in 2023, the major species cultivated were *Eucheuma denticulatum* (spinosum) and *Kappaphycus* (cottonii). The country's annual production is low relative to the production of other countries, such as Indonesia at 150,000 MT, the Philippines at 100,000 MT, and Malaysia at 20,999 MT dry weight per year.

Figure 9: Seaweed Production Trend (MT)



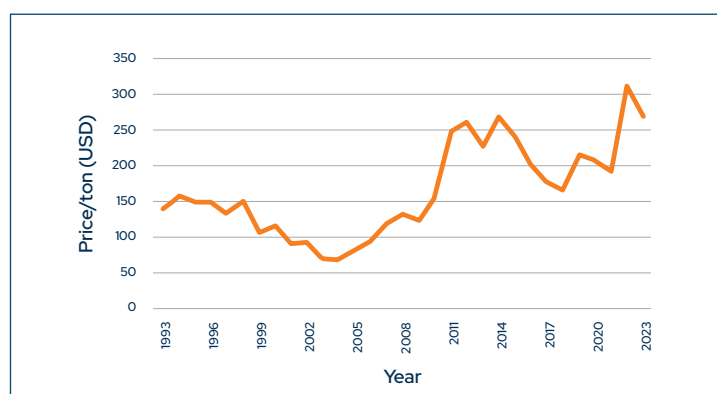
Source: Ministries in Zanzibar and mainland 2024.

Figure 10: Seaweed Production, Zanzibar and Mainland (MT)



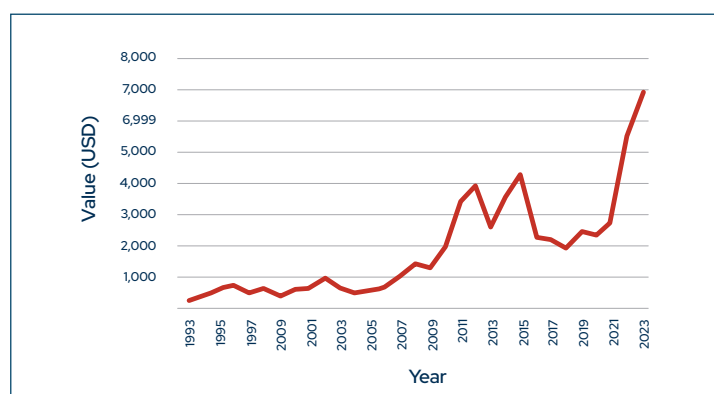
Source: Ministries in Zanzibar and mainland 2024.

Figure 11: Trend of Seaweed Prices, 1993–2023



Source: Ministries in Zanzibar and mainland 2024.

Figure 12: Production Value (US dollars)

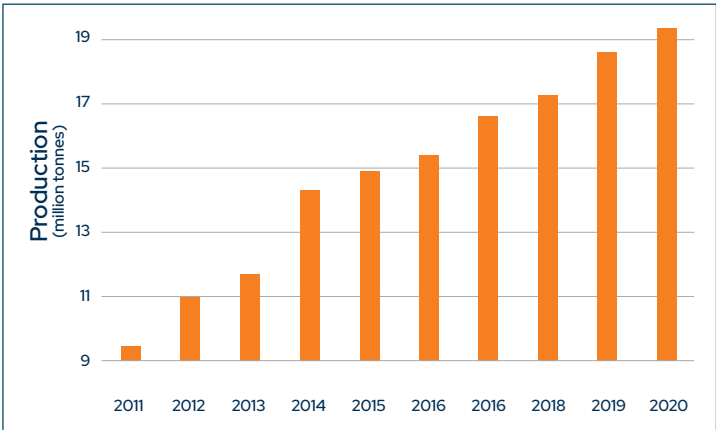


Source: Ministries in Zanzibar and mainland 2024.

16. According to interviews with farmers, awareness of disease management practices has improved, including the practice of quarantining affected stems and refraining from using them as seeds for the next cultivation cycle. Farmers also reported that improved climatic conditions have contributed to better farming outcomes. However, no official study has been conducted to verify these observations.
17. Berya 2023.

Figure 13 shows a parallel trend in China’s seaweed production. Until 2014, China’s seaweed production was increasing rapidly. From 2011 to 2014, production grew by 47 percent, rising from 9.5 million MT to 14.3 million MT. However, between 2015 and 2018, the growth rate slowed to 21 percent, with production increasing from 14.9 million MT to 17.3 million MT over the same three-year period.

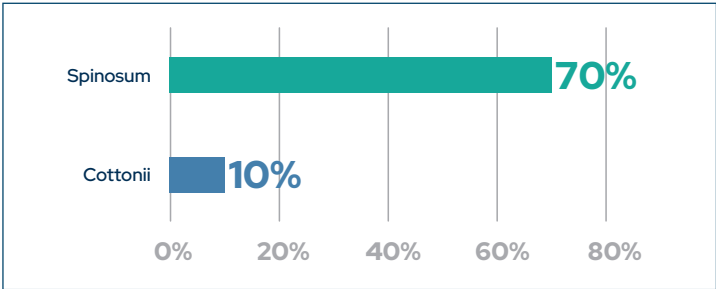
Figure 13: China’s Seaweed Production, 2011–2020



Source: FAOSTAT 2024.

Tanzanian seaweed farming, like many global tropical countries, focuses on strains of *Eucheuma* and *Kappaphycus* imported from the Philippines, yielding three main species currently cultivated (*Eucheuma denticulatum*, *Kappaphycus alvarezii*, and *Kappaphycus striatus*). The species breakdown is *Eucheuma* (70 percent) and *Kappaphycus* (10 percent). Production involves farming, harvesting, and drying, primarily carried out by farmers. The ice-ice outbreak has caused massive diebacks of *Kappaphycus* in particular, and production decreased from 1,000 MT in 2001 to less than 200 MT in 2018. The production of *Eucheuma denticulatum* also decreased due to ice-ice disease and other climate change-induced challenges.

Figure 14: Breakdown of Species Grown in Tanzania



Source: Key informant interviews.

Figure 15: Seaweed Species *Eucheuma denticulatum*, *Kappaphycus alvarezii*, and *Kappaphycus striatus* (L–R)



Source: F.E. Msuya.

Producers include individual farmers, farmer cooperatives, and families engaged in seaweed farming along the coastline of mainland Tanzania and Zanzibar. In 2024, the sector comprised about 30,000 farmers¹⁸ (20,000 in Zanzibar and 10,000 in mainland Tanzania), with over 80 percent being women. The number of seaweed farmers in Zanzibar declined from 23,000 in 2011 to 16,000 in 2020. This reduction is attributed to fluctuating prices, low profitability relative to input costs, labor intensity, and the impact of diseases and pests that disrupt production cycles. More than 83 villages participate in seaweed farming in Zanzibar, including 50 villages across Unguja Island and 33 across Pemba Island. However, some villages do not participate due to unsuitable environmental conditions. Notably, 80 percent of Zanzibar's seaweed comes from Pemba. Farmers average 1.5 MT to 3 MT per month. Farmers typically receive support from exporting companies, which provide farming materials, occasional on-farm extension services, and general farming management assistance. The government also plays a role in overseeing the production process, monitoring export company licenses, occasionally providing farming inputs, and linking farmers with exporters.

During production, seaweed is planted, weeded, and harvested. Once dried, it is sorted and cleaned to remove dirt and sand. Farmers store the dried seaweed at home for later sale or sell it directly, depending on the harvest volume and market conditions. Initially, major exporters handled most supply and logistics functions, providing materials and logistical support. However, after 2002, free-trade legislation allowed many farmers to take on these roles and sell their crops to the highest bidder.

Challenges

- **Input:** A critical challenge in the sector is limited access to essential inputs. The low-profit margin from seaweed farming prevents farmers from investing in necessary inputs, which cost \$82 per year¹⁹ for the traditional farming method. For farmers to be able to buy these inputs independently, the price of 1 kilogram (kg) of spinosum needs to be between 1,000 and 2,500 Tanzanian shillings.
- **Climate change:** Tanzanian seaweed production faces significant challenges due to climate change, particularly rising seawater temperatures. This change has notably impacted two key seaweed species: *Eucheuma* and *Kappaphycus*. *Eucheuma*, known for its resilience, previously thrived in water temperatures up to 35°C. However, current temperatures reach as high as 38°C. Similarly, *Kappaphycus* is more sensitive to high temperatures and cannot grow effectively when temperatures surpass 35°C. El Niño events have caused further disruption by introducing freshwater inflows that disturb the intertidal farming zones. Moreover, unpredictable rainfall has affected both farming and drying seaweed.
- **Seaweed diseases:** Increased seawater temperatures have facilitated the occurrence of diseases like ice-ice and epiphytes, negatively affecting seaweed growth on farms. These diseases cause diebacks of both *Kappaphycus* and *Eucheuma*, especially during hot seasons (December to February).

Figure 16: Ice-Ice Symptoms: The Whitening of the Thallus



18. Msuya et al. 2022.

19. Based on author's calculations.

- **Suboptimal farming methods:** The common off-bottom farming method is becoming less effective, reducing production and the ability to grow high-value *Kappaphycus*. The limited access to improved seed varieties further affects productivity.
- **Shift in seaweed species:** The higher temperatures have made it difficult for farmers to cultivate the more valuable *Kappaphycus*. As a result, they have been compelled to focus on the lower-valued *Eucheuma*, reducing their returns.
- **Seasonal activity:** Seaweed production has shifted from being year-round to becoming more seasonal. During the hot season, some farmers cease farming operations, waiting instead for the cooler and rainy seasons to resume their activities. This, however, leads to problems with drying seaweed during the rainy season because there are limited transport options (vehicles, roads) for moving seaweed from farms to drying areas.
- **Conflicts with tourism:** Competition for space and resources with tourism activities has resulted in blocked pathways and chemical discharges affecting seaweed farms. Kite surfing and water scooters damage the seaweed ropes and farms.
- **Lack of coordinated support:** There is a lack of coordinated support for farmers, as multiple stakeholders, such as nongovernmental organizations (NGOs), often provide assistance to the same communities or villages. This overlap leads to inefficient use of resources and confusion among farmers, limiting the overall impact of these initiatives.
- **Health:** Seaweed farmers in Tanzania face health issues, including eye and skin conditions, due to prolonged exposure to seaweed and the harsh marine environment. There are no established provisions for healthcare support when farmers fall ill.
- **Lack of drying and storage facilities:** There are no proper drying and storage facilities at seaweed landing sites. Without designated drying areas or warehouses, farmers are often forced to transport their harvested seaweed to their homes. As a result, seaweed is frequently dried against house walls and stored in unsuitable places such as bedrooms, compromising its quality and market value. The lack of appropriate infrastructure contributes to post-harvest losses and reduces the competitiveness of Tanzanian seaweed in the global market.
- **Absence of water, sanitation, and hygiene (WASH) facilities:** There are no WASH facilities at landing sites. Without access to clean water and sanitation, farmers are unable to maintain hygiene standards during post-harvest handling, increasing the risk of contamination. The lack of these basic amenities negatively impacts both the quality of the seaweed and the well-being of the farmers.
- **Lack of gender-sensitive amenities:** Women face additional challenges due to the lack of gender-sensitive amenities at landing sites. Lactating mothers, for example, do not have access to designated spaces where they can take care of their children while working. This lack of support infrastructure makes it difficult for women to fully participate in seaweed farming and benefit from economic opportunities in the sector.
- **Unsafe drying practices:** Due to the absence of designated drying areas, farmers often resort to unsafe practices such as hanging seaweed on trees or drying it on cliffs along the beach. These methods not only pose safety risks but also expose the seaweed to contaminants, reducing its quality. Ensuring access to proper drying facilities is essential for improving both farmer safety and product standards.

Recommendations

- **Technology development:** Develop optimal low-capital, deep-water farming technologies to replace the less effective off-bottom method.
- **Farmer training:** Train farmers in using new technologies and equipment, weighing seaweed, and understanding post-harvest processes such as drying, grading, and storage. Provide swimming lessons to farmers, particularly women, to enable safe and confident deep-water farming.

- **Transportation devices:** Design or provide support for obtaining equipment to help farmers transport harvested seaweed from offshore sites to onshore drying sites.
- **Farming materials supply:** Support farmer groups to establish shops selling essential seaweed farming materials.
- **Seed sources and facilities:** Establish sea-based nursery farms and tissue culture laboratories to provide disease-free seeds.
- **Solar dryers:** Design and deploy large-volume solar dryers to facilitate seaweed drying, especially during rainy seasons.
- **Centralized database for support coordination:** Develop a comprehensive database that tracks the activities of different stakeholders engaged in providing support to farmers. It would provide information including the name of the organization, beneficiary, service support, and geographical area.
- **Grading:** Grade seaweed produced by farmers to ensure price differentiation. Higher-quality seaweed can command premium prices.
- **Public investment in storage, drying, and logistics infrastructure:** Seaweed farming under the smallholder business model is not financially viable to drive transformational changes in post-harvest handling and drying without external subsidies or government funding. Significant improvements in these areas would require substantial investment beyond the capacity of individual farmers in building designated drying areas, warehouses, and transportation infrastructure to reduce post-harvest losses and improve the quality and marketability of Tanzanian seaweed.
- **Development of early warning systems:** Establishing early warning systems for seaweed farmers can help mitigate risks associated with extreme weather events, environmental changes, and disease outbreaks. These systems should provide timely and accurate information to farmers to enhance preparedness and minimize losses.
- **Provision of gender-sensitive amenities:** Provide women-friendly spaces at landing sites, such as designated areas for lactating mothers, childcare services, and play areas for children.
- **Provision of WASH facilities:** WASH facilities should be established at seaweed landing sites to ensure proper hygiene during post-harvest handling.
- **Development and implementation of spatial zonation:** The government could develop and implement a spatial zonation plan for marine fisheries, aquaculture, tourism, and conservation. This approach would help avoid conflicts between different marine activities and optimize the use of marine space for economic and environmental priorities.

3.2.2 Aggregation

The aggregation and purchasing stage involves the regular collection of seaweed from farmers, typically when they bring it for sale. At this stage, quality assurance measures are also implemented to assess the procured seaweed, ensuring it meets the standards required by end-market consumers, including processors and individual buyers. This is done by checking primarily two parameters: that the seaweed is dry enough (30–35 percent moisture) and that it is clean. If these two factors are not achieved, then the cleaning and drying process is repeated. During the purchasing process, if the seaweed is too wet or contaminated with impurities, it is not accepted. Instead, farmers are required to dry and clean the seaweed before returning to sell it. Once procured, seaweed is stored in sheds or warehouses before it is ready for trade.

Challenges

- **Inadequate drying and cleaning:** Some farmers do not sufficiently dry and clean the seaweed before bringing it to market. Consequently, they are either sent back with their seaweed, or the buyer must incur additional expenses to dry and clean it properly.

- **Unethical practices:** According to some buyers, certain farmers engage in unethical practices, such as concealing wet seaweed inside sacks of dry seaweed or adding stones and sand to increase weight. This creates additional labor for buyers, who must sort and clean the seaweed before processing or resale.
- **Irregular purchasing and payment delays:** Buyers sometimes do not purchase seaweed for months, forcing farmers to store large quantities at home. Additionally, farmers occasionally send their seaweed to buyers but are not paid immediately, being told to wait for days or even weeks.

Recommendations

- **Training and support for farmers:** Implement training programs to educate farmers on the importance of proper drying and cleaning techniques for seaweed. Providing practical demonstrations and support can ensure that farmers meet quality standards, reducing the likelihood of seaweed being rejected or requiring additional processing by buyers.
- **Implementing quality control measures:** Establish quality control measures at collection points to detect and discourage unethical practices. This can be achieved by implementing systematic inspection protocols, including random sampling and moisture content testing to detect wet seaweed. Trained quality assessors can visually inspect and weigh batches to identify inconsistencies, while the use of simple tools such as refractometers or drying meters can help verify moisture levels. Additionally, introducing clear guidelines on acceptable quality standards, along with transparent grading systems, can help standardize the evaluation process. Farmers who consistently meet these standards can be rewarded through premium pricing or priority access to markets, while penalties such as rejection of substandard batches or temporary bans for repeated violations can discourage unethical practices.
- **Improved storage facilities:** Develop community storage facilities equipped with proper drying and cleaning tools. This will help farmers maintain the quality of their seaweed and reduce the burden of individual storage, particularly during periods when buyers are not purchasing seaweed.
- **Creating cooperative associations:** Encourage seaweed farmers to form cooperative associations. These cooperatives can facilitate collective bargaining, ensuring fair prices and timely payments. They can also provide a platform for sharing best practices and resources, improving overall seaweed quality and marketability.

3.2.3 Processing

Tanzania began value-added processing of its cultivated seaweed in 2006, with the first product developed in Zanzibar under the Zanzibar Seaweed Cluster Initiative (ZaSCI).²⁰ Since 2006, more than 40 groups comprising over 600 small-scale processors across 30 regions have been engaged in producing food and cosmetic products from seaweed. Despite producing more than 70 different products, seaweed processing uses only 1 percent of the total volume of seaweed produced in Tanzania. The majority of the seaweed is sold to overseas buyers as unprocessed dry raw material for industrial purposes (that is, kappa and iota carrageenan extraction). The market for processed seaweed products has largely relied on tourists and exhibitions, including the Dar es Salaam International Trade Fair (Sabasaba) and the Agricultural Trade Fair (Nanene). As is the case with farming, most processors are women. There has also been a recent increase in youth participation in the seaweed sector. This can be attributed to a growing awareness of the industry's potential and targeted initiatives. Organizations and governments have launched training programs to equip youth with the technical skills needed for processing, value addition, and entrepreneurship.

In addition to traditional drying and trading, new value-added products are emerging, increasing farmers' cash income. These products include grinding seaweed to produce powder and manufacturing seaweed-based cosmetics and food products such as soap, body creams, juices, and jam. For example, grinding dry seaweed (*Eucheuma denticulatum*),

20. ZaSCI predominantly comprises researchers, small-scale farmers and processors, government departments, and other partners. Notably, between 57 percent and 100 percent of processors across various coastal villages around the country are women.

which sells for \$0.25 per kilogram, allows farmers to sell the powder for \$6–\$12 per kilogram (1 kg of powder requires about 2 kg of dry seaweed). Farmers also sell seaweed soap for \$0.60–\$1 per 75 grams (g) piece (yearly profit margin of 52 percent). Additionally, processors bleach seaweed to produce white dried seaweed, which is sold for up to \$10–\$20 per kilogram depending on location and demand. Some processors collect seaweed salt, exuded during drying, and sell it for \$12 per 100 g packet in Bagamoyo. Various actors work with farmers, exporters, and other stakeholders in these value-addition efforts.

Establishment of Carrageenan Processing Facility by ZASCO

To develop the seaweed industry, the government of Zanzibar formed the Zanzibar Seaweed Company (ZASCO), a public-private partnership facilitated by the Ministry of Trade and Industrial Development and the private player Nutri-San. It has 20 staff members and was established in 2022 with four shareholders: Zanzibar Social Security Fund, Zanzibar Insurance Corporation, Zanzibar State Trading Company, and Zanzibar Ports Corporation. The aim of the venture is to process seaweed to produce carrageenan at a seaweed processing plant, which is being established by the Zanzibar government at Chamanangwe in Pemba. The carrageenan will be sold to industrial buyers to produce various products. ZASCO is working in partnership with United Kingdom-based company Nutri-San, which has a processing animal feed plant in Viet Nam. ZASCO is providing the necessary land, infrastructure, and operational resources, while Nutri-San is contributing advanced processing technology developed by Mitsubishi and market links to facilitate the global distribution of the processed carrageenan.

ZASCO also aims to increase seaweed production from the current 12,000 MT to 30,000 MT (dry weight), which is also the maximum capacity of the processing plant. Direct employment will involve more than 300 farmer groups,²¹ and indirect employment is expected to benefit 50,000 farmers. Moreover, the government has allocated 1.5 billion Tanzanian shillings for farming inputs such as ropes. ZASCO's efforts also include procurement strategies to stockpile seaweed during the construction of the plant to ensure readiness for processing when the plant starts operating.

ZASCO has formulated its Five Years Strategy and Plan for 2023–2025. Information from ZASCO shows that the following activities have been concluded so far:

- Buy *Eucheuma* and *Kappaphycus* for producing carrageenan
- Buy ulva to be used in making animal feed.

ZASCO is also working to raise the price of seaweed by purchasing it at higher prices, which incentivizes exporters to follow suit. ZASCO's intervention has led to an increase in seaweed prices from 600 to 1,000 Tanzanian shillings/kg for *Eucheuma* (67 percent increase) and from 1,000 to 2,500 Tanzanian shillings/kg for *Kappaphycus* (150 percent increase). As the processing plant is located closer to producers, ZASCO favors buying directly from farmers and associations, which helps to reduce reliance on middlemen, reduce overall expenses, and therefore offer better prices for farmers. ZASCO's initiative also includes distributing subsidized inputs, running training sessions, and providing boats for deep-water farming, benefiting 500 farming groups, of which 250 groups have already been reached to date.

This is a mutually beneficial scheme, as a global carrageenan extraction unit can procure raw seaweed directly without relying on middlemen or exporters by being located closer to the producing region. In doing so, the company can avoid transportation, insurance, and freight costs, which significantly reduces overall expenses. This cost advantage provides the company with the financial flexibility to offer better prices to seaweed farmers than traditional exporters or traders. This has led to exporters exploring new producing regions on the mainland coast.

The global high-grade carrageenan extraction industry is dominated by a few sizable players, but the sector is marked by intense price competition. Companies such as CP Kelco, Marcel Trading Corporation, FMC Corporation, E.I. du Pont de Nemours and Co., Gelymar S.A., Cargill Incorporated, and Kerry Group bring unique advantages to the market.

21. 2024 World Bank stakeholder workshop.

These include innovation in ingredient development, robust supply chains, global reach, and a focus on sustainability and customization. Their combined expertise spans food safety, specialized hydrocolloids, agricultural integration, and advanced textural solutions, ensuring competitive pressure and continual market evolution. Strategic acquisitions and investments in niche markets further bolster their capacities, enabling them to cater effectively to evolving consumer and manufacturer demands.

Box 1: Competitive Analysis of ZASCO

PORTER'S FIVE FORCES FRAMEWORK FOR ANALYSING ZASCO'S CARRAGEENAN PLANT

ZASCO's entry into the global carrageenan extraction industry places it in an oligopolistic market landscape, where high capital investment and advanced technology create significant entry barriers, limiting the number of players. As a result, only a few companies dominate the global market. However, competition between these big multinational companies is intense. The competition primarily revolves around economies of scale and production capacity, with companies often undercutting the unit cost and offering a more competitive price for the extracted high-grade carrageenan. Each player strives to undercut competitors in an effort to scale operations and increase profitability, making the market unsaturated but fiercely competitive and limiting the entry of new companies.

1. Competitive rivalry

- The carrageenan market is competitive, with established players like CP Kelco, Marcel Trading Corporation, FMC Corporation, E.I. du Pont de Nemours and Co., Gelymar S.A., Cargill Incorporated, and Kerry Group.
- ZASCO's localized operations and partnerships with international private players, such as Mitsubishi and Nutri-San, offer a significant advantage in East Africa, but it may face stiff competition from established global players.

2. Bargaining power of suppliers

- ZASCO's proximity to seaweed farming regions minimizes reliance on intermediaries, reduces costs, and ensures fresh, high-quality dried raw seaweed.
- Higher prices paid to farmers strengthen relationships and secure consistent supply, giving ZASCO leverage over competing exporters.

3. Bargaining power of buyers

- ZASCO's control over the production process enhances its ability to offer competitive pricing and quality to potential international buyers.
- However, in markets like Europe, strong buyer negotiating power persists, as buyers seek established and reliable suppliers. They also have huge storage capacity to practice price speculation and buy seaweed when prices are low.

4. Threat of new entrants

- The industry's capital-intensive nature and technological requirements create significant barriers.
- ZASCO's early investments and partnerships solidify its position in Tanzania as a first-mover advantage, but private companies could enter as the market matures.

5. Threat of substitutes

- Carrageenan's unique properties (for example, gel formation and synergistic behavior with other hydrocolloids) make it difficult to replace in certain applications.
- Competing hydrocolloids (such as pectin, xanthan gum, and agar) present a threat, but their functionality differs significantly, reducing direct substitution risks.

Current Processing Status in Tanzania

Seaweed processing in Tanzania is an emerging sector primarily supported by cooperatives, small enterprises, and individual processors. Women and youth are the predominant participants, contributing significantly to value addition through products such as soaps, lotions, seaweed powder, herbal teas, and cosmetics. Despite its potential for profitability, the sector faces challenges including climate change impacts, quality control issues, high costs for packaging and transportation, and limited access to certification and adequate processing facilities. While proximity to seaweed farming regions offers logistical advantages, the industry is largely small scale and informal, with limited capacity for international exports. The local market remains the primary outlet, especially targeted toward tourists. International demand is addressed mostly through informal channels.²²

Box 2: Examples of existing processors in Tanzania

EXISTING PROCESSORS IN TANZANIA

Sus Blue Shop:

This retailer purchases seaweed from farmers at 3,000–4,000 shillings per kg and resells it at 10,000 shillings per kg. It also sells various seaweed-based nutrition and cosmetic products. Seaweed soap is priced at 3,000 shillings and seaweed powder at 50,000 shillings per kg. Despite having an online presence, 95% of their sales occur offline, with 75% of their customers being tourists. They collaborate with tour guides who earn a 10% commission on sales.

Furahia Wanawake Group:

This group grows the *Spinosa* variety and faces challenges such as climate change and high operational costs. They own a cooperative farm. They convert all their produce into value-added products. Annual profit from processing amounts to 600,000 shillings. The cooperative markets its dry seaweed to individual buyers in quantities ranging from 15 to 30 kg, priced at 2,000 shillings per kilogram. Bleached seaweed is priced at 3,000 shillings per kilogram. Their products are primarily sold to tourists. The cooperative uses traditional packaging materials, including coconut tree bark and banana leaves, in addition to paper boxes obtained from the mainland. Tourists exhibit a preference for traditional packaging over boxes.

Ahsam Tea:

This processor produces seaweed-based herbal tea and masalas. The Seaweed Tea Masala contains 65% seaweed, with spices such as cinnamon making up the remainder. It is sold in 260 gm bottles at 2,000 shillings and 10 gm sachets at 200 shillings. The Herbal Tea comprises 15% seaweed, combined with tea leaves and spices. Sales of tea total 5.62 million shillings monthly, with Masala sales reaching 200,000 shillings. Most products are sold locally in Pemba, with secondary markets in Dar es Salaam and tertiary sales in Zanzibar. Informal exports to Kenya and the Democratic Republic of the Congo are also seen. The company purchases seaweed powder from farmers at 5,000 shillings per kg. This is facilitated by the Milele Zanzibar Foundation (MZF) network. Ahsam Tea benefits from a reduced cost through MZF's training programs. They face high packaging and transportation costs but have established a system to maintain consistent sales, with a minimum order of 100 bottles.

Ukweli Ni Njia Safi Group:

The cooperative farms *spinosa*. All the seaweed harvested is processed into various products. When they do not have enough seaweed for processing, they purchase from other. They make food products such as juice, jam, chilli sauce and cosmetic products such as soap, hair oil, massage oil and body cream. Seaweed products sell between USD 1–8. Packaged dry seaweed is sold at 5000 TZS per 500g and bleached seaweed for 6,000 TZS. Unpacked seaweed, the price is 5,000–6,000 per kg. Seaweed powder is sold for 20,000 TZS per kg. Monthly sales range around 80–90 kg of seaweed and 400–600 kg of powder.

22. Annex 1 provides examples of existing processors in Tanzania.

EXISTING PROCESSORS IN TANZANIA

Isha Products Group:

This is a youth group formed in 2020. The cooperative farms *spinosum* and process seaweed into various products. They sell them domestically and internationally. Dry unbleached seaweed is sold at 5,000 TZS per 500g (10,000 TZS per kg) and bleached seaweed for 5,000 TZS for a 250g packet (20,000 per kg). Regular monthly sales include 50kg of seaweed and 100kg of powder. Other products include soap, scrub, shampoo, lip balm which sell for up to 10,000 TZS per piece. They face challenges in market demand, quality control, and obtaining packaging materials.

Chokocho Farmers Focus Group:

his group produces seaweed and sea cucumber products. They process 1% of their harvest into soaps and lotions. The packaging costs include 400 shillings for plastic bottles and 6,000 shillings each for both regular and small bottles. They face operational challenges such as high transportation costs, unavailability of packaging material, and climate impacts.

Kihogoni Cooperative:

This processor group produces a range of seaweed-based products, including soap and lotion. They produce 175 pieces of soap each month, each priced at 1,000 shillings. Lotion production remains limited, with only 40 pieces per year priced at 3,000 shillings each. Sales are distributed across Pemba, Zanzibar, Dar-es-Salaam, and Southern Tanzania. Despite owning a seaweed grinder valued at 8 million shillings, the cooperative only purchases seaweed powder and not dried seaweed. Processing is done at individual homes with hand-held equipment. The cooperative lacks ZBS (Zanzibar Bureau of Standards) certification due to the absence of a dedicated processing facility. They face challenges related to market demand and production capacity.

Healthy Seaweed Café:

Located in Dar es Salaam, it is a social enterprise focused on adding value to seaweed for food products, promoting healthy lifestyles. The café buys seaweed from farmers, processes it into various food products, and also packages it as raw dried seaweed after thorough cleaning. They process both cultivated red seaweed and green seaweed (*Ulva*). They source their seaweed from Zanzibar due to higher volumes and cleaner quality compared to the mainland.





Challenges

- **Low prices:** Although seaweed prices have risen over the years, they have not kept pace with the rising cost of living. Farmers feel that the prices they receive for seaweed are too low, given the effort they put into farming. It is noted that seaweed farmers in Tanzania realize only 30–40 percent of the export price, compared with 60–70 percent for farmers in Southeast Asia. Additionally, the average net income from family labor in seaweed production in the Solomon Islands is approximately 3.7 times higher than in Tanzania.²³ The income for Tanzanian farmers is relatively low because exporters pay them less. Exporters are compelled to offer lower prices because they must compete in international markets with Southeast Asian suppliers, who benefit from deep-sea farming and economies of scale, allowing them to produce at a lower cost.

Table 3: Seaweed Prices on International Market (\$/MT)

EXPORTING COUNTRY	2015	2016	2017
Taiwan	3,938	7,657	7,576
Chile	3,179	2,043	3,683
Japan	3,307	5,404	2,965
Malaysia	1,236	739	977
Indonesia	1,039	716	916
Philippines	956	801	906
Zanzibar	386	471	389

Source: Msafiri 2021.

- **Limited market (dry seaweed and products):** The Tanzanian market for raw dried seaweed is heavily dependent on global market trends, unlike countries where seaweed is both farmed and consumed domestically. Market conditions have worsened, with buyers not purchasing seaweed, leading to accumulated unsold stocks for farmers. This is driven by speculative buying. Since seaweed has a long shelf life, major international buyers purchase large quantities when prices are low, anticipating future demand. However, when prices rise, demand decreases as buyers delay purchases and consume the seaweed stocked in their warehouse from the previous season.
- **Seed availability:** The availability of seeds for replanting has been a consistent challenge, especially after a bad growth season (the hot season). After the hot season, when most seeds are lost, farmers spend the good growth season propagating seeds. This is an inefficient use of time and resources.
- **High-post harvest losses:** There are high losses during drying, storage, and transportation of seaweed. Seaweed is often carried on the head, making it easy for wet seaweed to break and be lost. This issue also arises when transporting seaweed from drying areas to storage and marketing points. Additionally, high temperatures lead to rotting and strong winds cause the seaweed to break from the ropes. Losses may reach up to 20 percent. No studies have quantified actual post-harvest losses

- **Emerging conflict between seaweed farming and tourism:** A growing conflict has emerged between seaweed farming and tourism, especially in Paje, Zanzibar. Kite surfing by tourists often occurs in the same zones occupied by seaweed farms.
- **Poor product mixing and finishing:** Inadequate product mixing, finishing, and packaging, as well as a shortage of suitable packaging materials and service providers, lead to variable product quality, such as non-uniform seaweed soaps.
- **Certification difficulties:** Products made by community groups are not certified by the Tanzania Bureau of Standards or the Zanzibar Bureau of Standards, which restricts their ability to be exported to other countries in the region. Certifying value-added products is challenging due to substandard working premises and high certification costs.

Recommendations

- **Central processing unit:** Establish a central processing unit where different groups can produce consistent products using standardized machinery and parameters.
- **Standard operating procedure guidelines:** Develop standard operating procedure guidelines and provide training on equipment usage to ensure consistent product quality.
- **Improved packaging:** Collaborate with packaging entrepreneurs to create desired packaging materials.
- **Centre for quality control:** Establish a center for quality control to ensure consistent product standards.
- **Government incentives for processors:** The government can provide targeted incentives such as tax breaks, grants, subsidies, and financing schemes to support the establishment of medium- to large-scale ancillary industries. This would encourage private sector participation in value addition using the carrageenan produced in the country.

3.2.4 Retailers

Retailers buy packaged seaweed and seaweed powder from processors rather than directly from farmers due to better quality control, despite the higher cost involved. Clean seaweed commands a price range of 3,000 to 5,000 Tanzanian shillings per kilogram, whereas unclean seaweed is sold at 800 to 1,000 Tanzanian shillings per kilogram. The purchased seaweed is repackaged with the retailer's branding and contact information before being sold.

The main challenge faced by retailers is the availability of seaweed at affordable prices. They also face the challenge of setting competitive prices for their products, as higher purchase prices impact their selling prices. For example, Sus Blue Shop purchases seaweed at 3,000–4,000 Tanzanian shillings per kilogram and sells it at around 10,000 Tanzanian shillings per kilogram. Seaweed powder is purchased at 12,000–15,000 Tanzanian shillings per kilogram and sold at 40,000–50,000 Tanzanian shillings per kilogram in its retail shop. This significant markup reflects the costs associated with quality control, branding, and packaging.

In terms of opportunities, there is potential to explore seaweed pricing along the production chain, from producers to processors and sellers. Moreover, conducting awareness campaigns through media channels, particularly television, can educate people about the nutritional value of seaweed and its viability as a business, especially appealing to young entrepreneurs. Retailers like Darajani Market (Zanzibar Spice Communique) conduct 85 percent of their sales online, primarily to American and Kenyan customers, but through the informal route or direct-to-customer channels. They dispatch products through a chain of personal networks from Zanzibar to Nairobi, highlighting logistical strategies that other retailers could adopt.

Furthermore, training on packaging and marketing, collaborations with tour guides, and participation at exhibitions are effective strategies to increase sales. For example, Sus Blue Shop collaborates with tour guides (who receive a 10 percent commission) and participates at exhibitions to boost visibility and sales.

3.2.5 Export

The Tanzanian seaweed export market is characterized by a network of small-scale producers that supply dried seaweed to exporters. These exporters then handle the logistics of getting the product to international markets. The main markets for Zanzibar seaweed include the United States, Denmark, France, Spain, Chile, China, and Korea. Smaller companies in Tanzania often have sister multinational companies abroad, such as Cargill Texturizing Solutions in France, FMC BioPolymer in the United States, and Copenhagen Pectin A/S (CP Kelco) in Denmark. These companies further process the seaweed for use in industries such as pharmaceuticals, cosmetics, food, and textiles.²⁴ The demand for Tanzanian seaweed in these markets is driven by its quality and the consistency of supply.

With rising local prices, some exporters have started sourcing seaweed from new production areas on the mainland, expanding their supply base beyond traditional areas like Zanzibar and Pemba. This diversification is expected to lead to higher national production levels and greater export volumes in the future.

Previously, some companies baled seaweed in the villages. However, this practice has declined due to increased competition, fluctuating volumes, and operational costs. Since the announcement of free trade in 2002, seaweed is typically baled into 50 or 100 kg units before export. These bales are then shipped to the harbor and sent abroad for further processing, such as gel and carrageenan extraction. Collectors and exporters operate within or near farming villages. They inspect the quality of the seaweed brought in by farmers and make purchases. The purchased seaweed is stored in designated storage rooms within the villages. The exporters may invest in the construction of warehouses. Once enough seaweed is accumulated to meet buyer requirements, it is transported to the harbor for baling.

Exporters need to obtain approvals and export permits or licenses from the ministries responsible for trade, fisheries, and investment. These steps are regulated under the Fisheries Act (2003) and the Zanzibar Trading Act (2013).²⁵

Table 4: Key Export Companies

KEY EXPORT COMPANIES	
Mwani Mariculture	Hamad Seaweed Enterprise
C-Weed Corporation	Multipack Commodities
Zanzibar East Africa Seaweed Company (ZANEA)	Zanzibar Agro-Seaweed Company Limited
Ledo Biashara	ZanQue Aqua Farms
King David Foundation	Inovo Company Limited
Kido Seaweeds	Zanzibar Shell
Hill Seaweed Limited	S.M. Rashid
Kai Trading	Zanzibar Seaweed Company (ZASCO)

Source: Msafiri 2021.

24. Neish and Msuya 2013; Neish and Msuya 2015. See also www.cargilltexturizing.com, www.fmcbiopolymer.com, and www.cpkelco.com.

25. Neish and Msuya 2015.

C-WEED CORPORATION: Established in 1993, C-Weed Corporation is a major player with over 50 buying posts in Zanzibar and 20 on the mainland. This exporter provides necessary inputs to farmers. It faces challenges with reduced market demand, which has led to an excess inventory of 5,000 MT. While monthly export market demand is typically around 600 MT, it occasionally reaches 1,000 MT. The company primarily exports to the United States, France, China, and Spain. Its margins are typically small (around 5–10 percent), but they have been pressured by fluctuating market conditions and international competition. In 2013, the company planned to start a seaweed processing company on the mainland.

ZANZIBAR EAST AFRICA SEAWEED COMPANY (ZANEA): ZANEA, the first company to start commercial seaweed farming in 1989, supports farmers by providing farming materials, purchasing seaweed, and exporting it. The company emphasizes the importance of empowering farmers to become self-sustainable through education, suggesting that farmers should treat seaweed farming as a serious business. ZANEA believes that with proper business knowledge, farmers can produce 2–3 MT of seaweed per month per person.

Challenges

- **Pricing pressures:** Exporters have traditionally offered lower prices to farmers—around 600 Tanzanian shillings per kilogram of seaweed. However, ZASCO's initiative to offer 1,000 Tanzanian shillings per kilogram has pushed exporters to reconsider their pricing strategies and has increased competition within the local market.
- **Market fluctuations:** Exporters deal with significant fluctuations in both supply and demand, which affects their ability to maintain stable operations and pricing. Demand is more stable in Southeast Asian markets than in Tanzania. Southeast Asia has a large market size and consumes the majority of its production domestically while supplementing supply with imports from other countries. Conversely, Tanzania lacks a strong domestic demand for seaweed, making it overly dependent on exports. This increases Tanzanian stakeholders' vulnerability to global price fluctuations and external demand shocks.
- **Logistical issues:** Transporting bulky seaweed from production areas to processing or export facilities is cumbersome and costly, especially given the deteriorating road conditions and the need for frequent, large-volume movements.
- **Taxes:** Multiple taxes are imposed on exporters by various authorities at different stages of the seaweed value chain. These taxes include:
 - **Stamp duty:** 3 percent of export value or gross earnings for companies not registered for value-added tax (VAT).
 - **Royalties:** 2 percent of export value, paid to the Department of Fisheries.
 - **VAT:** 18 percent for VAT-registered companies.
 - **Corporate tax:** 30 percent of earnings.
 - **Skills development levy:** 4 percent of payroll value.
 - **Zanzibar Maritime Authority levy:** 15,000 Tanzanian shillings per lorry entering the port area in Pemba and Unguja.
 - **Local levies and taxes:** These vary by government authority.

In contrast, seaweed-exporting countries in Southeast Asia generally impose fewer direct taxes on exports, making them more competitive in the global market. For example, Indonesia and the Philippines have a zero-rated VAT on exports and do not impose an export levy on raw seaweed.

- **Presence of “predator buyers”:** Predator buyers purchase seaweed without investing in farming and offer higher prices. This practice tempts farmers to harvest immature seaweed, reducing its quality and negatively affecting the global market reputation of Tanzanian seaweed.

- **Marginal profit:** Exporters earn marginal profits because of the competitiveness of the seaweed market. Their products face strong competition from countries like China and Korea. These countries have established deep-water farming practices, allowing them to produce seaweed more efficiently and at a lower cost.

Recommendations

- **Tax harmonization:** Streamlining and consolidating the various taxes imposed on seaweed exporters can enhance the sector's competitiveness. Clear delineation of responsibilities among tax authorities, such as the Tanzania Revenue Authority, the Zanzibar Revenue Board, and local governments, would create a more predictable and efficient taxation framework, reducing administrative burdens and fostering a more conducive business environment.
- **Youth involvement:** With rising unemployment, there is an opportunity to attract more educated youth into the seaweed sector, particularly through value-added processing and the adoption of innovative farming techniques. By modernizing the industry and improving income prospects, seaweed farming and processing can become a viable and attractive livelihood option for young entrepreneurs.

3.3 Enabling Environment

3.3.1 Policy Environment

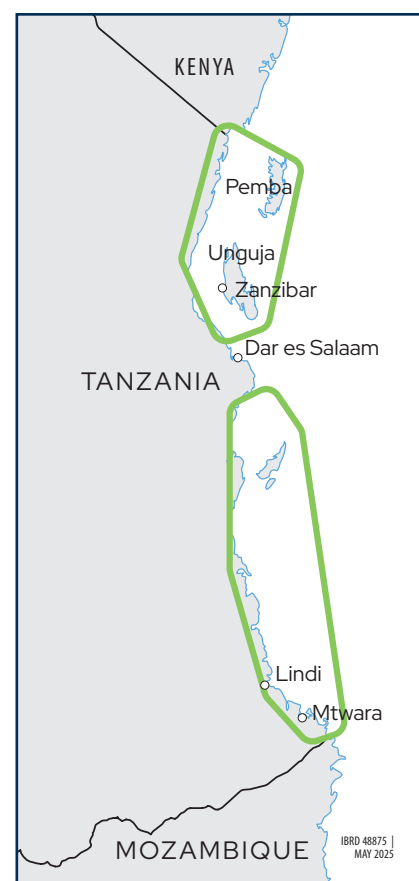
In Tanzania, biosecurity policy is governed by the United Republic of Tanzania, which consists of two main governmental bodies: one governing mainland Tanzania and the other governing the semi-autonomous Zanzibar Islands.

Consequently, there are two governments: the government of Tanzania, which is responsible for union matters, and the Revolutionary Government of Zanzibar, which administers affairs specific to Zanzibar.

Figure 16: Map of Seaweed Cultivation Areas (highlighted in green)

In Zanzibar, the government of Tanzania retains authority over union matters such as home affairs and military operations. Meanwhile, the Zanzibar government, as an autonomous entity, oversees sector-specific responsibilities, including education, health, and industries such as fisheries and aquaculture. Both governments have their own ministries and, as a result, implement separate policies.

The two ministries of fisheries, through their respective departments of marine aquaculture, are responsible for developing draft policies that are approved by their respective parliaments before implementation across the seaweed industry.



Source: Rusekwa et al. 2020.

While there are numerous policies, regulations, and frameworks governing sectors such as agriculture, fisheries, wildlife (land-based), and tourism, there is no dedicated policy or national value chain strategy for seaweed. Seaweed is referenced in various policies and strategies related to fisheries, agriculture, and the blue economy. The seaweed sector is directly linked to the fisheries and aquaculture sectors. This means that the laws, regulations, and frameworks governing the fisheries sector also apply to seaweed cultivation. However, the majority of these existing frameworks do not include specific measures pertaining to seaweed cultivation. Instead, seaweed is typically mentioned under the broader term “aquatic plant.”

Table 5: Frameworks/Authorities Related to the Seaweed Sector

	AUTHORITY	RELEVANCE TO SEAWEED SECTOR
1	Ministry of Livestock and Fisheries (United Republic of Tanzania)	Provides directives on how to promote the seaweed industry in Tanzania and developed the National Fisheries Policy of Tanzania (2015)
2	Ministry of Natural Resource and Tourism (United Republic of Tanzania)	Developed the Seaweed Development Strategic Plan (2005)
3	Ministry of Blue Economy and Fisheries (Zanzibar)	Provides directives on how to develop the seaweed industry in Zanzibar and developed the Blue Economy Policy for Zanzibar (2020)
4	Seaweed Technical Group, Ministry of Blue Economy and Fisheries	Tasked with proposing a comprehensive research agenda to guide sector development and inform policy decisions
5	Vice President’s Office Division of Environment	Helps to ensure that seaweed is grown in the appropriate area (for example, pollution-free) and that produced seaweed is of good quality
6	Tanzania Coastal Management Partnership Support Unit and Mariculture Working Group	Developed the Tanzania Mariculture Guidelines Source Book (2001)
7	National Environment Management Council and local government	Developed the Environmental Management Act (2004)
8	Zanzibar Research Agenda (2015–2020)	Identified research priority areas, which include seaweed
9	Zanzibar Seaweed Cluster Initiative	Researches and develops innovative seaweed farming technologies and value addition
10	Commission of Science and Technology	Oversees and financially supports research to understand the causes of diseases and epiphytes

Source: *Rusekwa et al. 2020.*

Entry to the Seaweed Sector

Entry into the seaweed farming and business sectors in Tanzania follows specific guidelines and procedures. At the farming level, individuals living in coastal villages have unrestricted access to engage in seaweed farming. They can establish farms in available spaces within their villages. Once a person starts farming in a selected area, that space becomes their designated farm, protected under the informal arrangement of “rural modesty.” This system involves mutual protection among farmers to safeguard each other’s farming areas from external intrusion. Villagers typically farm where they live, and they can allocate farming spaces to fellow villagers from the same area. For outsiders from other areas, entry is facilitated by requesting farming space from local farmers. No licensing requirements or land purchases are involved in seaweed farming.

The entire framework governing seaweed farming is regulated and monitored by the local government authorities. They work in direct coordination with the central government to ensure the effective management of farmers, farming areas, and the seaweed business as a whole.

Exporters and Regulatory Requirements

Exporters interested in engaging in the seaweed business must apply for export licenses before starting operations. These licenses entail obligations such as tax payments, levies, and fulfilling community social responsibilities. Exporters are expected to contribute a percentage of their income toward community development projects, which may include supporting infrastructure development of schools and hospitals, for example. The process of obtaining these permits and licenses is regulated under the Fisheries Act and the Trading Act, ensuring that exporters adhere to quality standards and sustainable practices.

Government Support and Interventions

Government support and regulatory framework: The government has introduced direct interventions to support processors, particularly in Pemba. These include providing necessary inputs like tie-ties and ropes to farmers and establishing buying centers. In collaboration with various stakeholders, the government supports initiatives to enhance the seaweed value chain. This includes joint programs with international organizations—such as the International Fund for Agricultural Development, the Food and Agriculture Organization (FAO), the World Food Programme, and UN Women—aimed at boosting production and value addition.

ZASCO’s role and pricing strategy: ZASCO has been instrumental in driving value addition by establishing processing facilities for carrageenan extraction. Its pricing strategy, offering 1,000 Tanzanian shillings per kilogram of seaweed compared with the 600 Tanzanian shillings traditionally offered by exporters, has significantly impacted market dynamics. This higher price has incentivized farmers and pushed traditional exporters to diversify their operations and explore new production areas on the mainland.

Recommendations

- **Develop specific seaweed policies and a national strategy:** The ministries overseeing seaweed development should collaborate to formulate dedicated policies and frameworks tailored to the needs of the seaweed sector. These policies would provide clear guidelines for farming practices, management strategies, and trading regulations. Additionally, a dedicated national seaweed strategy should be developed to ensure a comprehensive and coordinated approach to sector growth, addressing key challenges and opportunities while aligning with broader national economic and environmental objectives.

- **Establish a coordination mechanism:** There is a need to establish a specialized administrative unit tasked with coordinating and monitoring seaweed development initiatives across the country. It would help reduce overlaps in investments by donor organizations. This entity would play a pivotal role in organizing and leading the establishment of functional seaweed cooperatives. It would also provide initial support and coordination for seaweed extension services.
- **Expand market opportunities:** Ministries responsible for trade and investment should help expand the market for seaweed products. This includes creating a conducive environment that attracts both local and foreign private companies to invest in carrageenan processing plants in the country. Efforts should be made to increase seaweed production to meet growing market demands.

3.4 Natural Environment

Tanzania is situated along the eastern coast of Africa. It has a diverse and rich marine environment that is conducive to seaweed farming. The country's shoreline predominantly features rocky formations, while areas near river mouths exhibit muddy and sandy substrates. This variety in shoreline composition creates different habitats suitable for a range of marine species.

Geographical and Climatic Features

The coastal region of Tanzania experiences a warm tropical climate with an annual mean temperature ranging between 24.3°C and 29.7°C. The highest seawater temperatures typically occur from January to March, while the lowest are recorded during June and July. The coastal waters are influenced by the seasonal monsoon winds, the Northwest monsoon from October to March and the Southwest monsoon from April to September. These winds significantly affect ocean currents, contributing to the dynamic marine ecosystem and facilitating the growth of seaweed.

Tidal Dynamics

Tanzania experiences mixed tides characterized by two high and two low tides of varying magnitudes per day. The timing of low tides plays a crucial role in the distribution of marine algae, as intertidal organisms are exposed to atmospheric conditions that can induce stressors such as desiccation, salinity fluctuations, and lethal temperature extremes. From October to March, the lowest tides generally occur during the day, which can adversely affect algal exposure. Conversely, from May to August, the lowest tides occur at night, alleviating some of the exposure-related stresses.

Seawater Quality

The average salinity of open seawater along the Tanzanian coast ranges from 34.5 percent to 35.5 percent.²⁶ However, localized variations may occur near large river mouths and tide pools, which can influence salinity levels and subsequently affect marine biodiversity. The abundance of nutrients in Tanzania's eutrophic waters fosters the growth of various seaweed species, although many remain unexploited.

Coral Reefs

Coral reefs are prevalent along the Tanzanian coastline, providing a critical habitat for numerous marine organisms and playing a vital role in maintaining the ecological balance. These reefs break the force of incoming waves, creating optimal water movement conditions essential for various algal species. The coral lagoons, situated between coral ridges and the shoreline, further enhance the productivity of marine algae by providing a sheltered environment.

²⁶ Sen 1991.

3.5 Governance Analysis

3.5.1 Horizontal Linkage

In Tanzania, seaweed farming is labor-intensive and requires group efforts for tasks such as planting, harvesting, and drying. Consequently, farmers often form cooperatives to share labor, knowledge, and resources such as inputs. Furthermore, the Tanzanian government is promoting the formation of cooperatives by offering incentives such as boats and farming equipment exclusively to cooperatives.

Seaweed cooperatives in Tanzania are fragmented, with numerous small-scale, independent groups operating across the country. Small cooperatives like Ukweli Ni Njia Safi, Kihogoni, and Chokocho Farmers Groups often lack the organizational capacity and scale required to compete in international markets. These cooperatives are involved in small-scale processing of seaweed-based products such as soap and cosmetics. The absence of an industrial-level body limits their ability to engage in advanced processing activities.

Larger cooperatives like JUWAMPE Farmers Group focus on advising farmers, advocating for various policies, and providing welfare support. They negotiate prices on behalf of their members to ensure higher prices for farmers.

ZaSCI plays a significant role in the horizontal integration of the seaweed value chain by helping farmers with value addition. Additionally, in collaboration with Milele Zanzibar Foundation, it organizes Seaweed Day every year. This event is a crucial platform for networking and knowledge sharing. During the event, farmers and cooperatives can connect with buyers, processors, and other stakeholders to explore market opportunities and learn new farming techniques.

3.5.2 Vertical Linkage

The off-taker model is widely used in Tanzania's seaweed industry, where processors and exporters provide essential inputs such as ropes, boats, and training to farmers in exchange for a guaranteed supply of seaweed. The profitability of seaweed farming is heavily reliant on these arrangements. Farming is not viable without the provision of necessary subsidized inputs. This dependency can be precarious if market conditions shift.

These agreements are informal. Formal contract farming is prohibited in Tanzania, so exporters are unable to claim farming inputs as accounting expenses. Additionally, farmers may side sell to other buyers who offer them higher prices, leaving no power to exporters to secure supply. Companies following these informal off-taker models include C-Weed Corporation and ZASCO.

The establishment of the multi-stakeholder platform ZaSCI has been instrumental in strengthening vertical linkages. This platform facilitates communication and collaboration between different actors in the value chain, helping to address common challenges such as access to inputs, quality control, and market access.

3.6 Support Services

3.6.1 Access to Finance

Improving the quality of Tanzania's seaweed requires increased access to finance for small and medium enterprises (SMEs) and farmers to invest in improved seeds, drying equipment, and other essential inputs. In addition to support from exporters in the form of planting materials, boats, and other farm-related items, seaweed farmers in Zanzibar receive financial assistance from various sources. The government plays a significant role by providing funding through departmental and ministerial projects. The government of Zanzibar has also facilitated the creation of farmers' associations, such as Jumuiya ya Wakulima wa Mwani Zanzibar in Zanzibar and JUWAMPE in Pemba, which serve as channels for funding opportunities.

Farmers can also access credit through savings and credit cooperative societies, village corporate banks, and non-banking systems like Vibubu, which are cooperatives formed by farmers for financial purposes. Funding may come from the government, NGOs, associations, and contributions from cooperative members. Additionally, institutions such as the Institute of Marine Sciences and the Commission for Science and Technology help farmers access credit to participate in exhibitions.

Financial institutions and microfinance institutions with products tailored for SME clients could play a crucial role in supporting the sector's growth. A comprehensive assessment of active financial institutions, financial regulatory authorities, and microfinance institutions involved in the seaweed sector is beyond the scope of this report, but this remains an important area for future research. Identifying and engaging with financial providers could help develop tailored financing mechanisms for seaweed farmers, cooperatives, and processors.

3.6.2 Research and Development

Research is crucial for the sustainability of the seaweed industry, addressing issues across the value chain from production to export and consumption. Numerous public and private research institutions, including universities, contribute to seaweed research and development in Tanzania. These institutions include the University of Dar es Salaam, Sokoine University of Agriculture, the State University of Zanzibar, the Tanzania Industrial Research Organization, and the Zanzibar Fisheries Research Institute.

Research on climate-resilient seaweed varieties is increasingly important due to the effects of climate change. Seaweed species must be able to withstand rising temperatures, ocean acidification, and other environmental changes. By focusing on breeding or genetically modifying seaweed varieties that can thrive under changing climatic conditions, research can help farmers maintain productivity and reduce vulnerability to climate-related risks.

According to the Institute of Marine Sciences, research is under way to assess the growth potential and commercial viability of three seaweed species. These efforts have also been discussed in multi-stakeholder platform meetings organized by ZaSCI. However, the introduction of new seaweed species remains a long-term intervention, requiring at least 5–10 years of rigorous testing before they can be safely introduced and widely adopted at a commercial scale. Given this timeline, immediate sector growth efforts should focus on improving existing commercially viable species, such as *spinosum*, *cottonii*, and *ulva*, through hybrid strain development, climate resilience, and yield enhancement.

In addition, there is a pressing need to establish a tissue culture laboratory. These facilities could adapt successful models from other countries to meet local conditions and improve productivity. Training programs could also be conducted.

Finally, there is a critical need for a detailed study to assess the forecasted demand, associated costs, and potential benefits across the value chain in Tanzania. Farmers often lack a clear understanding of the factors that influence pricing. This analysis would provide insights into market dynamics and improve decision-making.

Extension

The State University of Zanzibar is implementing a program aimed at certifying extension officers as “Certified Financial Literacy Officers.” There is a need to provide additional training for these officers to equip them with the necessary skills to manage funds effectively. This will enhance their ability to support local communities in financial decision-making, ensuring sustainable and efficient management of resources.

Challenges

- Limited dissemination of research results, with most funding ending at the output stage.
- Insufficient government and private funding for seaweed sector research.
- Lack of funding continuity, as many funders do not support pilot phases after project completion.
- Insufficient expertise in seaweed diseases and pests.
- Limited financial literacy among extension workers.
- Lack of public investment in extension services.
- Lack of seaweed-specific knowledge among government extension officers.

Recommendations

- **Expand value chain-focused extension services:** Extension services should be expanded to cover all segments of the seaweed value chain. This includes training on modern farming techniques, quality control, value addition, and market access to enhance the competitiveness and sustainability of seaweed farming.
- **Build government capacity for extension services:** The government should strengthen its capacity for seaweed extension services by:
 - Providing improved equipment and resources to extension agents.
 - Offering specialized training to district fisheries officers and extension agents, particularly on seaweed culture, post-harvest handling, and marketing.
 - Recruiting or designating aquaculture-specific extension officers to ensure technical expertise in seaweed farming.
- **Enhance research capacity:** To support the long-term growth of the sector, the government should enhance its research capacity in key areas such as climate-resilient seaweed strains, seaweed seed breeding, and genetic improvement, and increase its collaboration with academic and research institutions.
- **Strengthen input provision:** The government should establish and enhance the capacity of national hatcheries to produce high-quality seaweed seed.

3.6.3 Transportation

Road transport is the primary mode of transportation in Tanzania, with a high road density of 0.31 km/sq. km. However, less than 7 percent of the roads are paved. Several challenges in road maintenance have left nearly half of the network in poor condition. The government is addressing these issues through institutional reforms and the establishment of a Road Fund to improve road upkeep and financing.

The bulkiness of dried seaweed adds to the challenges of road transportation. Transporting seaweed from production areas to processing or export facilities is cumbersome and costly, especially given the deteriorating road conditions. Exporters must manage the logistics of moving large quantities of seaweed from production areas to ports for shipment. Furthermore, the lack of deep-water ports in key production areas like Pemba necessitates additional handling and transportation steps. This logistical challenge is compounded by the need for frequent and large-volume movements.

In contrast, processed carrageenan is less bulky and easier to transport, reducing logistical costs and complexities. The establishment of local processing facilities, such as the new carrageenan extraction plant, is expected to alleviate some of these transportation challenges by allowing seaweed to be processed closer to its production sites, thus minimizing the need for extensive road transport.

3.7 Strengths, Weaknesses, Opportunities, and Threats in the Seaweed Industry

STRENGTHS • Long history of seaweed cultivation • Ideal climatic conditions for spinosum and cottonii varieties • About 80 percent women participation • Reliable labor availability from coastal communities • Demand from China, Denmark, Korea, the United States, Spain, and France • Tanzania's spinosum fetches a higher price than spinosum from other countries • Government and international support for sector development • Centrally located for strategic trade opportunities	WEAKNESSES • Ice-ice and epiphyte infestation negatively impact productivity • Limited access to advanced farming practices due to insufficient training and resources • Limited access to finance and investment • Limited processing • Lower cottonii production despite its higher market price than spinosum • High post-harvest losses due to inadequate drying, transport, and storage practices • Poor seed stock availability due to a lack of nurseries • Fragmented policy and regulatory framework, with no dedicated seaweed policy
OPPORTUNITIES • Expansion into value-added products • Strong regional demand, with significant untapped market potential for growth • Development of local processing capacity, with ZASCO's carrageenan plant, enabling the setup of ancillary industries • Growing global demand for sustainable, seaweed-based products, particularly in eco-friendly sectors • Market development linked to tourism • Seaweed farming's potential for carbon sequestration and methane reduction	THREATS • Intense global competition from established seaweed producers like Indonesia and the Philippines • Market and pricing volatility due to external shocks and fluctuating global demand • Potential conflicts with the tourism industry over land and marine resource use, especially in Zanzibar • Vulnerability to climate change (rising sea levels and temperature) • Competition from substitute products such as synthetic carrageenan, plant-based bio-fertilizers, and algal-based alternatives

The Tanzanian seaweed industry, rooted in over 30 years of cultivation, has significant potential for growth. The seaweed sector is a significant part of Zanzibar's economy, contributing 17.8 percent of total exports and employing around 16,000 people, predominantly women. The primary export destinations include the United States, France, and Denmark, which are highly valued for their demand consistency and quality standards. Tanzania has optimal conditions for growing spinosum and cottonii varieties.

The sector relies heavily on exports of raw dried seaweed, with minimal local processing capacity. However, investments like the carrageenan plant (ZASCO) are emerging to enhance local value addition. Once fully operational, this facility aims to shift production from raw exports to processed carrageenan, positioning Tanzania to capture more value locally and generate additional job opportunities.

Government interventions to provide farmers with essential inputs (such as ropes and drying equipment), coupled with strategic international partnerships, are also bolstering the sector. Entities aim to improve the quality of Tanzanian seaweed products by mitigating the adverse effects of practices such as harvesting immature seaweed.

The global market demonstrates a clear preference for the *cottonii* variety over *spinosum*. This is because, on export, carrageenan derived from *cottonii* (kappa carrageenan) produces a stronger gel than that obtained from *spinosum* (iota carrageenan). Consequently, *cottonii* commands a higher price in Tanzania, ranging between 1,800 to 2,500 Tanzanian shillings (\$0.40–\$0.50), while *spinosum* is priced lower at 700–1,000 Tanzanian shillings (\$0.30–\$0.40). However, the *cottonii* variety has experienced a decline in productivity and production in Tanzania due to shifting environmental conditions such as rising seawater temperatures, epiphytism, and fouling.

At the production level, Tanzanian seaweed farmers face recurrent issues like the ice-ice disease. Adverse environmental factors and fouling also significantly affect *cottonii* yields. These challenges are compounded by the high moisture content and bulkiness of seaweed, which increases transportation costs. To alleviate these logistical issues, processing facilities like ZASCO are strategically located close to production sites. This approach minimizes transport costs and enhances efficiencies within the supply chain. With continued investment and improvements in policy coordination, Tanzania could better compete with global seaweed leaders like Indonesia and the Philippines.

3.8 Seaweed Climate Adaptation and Mitigation Measures

Climate change presents increasing challenges to the seaweed industry, particularly through the rise of diseases and pests. Stakeholders are addressing these issues through various projects, studies, and development programs aimed at mitigating the effects of climate change. Several adaptation and mitigation strategies have been proposed, tested, and implemented. These include relocating farms to deeper waters (2–6 meters during low tide), developing deeper-water farming technologies, increasing awareness of early disease signs, and avoiding replanting infected seaweed.

3.8.1 Deep-Water Farming

Research indicates that farming seaweed in deeper waters can mitigate the impact of climate change, which often leads to diseases and pests. Deeper waters offer lower temperatures and more stable conditions, such as consistent salinity, which are crucial for seaweed health. Organizations like ZaSCI, the governments of Zanzibar and mainland Tanzania, and various research institutions support farmers in adopting these deeper-water technologies. Consequently, many seaweed farmers are voluntarily moving their farms to deeper waters. To make deep-water farming feasible, it is essential to provide swimming lessons for farmers and support them in acquiring boats and engines.

Deep-sea farming in Tanzania remains in its early stages and is less mechanized than the high-capital models adopted in Korea and other Southeast Asian countries. The current approach focuses on introducing motorboats and providing basic swimming training for farmers. However, most operations are still performed manually, with minimal use of specialized equipment.

Figure 17: Commercial Seaweed Farming



Source: Shutterstock Video Clip ID 3450207755.

ZaSCI, in collaboration with partners such as Sea PoWer and Aqua-Farms Organization, has piloted deep-water technologies like tubular nets in Zanzibar (Muungoni, Dimani Ndambani, and Makangale-Pemba) and mainland Tanzania (Kilwa Kivinje). The tubular nets technology, originating from Brazil, was implemented in Tanzania in a project funded by the Western Indian Ocean Marine Science Association from 2014 to 2015. Other technologies explored by ZaSCI with the Institute of Marine Sciences at the University of Dar es Salaam include floating line systems, bamboo rafts, and net baskets.

Among these, tubular nets have shown the most promise, leading to pilot projects in three villages. However, challenges remain, particularly during the windy seasons (Northeast and Southeast monsoons) when the nets face rough seas. Additionally, during periods of calm weather, seaweed in tubular nets tends to rot due to slow water movement. Stakeholders involved in these pilot projects suggest the need for further technological development to overcome these weather-related challenges. Cages are one technology that could be more suitable for deep-water farming and warrant experimentation and possible expansion if successful.

3.8.2 Preventing Diseases

Creating Awareness of Initial Signs of Disease

It is crucial for farmers to recognize and respond to the initial signs of ice-ice disease, epiphytes, and other pests. Early detection enables farmers to take timely actions to prevent the spread of diseases and protect their crops and income. However, the knowledge of these early signs is still limited in Tanzania. Increasing this awareness is essential. Farmers can be educated on basic water conditions, such as measuring water temperature using simple tools like hand thermometers and observing water movement. This knowledge can help farmers estimate the onset of diseases and epiphytes. This approach, described as “teaching traditional farmers to become farmer-scientists,” empowers farmers to make informed decisions about whether to continue farming or pause until conditions improve.²⁷

Not Replanting Infected Seaweed

Many farmers, due to limited knowledge and lack of access to healthy seed sources, replant infected seaweed, leading to the spread of diseases and pests. Farmers must adopt good seed handling practices, including using “clean seed” during every cultivation season, to break the cycle of diseases and epiphytes. This practice could be the most effective way to prevent the spread of diseases among seaweed farms.²⁸

27. Largo, Msuya, and Menezes 2020.

28. Ndawala et al. 2022.

Quarantine Measures

The governments of Tanzania and Zanzibar should implement strict quarantine measures for introduced seaweeds to prevent the spread of pests and diseases from other countries. Effective quarantine practices can minimize the introduction of harmful organisms, such as epiphytes. A successful example of such measures can be seen in Fiji, where the government enforced strict quarantine protocols for its seaweed industry.²⁹

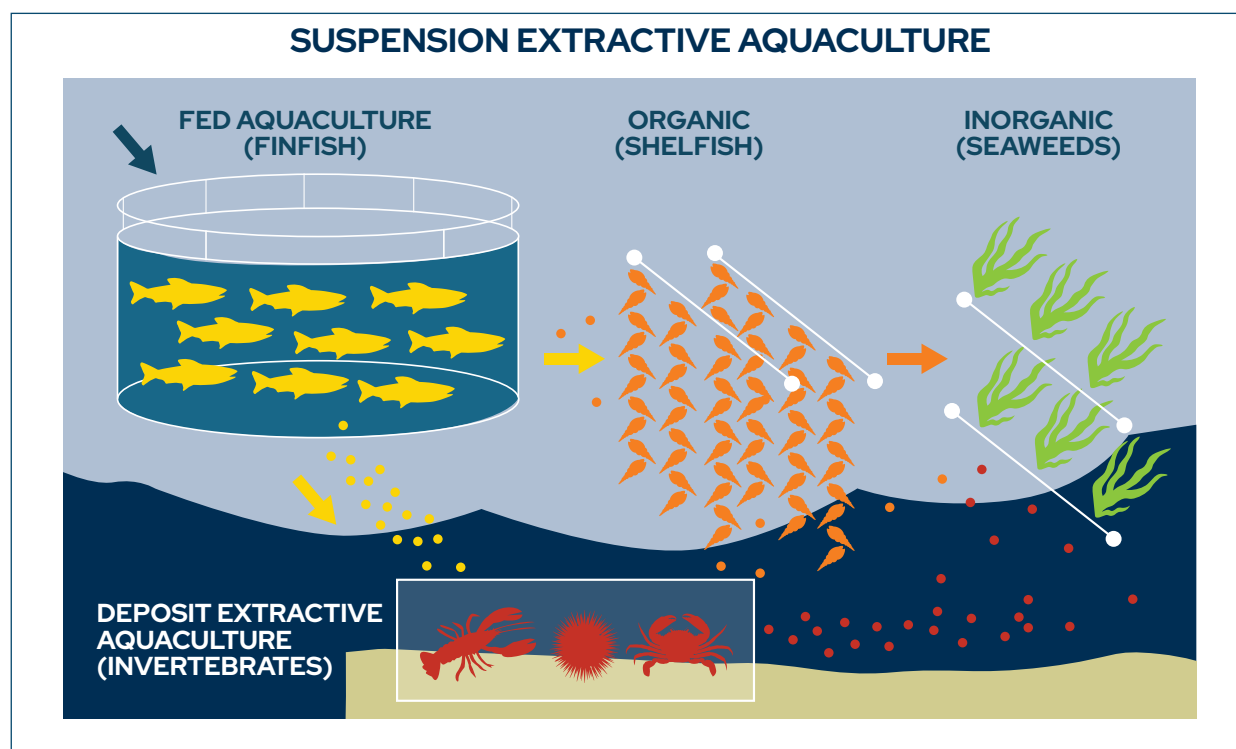
3.8.3 Developing Manuals for Coping with Climate Change

Guidebooks and manuals are essential for informing farmers and other stakeholders along the value chain about best practices and strategies to combat climate change effects. Historically, Tanzania lacked such guides, but recent efforts have produced valuable resources, such as guides on identifying and managing seaweed diseases and pests and improving productivity and traceability.³⁰ It is important to ensure these guides are distributed and used by farmers. More guides should be produced focusing on sustainable farming practices.

3.8.4 Engaging in Integrated Multi-trophic Aquaculture

Integrated multi-trophic aquaculture (IMTA) involves farming seaweed alongside marine animals, creating a polyculture system rather than a monoculture system (Figure 19 provides an example). This setup provides farmers with multiple crops in the same farming area. In Tanzania, studies have explored integrating seaweed with marine animals like sea cucumbers, shellfish, finfish, and crabs. Examples include land-based integration, where water from fishponds is used to irrigate seaweed ponds, and pilot projects integrating seaweed and sea cucumbers. The International Union for Conservation of Nature piloted a commercial-sized IMTA system in Pemba, combining seaweed and sea cucumber farming. This prototype, located in Chokocho village, offers a model for community adoption, although further efforts are needed to expand its use. Researchers could cultivate seaweed alongside sea cucumbers and other fish species to assess potential synergies and benefits.

Figure 18: Integrated Multi-trophic Aquaculture



Source: Global Seafood Alliance 2019.

29. Sulu et al. 2004.

30. The Nature Conservancy 2023.

At present, IMTA is primarily practiced as a research-based initiative rather than a commercially adopted model. To facilitate its broader adoption, particularly among smallholder farmers, public financing could be used to support the development of local IMTA setups near high-production zones beside coastal villages.

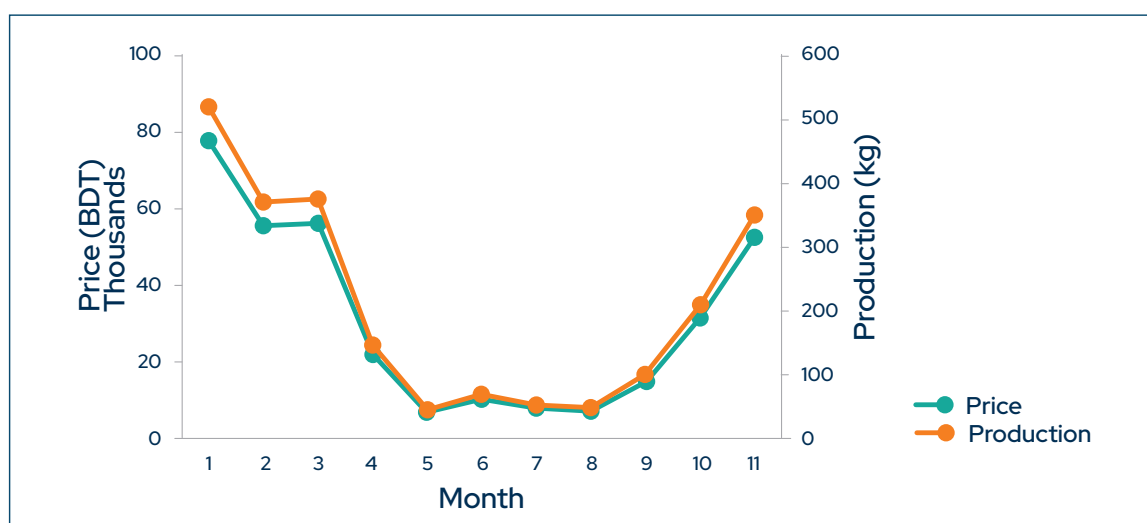
3.8.5 Improving the Genetic Stock of Farmed Seaweeds

To enhance the resilience of farmed seaweed, Tanzania should introduce more local strains of *Kappaphycus* and *Eucheuma* with a broader and stronger genetic base. This can be achieved through mass propagation using micropropagules and tissue culture techniques. These local strains could eventually replace the introduced, disease-compromised strains. However, challenges include the lack of tissue culture laboratories in Tanzania and the Western Indian Ocean region, and research indicating that local varieties do not yet thrive in farms. Opportunities lie in establishing tissue culture laboratories and continuing experiments to identify viable local varieties for cultivation.

3.8.6 Considering Seasonality

Climate change is forcing seaweed farming to become seasonal, with high water temperatures above 35°C affecting even hardy species like *Eucheuma*. During the hot season, some farmers stop farming and wait for cooler weather, while others continue, resulting in wasted efforts and resources. Farmers should be trained to practice seasonal farming (Figure 20), focusing on other activities during adverse conditions and maximizing farming during favorable seasons. This approach can help optimize production and resource use.

Figure 19: Seasonal Dynamics of Seaweed Production at a Commercial Farm



Source: Ahmed et al. 2022.

In collaboration with a research institute, a seasonal farming calendar could be developed. This calendar would be distributed as pamphlets to farmers. It could include details such as optimal planting and harvesting time for different varieties, tidal patterns and timings, weather and climate indicators, and alternative activities during the off-season.

3.8.7 Developing Drying Facilities

Investing in seaweed dryers is crucial for adding value to seaweed farming, particularly during rainy periods when achieving the desired 30 percent moisture content is difficult. Well-designed solar dryers in prominent seaweed farming villages can significantly reduce post-harvest loss and improve the quality of dried raw seaweed. Research shows that a solar drying system can reduce the moisture content of red seaweed from 90 percent to 10 percent within 15 hours. This technology can also boost seaweed production by enabling effective harvesting.

While it typically takes two to three days to dry seaweed in sunny weather, it can take up to seven days or more during the rainy season. As a result, many farmers avoid harvesting during this time, leading to losses as fully grown seaweed breaks off and is carried away by ocean waves. Climate change, causing increased and unpredictable rainfall, further complicates the harvesting process. When seaweed comes into contact with freshwater, such as rain during drying, it gets bleached. Excessive rain prevents drying, causing the seaweed to exude crude carrageenan, becoming slimy and ultimately unable to dry, leading to significant losses.

The Karume Institute of Science and Technology, in collaboration with Mavuno Lab, has developed solar dryers capable of drying 300 kg of fresh seaweed in 1–2 hours. Each unit features six trays. Each tray holds 20 kg of fresh seaweed. The dryer operates using solar panels and battery storage. Four such dryers have been produced, with initial design and production taking three months. New dryers can be produced in one month. These dryers can be scaled up, with increased capacity depending on funding and demand.

In addition, some small-scale solar dryer designs exist in Tanzania. To further mitigate losses, larger-scale solar dryer designs from Southeast Asia could be adapted to Tanzanian conditions.

3.8.8 Domesticating Other Seaweed Species

In response to climate change, it is recommended that other naturally growing seaweed species in Tanzania be researched and domesticated to complement the current species as current research on new species is limited in Tanzania. This includes red seaweed *Gracilaria* (for the production of agar), green seaweed *ulva*, and blooming seaweeds such as *Sargassum*. Additionally, *Asparagopsis taxiformis*, which grows naturally in Tanzania, could be domesticated to reduce methane emissions from cattle.





4. INVESTMENT OPPORTUNITIES & FUTURE POTENTIAL MARKET SECTORS

4. INVESTMENT OPPORTUNITIES AND FUTURE POTENTIAL MARKET SECTORS

The Tanzanian seaweed industry predominantly focuses on *spinosum*, *cottonii*, and *ulva*, as these species have well-established commercial value and strong market links. Given their existing demand, it would be more effective to enhance these three species rather than introduce entirely new varieties. Investing in the development of hybrid strains that are climate resilient and high yielding can improve productivity and sustainability while ensuring consistency in supply. In contrast, introducing new species would require significant awareness building among farmers and a longer adaptation period before reaching commercial viability.

4.1 Cooperative/Community Group Model

There are two distinct seaweed processing models. The first model is the cooperative/community group model, which focuses on producing seaweed powder, body oil, soaps, snacks, and other value-added products. This model requires relatively low capital investment and aligns well with the needs and capacities of smallholder farmers.

4.1.1 Deep-Water Farming

Transitioning to deep-sea seaweed farming under a cooperative structure offers a promising alternative to traditional near-shore farming, which is prevalent in Tanzania. The shift to deep-sea farming would involve significant changes in production techniques, investment in new equipment, and the organization of farmers into cooperatives. This new approach aims to improve the quantity and yield of seaweed while ensuring better access to shared resources, training, and collective market power.

The primary advantage of deep-sea farming is access to a larger area and cleaner waters, which are less susceptible to pollution and environmental changes, resulting in higher-quality seaweed that commands a better price in the market. The cooperative model allows farmers to share the costs of necessary equipment and infrastructure, making the transition more feasible for small-scale producers. The model assumes that each cooperative will have 10 members. The cooperative would own the necessary equipment, including a boat and deep-water farming gear, such as shoes. Additionally, the cooperative would invest in training programs for its members, covering essential skills like swimming, safety procedures, and the practical aspects of deep-sea farming.

The financial analysis indicates that although the initial investment required for deep-sea farming is higher than traditional methods, the potential revenue gains outweigh the costs. The total input costs for a single farmer in the deep-sea model are estimated at 335,266 Tanzanian shillings (\$124.05), compared with 119,629 Tanzanian shillings (\$44.26) for the traditional method. Labor costs also rise from 90,593 Tanzanian shillings (\$33.52) for traditional farming to 115,600 Tanzanian shillings (\$42.77) for deep-sea farming. This difference is attributed to the additional inputs required by the farmers in the deep-sea method because the area under cultivation increases.

Despite these higher costs, the expected revenue per farmer using deep-sea farming is significantly higher, with an estimated annual income of 712,769 Tanzanian shillings (\$263.72), compared with 339,413 Tanzanian shillings (\$125.58) under the traditional system. This results in a net income of 377,502.80 Tanzanian shillings (\$139.68) for deep-sea farming, compared with 119,969 Tanzanian shillings (\$44.39) for traditional methods. The net profit margins increase from 35 percent for the traditional method to 53 percent for the deep-sea farming method.

If 100 cooperatives are targeted over five years, starting with 10 in the first year, scaling up to 25 in the second, 50 in the third, and reaching 75 in the fourth year, the investment is expected to break even within four years, with incremental

profits becoming positive by the third year. It has a net present value of \$288,097 and an internal rate of return of 129 percent. These figures demonstrate the long-term profitability of the deep-sea farming model, despite the higher initial investment and operating costs.

4.1.2 Processing Self-Help Groups (Seaweed Soap and Body Oil)

The global seaweed soap market is projected to grow from \$153 million in 2023 to \$503 million by 2030, at a compound annual growth rate (CAGR) of 8 percent. Similarly, the global algae oil market is expected to grow at a CAGR of 3.7 percent, reaching \$3,495.8 million by 2034. The increasing consumer demand for natural and organic products drives these market trends. Locally, the peak tourist season from May to January boosts demand for artisanal goods in Tanzania. Hotels and gift shops serve as significant sales channels for locally made products, further enhancing the market potential for seaweed products produced by self-help groups (SHGs).

The proposed business model focuses on empowering women-led SHGs to process seaweed into high-value products such as soap and body oil. This initiative leverages Tanzania's abundant seaweed resources while aligning with the growing global demand for natural and organic skincare products. Each SHG, consisting of 40 members, will process raw seaweed into value-added products using specialized equipment and comprehensive training.

The investment will support 550 SHGs, with a phased implementation plan starting with 10 SHGs in the first year and scaling up to 110 SHGs by the fifth year. The cumulative investment required over five years amounts to \$605,000. Key components of the investment include providing equipment, training programs, and branding support, and establishing market links. These measures aim to enable SHGs to produce premium products that command competitive prices in the marketplace. Each SHG will be equipped with essential tools such as seaweed grinders, drying trays, mechanical cutters, and oil presses. Members will receive training in production techniques, business management, and marketing. Premium packaging will increase the appeal of these products for local and export markets.

The financial model assumes that each SHG will produce and sell 6,600 soaps and 1,200 bottles of body oil per year. The average price per soap is 1,300 Tanzanian shillings (\$0.48), and the price per 100 ml bottle of body oil is 5,000 Tanzanian shillings (\$1.85). The production costs per SHG amount to 5,803,500 Tanzanian shillings (\$2,147), while revenues reach 15,900,000 Tanzanian shillings (\$5,883). This results in a net income of 10,096,500 Tanzanian shillings (\$3,736) and a profit margin of 64 percent.

The cumulative financial projections indicate a net present value of \$894,972 and an internal rate of return of 67 percent. The payback period for the investment is expected to be five years, highlighting the profitability and sustainability of the model.

This business model promotes women's empowerment by enabling SHGs to manage and own production activities. It also benefits farmers supplying raw seaweed and creates jobs within SHGs and associated supply chains. By strengthening local production capabilities and establishing robust market links, the model generates sustainable income and socioeconomic benefits for participating communities.

4.1.3 Solar Dryers

As part of the proposed strategy to improve the efficiency and profitability of the seaweed value chain in Tanzania, a significant opportunity lies in investing in solar dryers for drying seaweed. Seaweed producers in Tanzania rely on traditional drying methods, primarily sun-drying, which is subject to weather variability and often leads to inconsistent quality and contamination. A solar drying system offers a controlled, hygienic, and energy-efficient solution to address these challenges, enhancing the quality of dried seaweed while reducing dependence on fluctuating weather patterns.

The solar dryers would be introduced at the level of community seaweed cooperatives, enabling producers to maintain consistent quality and achieve higher yields. The dryers would be designed to harness solar energy, using locally available materials for construction, making the system both affordable and sustainable.

The operational costs of the solar dryers would be minimal, as they rely on solar energy, which is free and abundant. However, the following costs would need to be considered:

- **Maintenance:** Routine cleaning of solar panels, inspection of structural integrity, and repair of any wear and tear over time.
- **Labor:** Costs for labor associated with loading and unloading seaweed, maintaining the dryers, and ensuring optimal drying conditions. Local cooperative members could be trained to perform these tasks.
- **Materials:** Initial investment in materials for constructing the solar dryers, including wood, bamboo, plastic sheeting, and solar panels (if not already available in the community).
- **Transport:** Costs for transporting seaweed to and from the drying facilities, particularly if the dryers are located away from the immediate harvesting sites.

While the initial investment in solar dryers may be higher than traditional drying methods, operational costs are expected to be low, making this a cost-effective and sustainable solution in the long term.

4.2 Medium- to Large-Scale Industries

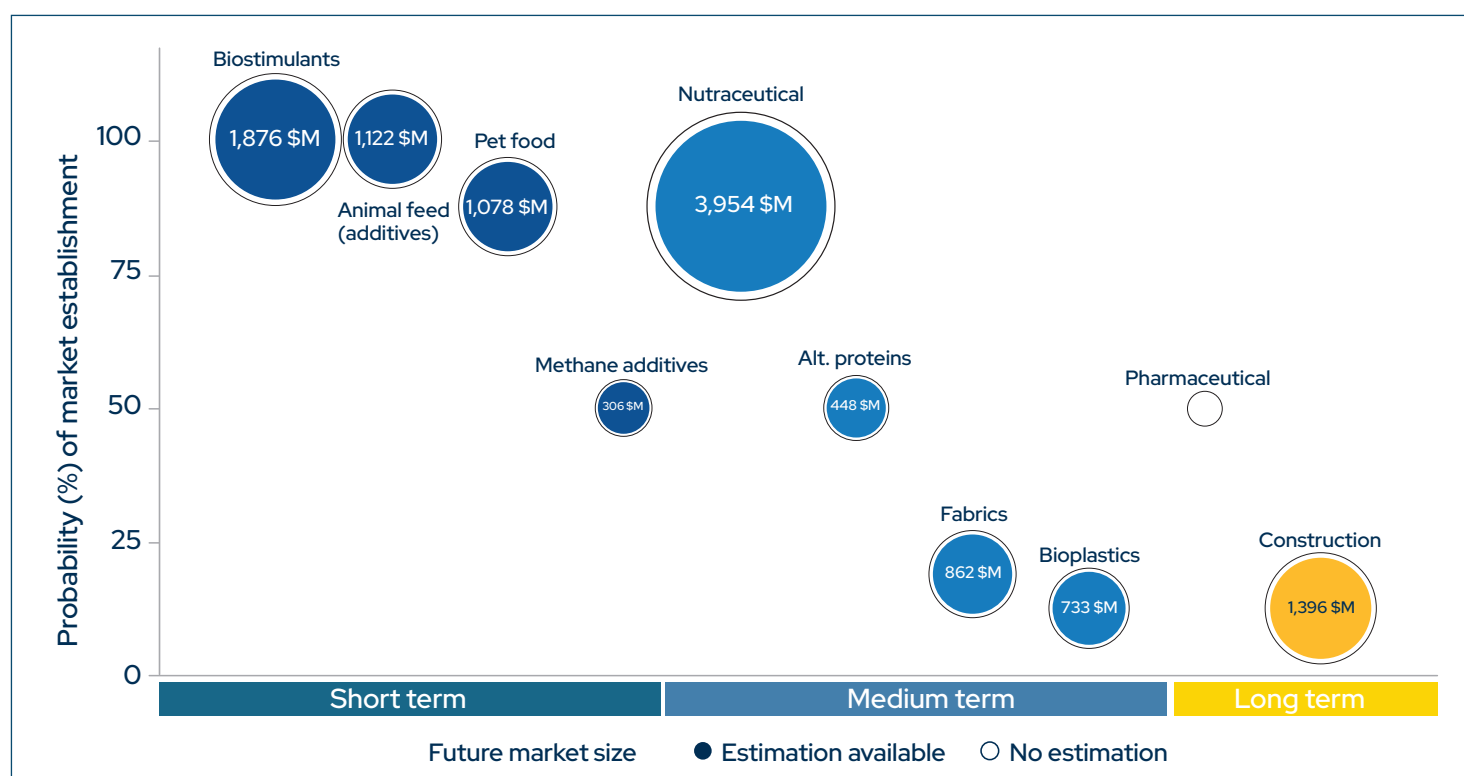
The second model consists of medium- to large-scale industries, including biofertilizer production, animal feed suppliers, carrageenan extraction units, and nutraceutical processing. These industries depend on raw seaweed as a primary input. Given the substantial capital investment required and the large quantity of raw seaweed needed, they are considered long-term interventions.³¹

Biostimulants, animal feed additives, bioplastics, ancillary industries, and pet food are the most promising markets for seaweed, projected to reach \$4.4 billion by 2030. Seaweed-based products in these high-growth markets already show competitive value propositions and prices. They also present low processing complexity with no significant challenges to scaling compared with other applications. Animal feed additives reduce dependence on synthetic products and improve animal productivity by reducing the feed conversion ratio. Methane-reducing additives represent a novel market, and even though there are significant technological and regulatory challenges, there are more vigorous efforts to overcome these in the short term compared to other markets.

Pharmaceuticals could offer a long-term market opportunity, but they face significant regulatory challenges and high product development costs. Due to many complex assumptions and lengthy approval times, projections of the market value for pharmaceuticals are unreliable. Building materials made of seaweed may present a long-term emerging market for construction, projected to reach \$1.4 billion by 2030. However, it is more likely used as a niche application within the construction industry or realized through waste valorization, where by-products from processing seaweed are repurposed for use in other applications.

31. Refer to Annex 2 for a list of potential investors.

Figure 20: Potential Market Size of Seaweed Products



Source: Hatch Innovation Services 2023.

4.2.1 Biofertilizers

Biostimulants are agricultural inputs that mitigate abiotic stress and enhance plant productivity through increased biological activity. They can be applied to increase crop yields and crop quality. In recent years, the impact of synthetic fertilizers on soil quality has gained growing attention in the agricultural sector and resulted in a wider interest in natural alternatives. Biostimulants are a low-cost alternative. Biostimulant products are often targeted at the organic agricultural sector because many synthetic crop improvements and defense products do not meet organic standards.

Value Proposition

The use of seaweed-based bioproducts has been gaining momentum in crop production systems in the past 30 years, owing to their unique bioactive components and effects. Seaweeds can be applied as biological agricultural input products in different forms, such as biofertilizers, liming materials, soil improvers, plant biostimulants, and fertilizing product blends. They increase crop resistance to drought, salinity, extreme temperatures, diseases, and oxidative stress. Most of the products are liquid. They are classified as biostimulants because they do not naturally contain enough fertilizer compounds to qualify as fertilizers. In the United States, seaweed-based products can be sold as “seaweed fertilizers” with the addition of just 1 percent conventional fertilizer, making it difficult to gauge the actual market size.

Market Overview

The global market size of biostimulants in 2022 was between \$2.5 billion and \$3.5 billion at the manufacturing level and has a projected CAGR of around 10 percent over the next decade. There are four main segments in the biostimulants market: seaweed extracts, fulvic or humic acids, microbial biostimulants, and amino acids. Seaweed extracts account for about 40 percent of the total market and were valued at about \$935 million in 2021.

Around 80 percent of biostimulants are used for row crops, fruits, and vegetables. Europe is the largest market for biostimulants, followed by Asia-Pacific. The rapid growth of the global biostimulants market has attracted two waves of new entrants: large companies expanding into the market through acquisitions and small research firms. The sector remains largely dominated by SMEs, which do not have the resources to distribute products themselves. It typically takes between two and five years to bring a new biostimulant product to market.

Globally, more than 500 companies are involved in the biostimulant and biological control agent market. This highly competitive market has relatively low barriers (minimal registration) to entry compared with the conventional crop protection market. Two business models are common in the seaweed-based biostimulant market. In the business-to-business model, companies source seaweed biomass, extract biostimulants, and sell them to large companies. These large companies have a distribution or retail network and use third-party labeling. In the second model, business-to-business-to-consumer, companies develop their own branded products and sell them through established market channels. This model is less common.

In terms of quality, Acadian Seaplants, BioAtlantis, and Maxicrop are among the leading providers of seaweed-based biostimulants. In terms of volume, Chinese companies are leading. In Tanzania, Coastal BioTech produces seaweed-based biostimulants. It has successfully tested the biostimulants on crops such as onions and cucumbers. The company aims to commercialize these products and has signed a memorandum of understanding with the Zanzibar Agricultural Research Institute to expand its activities.

Prices are typically set by the producers and distributors. Depending on market demand, prices can vary significantly. In North America, most algae-based biostimulants sell for \$8–\$20 per liter. In Europe, *A. nodosum*-based products sell for €5–€16 per liter. The recommended retail price for *Ecklonia*-based products is around €20 per liter.

Market Outlook

Biostimulants are an attractive market for developers of seaweed-based products:

- They are relatively simple to produce—most products are mechanically extracted liquid fertilizers.
- The solid co-product from this process can be sold as animal feed or pet food, while the biostimulant can be a co-product of hydrocolloid processing.
- The market has low regulatory requirements.
- The route to market is relatively fast and simple. There are established supply chains in place for agricultural inputs, and large global operators are looking for new products for their portfolios and sales channels.

4.2.2 Feed Additives

The global population is projected to reach 9 billion people by 2050. Concerns persist about the capacity to produce sufficient food to meet the growing global demand. One key challenge is the increasing demand for animal-based protein. Currently, soybeans and maize are the main feedstock used for animal feed. These products are also used in human food. Consequently, animal feeds that compete less with human food have been growing in popularity.

Value Proposition

The Tanzania Industrial Research and Development Organization is processing seaweed into “mineral blocks” for animal feed. Its suitability as an alternative feed component stems from its balanced amino acid profile, rich mineral and vitamin content, and special combination of bioactive compounds. These can improve nutrient absorption and provide a range of performance benefits for many animal species.

Seaweed has already been incorporated into animal feed regulations worldwide. In the European Union, it falls under both the “feed materials” and “feed additives” categories. These additives are subject to more stringent regulations than feed materials and undergo more tests.

Terrestrial Animal Feed

Seaweed extracts or meals are mostly sold as supplements for terrestrial animals and are generally incorporated at low inclusion rates—usually lower than 80 g per kilogram of feed. Macroalgae are used as sources of bioactive substances and minerals in livestock feeds and, to a lesser extent, as sources of protein.

The most prevalent algal feed ingredients are derived from brown macroalgae extracts. The principal algal feed components for poultry are green seaweeds, such as *Ulva* spp., with a suggested level of up to 10 percent feed inclusion. There are promising results for seaweed-derived swine feed supplements. The benefits of using these supplements include reduced piglet mortality and improved feed conversion ratios, animal health, and sow productivity. There have been positive results from adding fermented seaweed to pig feed.

Aquafeed

Fishmeal has traditionally been the primary protein source in aquatic feed. However, due to overfishing and the increasing demand for natural ingredients, alternative plant-based proteins are being used as a partial replacement. Seaweeds have been explored as a source of protein for aquatic feed products. These seaweed formulations also improve final product texture and flavor, increase yields, and reduce the use of synthetic and chemical additives. Around 20–30 percent of farmed brown kelps and *Gracilaria* are used as fresh feed for the aquaculture industry in China and Korea.

Table 6: Different Types of Protein Use and Price

INGREDIENT	USE	PRICE	SOURCE
Fish meal	Bulk ingredient	\$1.495 per kg (average price 2018–2022)	www.indexmundi.com
Soybean meal	Bulk ingredient	\$0.436 per kg (average price 2018–2022)	www.indexmundi.com
Lysine	Nutritional additive	\$1.20–2.80 per kg (between Mar 2022 and Feb 2023)	www.allaboutfeed.net
Theorine	Nutritional additive	\$1.28–3.48 per kg (between Mar 2022 and Feb 2023)	www.allaboutfeed.net
Vitamin A	Nutritional additive	\$24.5–76 per kg (between Mar 2022 and Feb 2023)	www.allaboutfeed.net
Vitamin D3	Nutritional additive	\$7.9–16.9 per kg (between Mar 2022 and Feb 2023)	www.allaboutfeed.net

Source: *International Bank for Reconstruction and Development / The World Bank, 2023.*

Market Overview

The market for animal feed additives was valued at \$38.86 billion in 2022. It is expected to grow at a CAGR of 3.9 percent from 2022 to 2030, reaching \$52.77 billion by 2030. Prebiotic additives such as seaweed can fall into the zootechnical additives category. The global zootechnical feed additive market was worth \$9.7 billion in 2022. Europe is the largest market, worth \$2.8 billion. Prominent zootechnical feed additive manufacturers include Alltech, Cargill, Delcon, DSM, DuPont, and Kemin Industries.

Table 7: Price of Protein

TYPE OF PROTEIN	PRICE [\$/KG] – 100% PROTEIN
Soy protein	2.0
Pea protein	5.0
Insect protein	41.0
Mycoprotein	13.0
Cultured meat	300.0
Whey protein	7.5

Source: McKinsey Report 2019.

Market Outlook

The seaweed-based animal feed additive market is projected to be worth \$1.1 billion in 2030. The market is expected to continue growing steadily over the next 10 years and remains promising for seaweed in the short term. The European seaweed animal feed supplement market is projected to reach \$2.4billion by 2030.

Due to the functional and economic benefits of seaweed, global understanding and interest in its use as an ingredient has increased significantly over the past 18 months, with customers expressing more curiosity and wanting to see data on its effectiveness. Despite pushback from global pharmaceutical players, changing legislation relating to sustainable farming practices in regions like the European Union will likely incentivize the adoption of seaweed in animal feed and other sectors. Numerous sustainability advantages are associated with using seaweeds, the majority of which are consistent with government objectives such as the European Union Green Deal, which targets more sustainable agriculture.

To reduce the risk of seaweed pollutants, global stakeholders are creating standard guidelines and international limits for the identification and quantification of contaminants in seaweed-based animal feed.

4.2.3 Alternative Proteins

According to some estimates, humans consume about 350 million MT of meat every year, and global meat production is projected to double by 2050 compared to 2022 levels. Without improvements to food supply chains, there may not be enough land to produce animal protein for the growing global population. Alternative proteins are proteins for human consumption that are not sourced from animals (for example, plant-based or food technology-based alternatives). They are widely seen as potential solutions to the problems associated with livestock production.

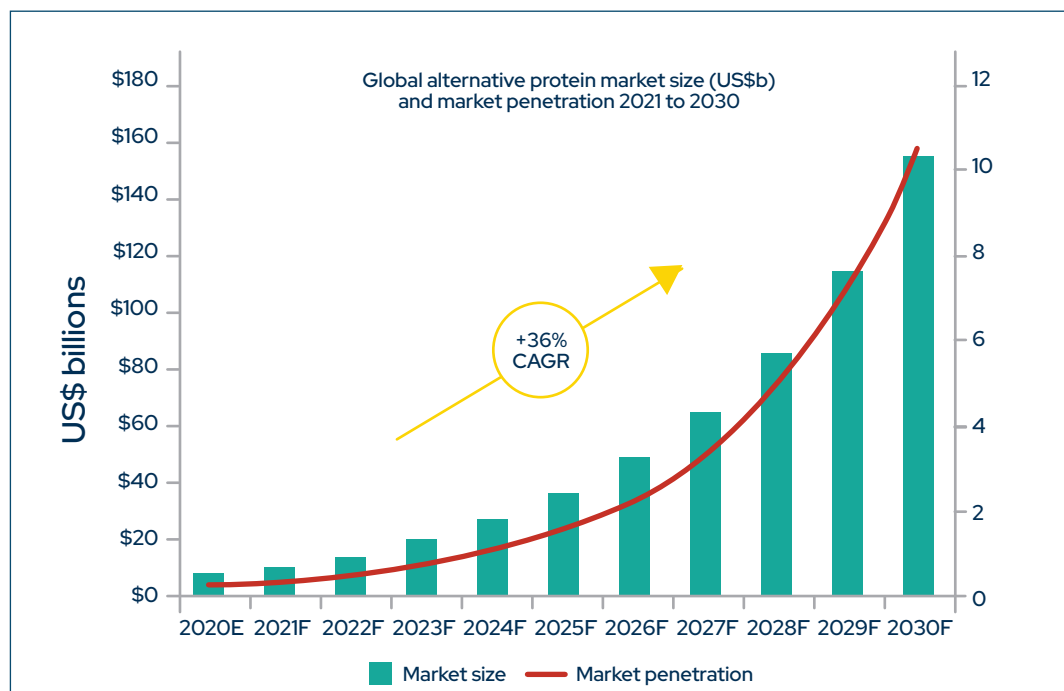
Value Proposition

Seaweeds are a potential alternative protein source. Macroalgae have been eaten for thousands of years and contain up to 47 percent protein by dry weight, although this varies greatly among species. Brown seaweeds typically have a lower protein content than green and red seaweeds. Seaweed-based, alternative protein products can benefit from a number of texturizing and stabilization functions that seaweeds themselves provide. Seaweeds also provide environmental benefits because they can be cultivated without the use of freshwater, land, or fertilizers. It is suggested that one acre of seaweed can yield as much protein as five acres of soybeans.

Market Overview

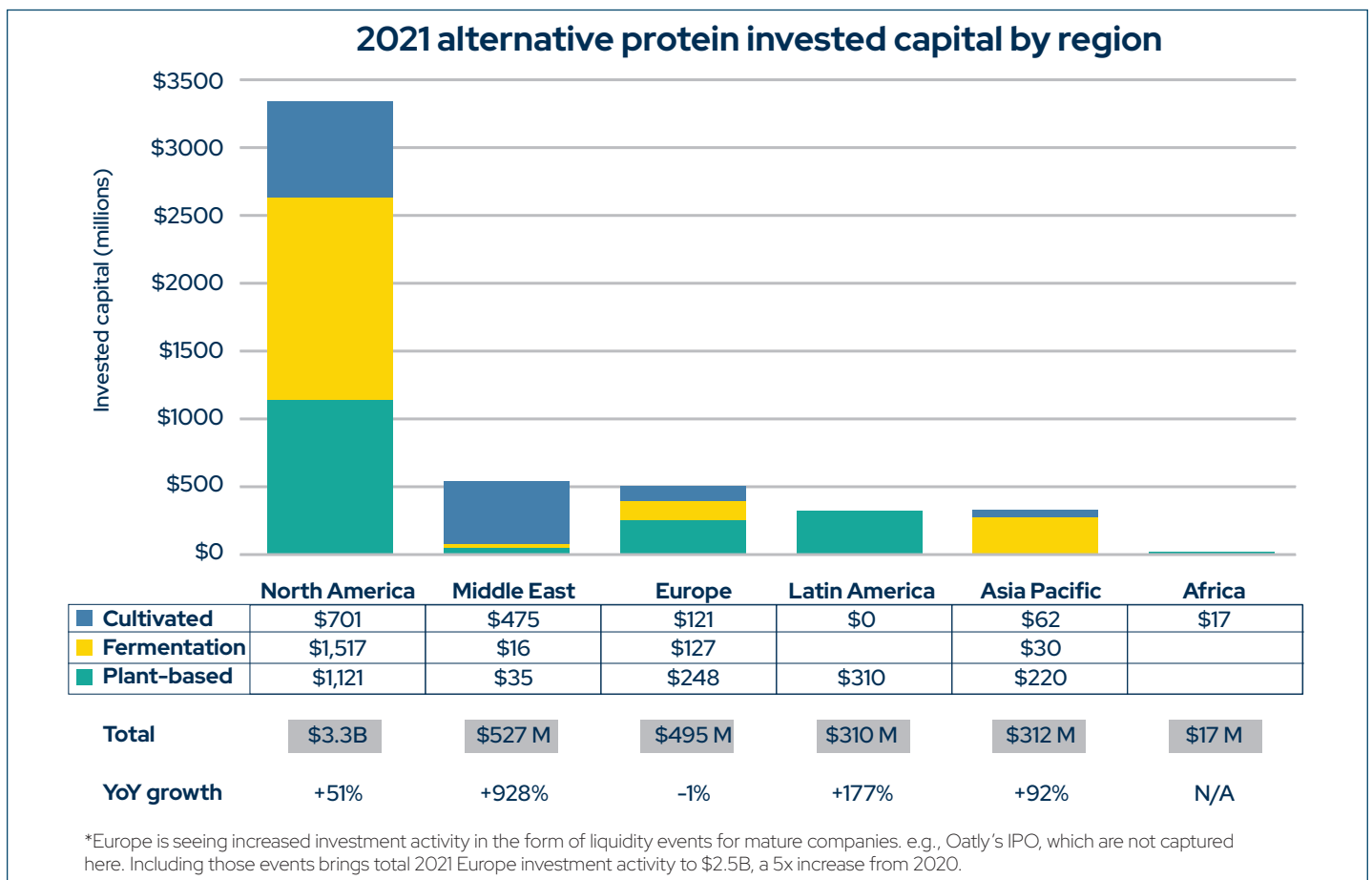
The global alternative protein market was valued at \$10.2 billion in 2022 and is expected to grow at a CAGR of 36 percent between 2022 and 2030. The two best-established protein sources on the market are both plant-based: soy and pea protein. Price points for these plant-based proteins are considerably cheaper than their alternatives. Alternative protein companies secured \$5 billion in disclosed investments. Some of the largest companies in this category include Impossible Foods and Beyond Meat.

Figure 21: Alternative Protein Market Size



Source: EY Parthenon Analysis, 2021.

Figure 22: Capital Investment in Alternative Protein



Source: GFI APAC, 2022.

There are a number of start-ups developing alternative proteins from seaweed. For example, New York-based AKUA and the Dutch Weed Burger are both creating plant-based patties using seaweed. Meanwhile, Umaro is developing a high-protein bacon substitute derived from dulse. Additionally, many developers are targeting seafood replacement products made from seaweed and other alternative ingredients. There is less need to add ingredients to mask the taste and odor of seaweed.

Start-ups typically use two business models to bring such products to market. The first is a business-to-business sales channel model. This typically involves using a biorefinery process to isolate high-protein content from seaweed. Developers in this category are either aiming to sell seaweed protein extract directly to other businesses or are working on a royalty or licensing model with large formulation companies, which, in turn, work with mass manufacturers of food products. The second is a business-to-consumer model where a company uses the inclusion of seaweed to market the sustainability of the product or to support health and nutritional claims. There are vertically integrated companies processing and developing seaweed-based alternative proteins, but the majority of start-ups in this category source seaweed directly from a network of farmers or processing companies.

Market Outlook

The market for seaweed-based alternative protein is expected to be \$448 million by 2030. Challenges that could delay market growth include the production cost of high-protein concentrates. Although seaweeds are used in the formulation of alternative protein products, they are not always used as the main protein source. If a developer wants a product to have seaweed as its first named ingredient, it is typically in conjunction with soy or pea protein.

Given the size of orders required by alternative protein product manufacturers, some companies have suggested that they would need a facility capable of processing over 10,000 MT of wet seaweed per year to meet the needs of the bigger food manufacturers. They will also need to rely on high-protein seaweed species and on potentially rotating the species on a seasonal basis. Seaweed-based protein can reach cost and yield parity with pea protein, but this depends on the demand for seaweed-based ingredients and an increase in the cultivation of high-protein seaweeds.

4.2.4 Methane-Reducing Feed Supplements

Methane has a global warming potential 28 times greater than that of carbon dioxide by unit. It is the main direct source of greenhouse gas emissions in beef and dairy production. In recent years there has been a focus on developing methane mitigation strategies for ruminants. Modifying their diet through feed additives can reduce their methane emissions.

Market Overview

The global sales of methane-reducing feed amounted to \$30 million in 2021. The global market for these products is forecast to reach \$1.18 billion–\$2.37 billion by 2030. Using this growth rate and using 2021 as a base, the estimated market value in 2022 was about \$47 million. Ruminant methane-reducing product segments include natural supplements (seaweed and essential oils), synthetic compound supplements, vaccines, and cow wearables.

Most companies developing seaweed feeds in this sector are cultivating *Asparagopsis*—either the tropical *A. taxiformis* or the temperate *A. armata*. Cultivation is taking place both in marine environments and land-based systems, where growth conditions³² can be more carefully controlled. Several start-ups, including SeaForest and CH4 Global, have since made announcements that they have successfully closed the *Asparagopsis* life cycle³³ using a combination of land-based and ocean-based farming practices. Meanwhile, the company Greener Grazing has been demonstrating how to close the life cycle of *A. taxiformis* using ocean-based grow-out.

32. Temperature, light, and nutrient levels.

33. The *Asparagopsis* life cycle consists of three stages: gametophyte, carposporophyte, and tetrasporophyte. The main challenge in aquaculture has been triggering the release of spores, a critical step to close the life cycle and enable large-scale production.

Over the past two years, FutureFeed has grown significantly and licensed its technology to many businesses globally. Another company, Sea Forest, has spent the past two years scaling up production at its 1,800-hectare marine lease in Triabunna, Tasmania, where it has invested over \$20 million in infrastructure. Sea Forest has tested its products with local dairy farmers, who give *Asparagopsis armata* supplements to their cows and sell the resulting milk to Fonterra, a dairy company from New Zealand. Meanwhile, in June 2021, CH4 Global made its first commercial sale of *Asparagopsis* cattle feed supplements in Australia. In August 2021, the company announced a partnership with Clean Seas Seafoods, a producer of kingfish, to set up a seaweed nursery and production trials on land, using wastewater from the fish hatchery. The company has a five-year target of reaching 150 million cattle, 10 percent of the world total, on all six habitable continents.

4.2.5 Bioplastic

Plastic pollution is a major environmental concern globally. Petroleum-based plastics are the primary source of this pollution. However, their non-biodegradable nature means they can persist for centuries, leading to accumulation in landfills and natural ecosystems.

Value Proposition

Seaweed is a rapidly renewable marine resource. Seaweed-derived bioplastics present a sustainable alternative to fossil fuel-based plastics. They have the potential to reduce greenhouse gas emissions by up to 67 percent and degrade much faster than conventional plastics. Moreover, seaweed-based bioplastics are both biodegradable and non-toxic to marine organisms.

Bioplastics are conventionally made from feedstocks such as corn or sugarcane. However, unlike conventional feedstocks, seaweed does not require arable land, fertilizers, or pesticides, making it a more sustainable and cost-effective alternative.

Figure 23: Types of Seaweed Bioplastic



Source: Mongabay 2023.

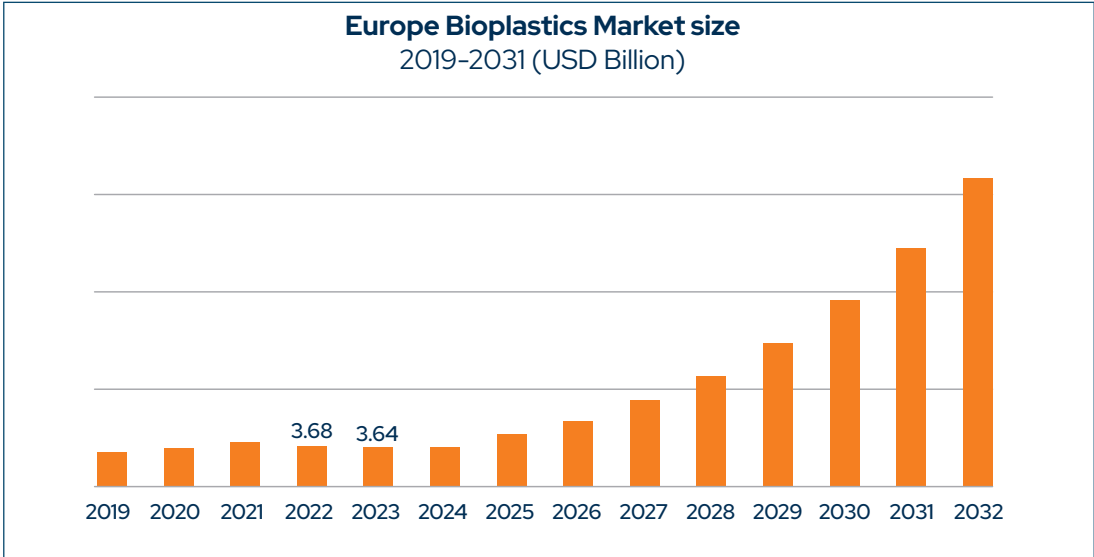
Market Overview

The global bioplastics market is growing rapidly. In 2023, the market size was valued at about \$7.49 billion, and it is projected to grow at a CAGR of 29 percent to reach \$56.99 billion by 2032.³⁴ This expansion is driven by increasing regulations and restrictions on single-use, non-biodegradable plastics in regions such as North America and Europe. Additionally, the increasing adoption of sustainable practices in emerging markets across Asia-Pacific is contributing to this projected growth.

34. Fortune Business Insights 2025.

Macroalgae (seaweed)-based bioplastics are expected to generate an incremental opportunity of \$21.3 million, with a projected 1.6x increase in market value between 2024 and 2034.³⁵ Their unique properties, such as excellent moisture and oxygen resistance, make them particularly suitable for various packaging applications, contributing to their market potential.

Figure 24: Europe's Bioplastic Market Size

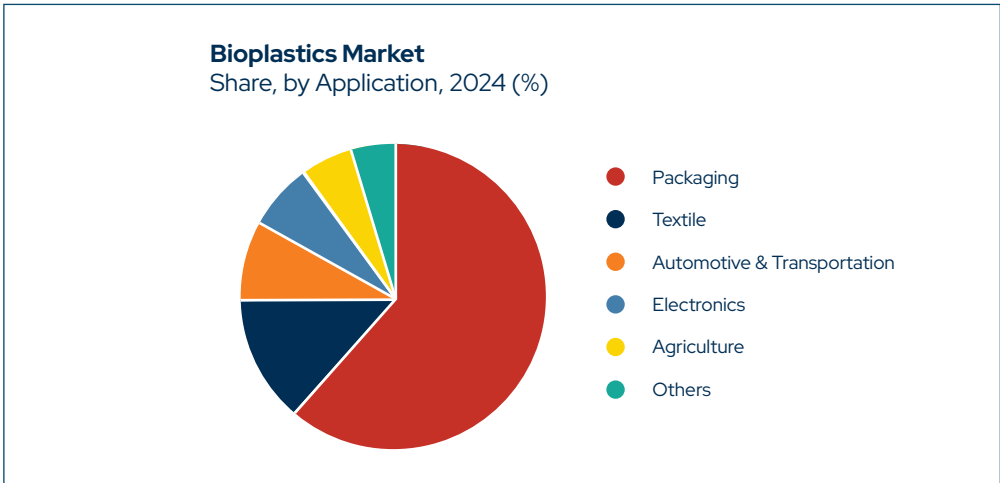


Source: Fortune Business Insights 2024.

Market Outlook

The global market for algae-based bioplastics is projected to grow at a CAGR of 4.8 percent from an estimated \$110 million in 2024 to \$175.8 million by 2034.³⁶ In 2023, the industry generated \$105 million in revenue and is expected to see a year-over-year growth of 4.6 percent in 2024. As countries enforce stricter plastic waste regulations, demand for sustainable alternatives like seaweed-derived bioplastics is anticipated to rise. Specifically, the packaging industry, a key sector for bioplastics, is expected to exceed \$22.6 billion by 2030, with bioplastics playing a central role in this expansion. The slow adoption of algae-based bioplastics can be attributed to concerns about their durability, scalability, and long-term performance compared to established bioplastics like starch-based plastics or polylactic acid.

Figure 25: Market Share by Application



Source: Grand View Research 2024.

35. Future Market Insights 2024.
36. Future Market Insights 2024.

4.2.6 Carrageenan and Ancillary Industries

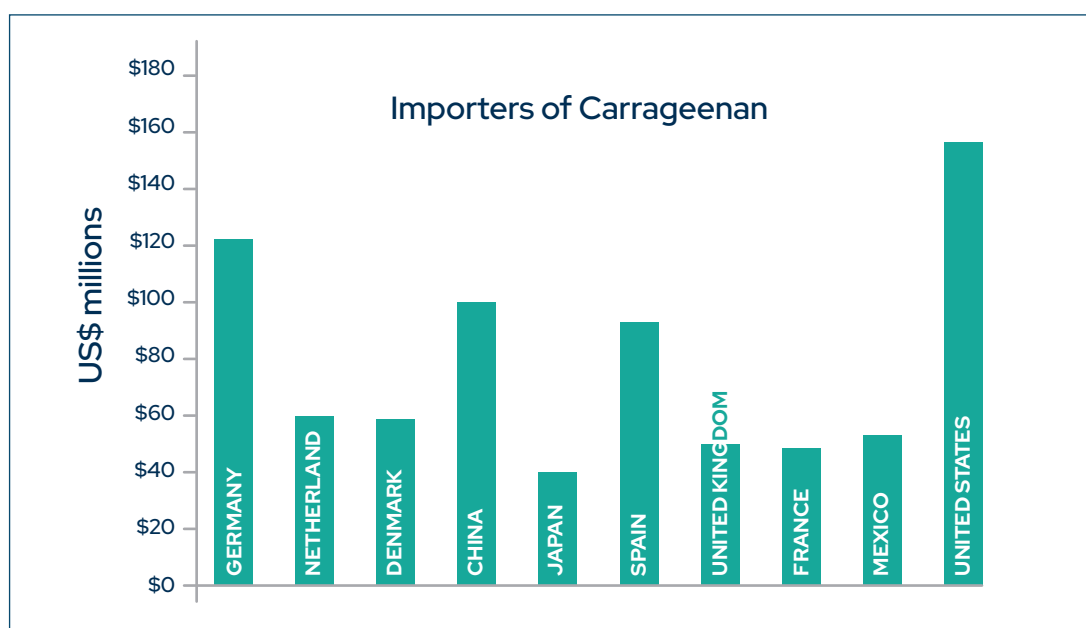
The establishment of the ZASCO facility and the local production of carrageenan in Tanzania present substantial opportunities for the growth of several ancillary industries. These industries include personal care, dairy products, and sustainable food and beverage products.

New market links may be required in the mid to long term for emerging seaweed-based products enabled by the processing of high-grade carrageenan in Tanzania. However, as the processing plant is not yet operational, it is too early to determine what ancillary industries may develop as a result of increased access to high-grade carrageenan. The growth of such industries will depend on private sector interest, investment, and government incentives to support the establishment of medium- to large-scale enterprises. Potential industries range from beverage manufacturing to cosmetics and nutraceuticals, each with distinct marketing and distribution requirements.

Value Proposition

The global carrageenan market is projected to grow at a CAGR of 6.5 percent from 2019 to 2029,³⁷ driven by increasing demand in sectors such as food, pharmaceuticals, and cosmetics. The United States is the largest importer of carrageenan, recording an import value of \$157.31 million in 2023. Germany is the second-largest importer with \$124.48 million. Despite its domestic production capabilities, China imported carrageenan worth \$100.79 million in 2023.

Figure 26: Top 10 Importers of Carrageenan by Value, \$ Million, 2023



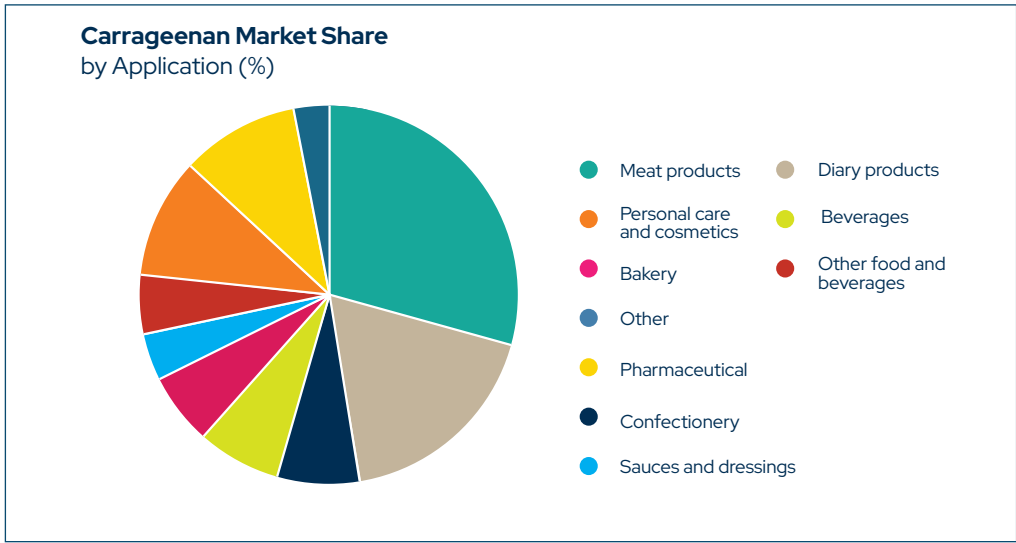
Source: Tridge 2024.

Carrageenan is a versatile ingredient that is extensively used across multiple industries due to its ability to gel, thicken, and stabilize products. It is predominantly used in meat products (Figure 28) to improve texture, retain moisture, and enhance the overall product quality. In dairy products, it is commonly used to stabilize proteins, prevent separation, and ensure a smooth consistency in products such as yogurt, cheese, and ice cream.

In the pharmaceutical sector, carrageenan serves as a critical excipient in drug formulations and extends to specialized applications such as tissue engineering, permeability enhancement, scaffolds for tissue growth, biofilms for controlled release, and hydrogels for medical and biotech use.

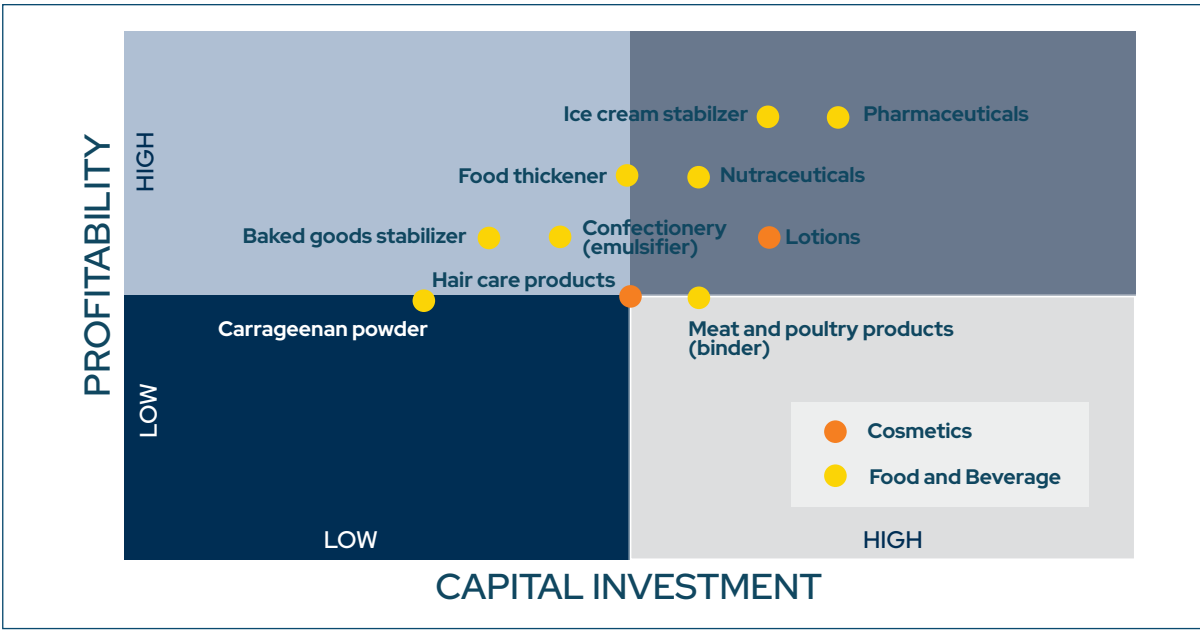
37. Mordor Intelligence n.d.

Figure 27: Market Share by Application, 2023



Source: Data from Grand View Research 2023.

Figure 28: Capital Investment and Profitability Matrix for Carrageenan Products



Source: Based on author's analysis

Products like pharmaceuticals, nutraceuticals, and ice cream stabilizers appear in the high capital investment and high profitability quadrant (Figure 29) due to the complexity and stringent regulatory standards involved in their production. Pharmaceuticals, for example, require rigorous testing and compliance, but their strong demand and higher value add ensure substantial profits. Similarly, ice cream stabilizers and nutraceuticals cater to niche markets where the quality-enhancing properties of carrageenan are highly valued. It results in premium pricing that justifies the capital outlay.

Conversely, products such as food thickeners and baked goods stabilizers occupy a moderate position in both capital investment and profitability. These products are commonly used across the food and beverage sector, making them essential but less specialized. Their production process is simpler than that of pharmaceuticals, which keeps investment requirements moderate. Although stable, profitability is tempered by competition within the food additives industry. Despite a large market size, margins may be decreasing due to commoditization and price pressures.

At the lower end of both capital investment and profitability are products like carrageenan powder and hair care products. In its basic form, carrageenan powder requires minimal processing and hence lower investment, but because it is widely available and undifferentiated, its profit margins are also small. While hair care products are inexpensive to produce, they compete with a variety of alternative ingredients, limiting both their market reach and profitability. These products are likely to attract smaller-scale producers with limited resources.

Table 8: Perceptual Ranking of Carrageenan Products

PRODUCT	CAPITAL INVESTMENT (scale 1–16)	PROFITABILITY (scale 1–16)
Food thickener	8	13
Lotions	10	12
Pharmaceuticals	11	14
Nutraceuticals	9	13
Confectionery (emulsifier)	7	12
Carrageenan powder	5	11
Hair care products	8	11
Ice cream stabilizer	10	14
Baked goods stabilizer	6	12
Meat and poultry products (binder)	9	11

Source: Based on author's analysis.

Market Overview

Food and beverage industry: The growing popularity of plant-based diets has propelled the demand for carrageenan, particularly in dairy alternatives. The global market was valued at \$27.94 billion in 2022 and is expected to grow at a CAGR of 8.9 percent to reach \$53.61 billion by 2030. As more consumers seek sustainable, natural ingredients in their food, carrageenan's role as a stabilizer and thickening agent in plant-based beverages is gaining momentum.

Cosmetics and personal care: The use of carrageenan in the cosmetics and personal care industry is expanding rapidly due to its natural, hypoallergenic properties. It is widely used in products such as lotions, moisturizers, facial masks, shampoos, and toothpaste due to its gelling and emulsifying properties. In 2021, the global natural cosmetics market was valued at \$13.58 billion and is projected to grow at a CAGR of 9.5 percent from 2022 to 2030. This growth is largely driven by consumer demand for sustainable and organic personal care products.

Additionally, the global demand for "clean beauty" products has led to greater interest in natural alternatives to synthetic chemicals, further enhancing carrageenan's appeal. Given the strong demand for natural, eco-friendly ingredients in cosmetics, Tanzania's carrageenan industry has the potential to secure a significant share of the global cosmetics market, which is projected to reach \$22 billion by 2030.

Pharmaceuticals: Carrageenan is an important excipient in the pharmaceutical industry, where it is used as a binder, stabilizer, and controlled-release agent in various drug formulations, including tablets and oral liquids. The global pharmaceutical excipients market, including carrageenan, was valued at \$8.85 billion in 2022 and is projected to grow at a CAGR of 7.3 percent to 2030. As the demand for oral solid dosage forms and controlled-release systems continues to grow, carrageenan's applications in the pharmaceutical sector are expected to increase.



5. RECOMMENDATIONS



5. RECOMMENDATIONS

The recommendations in this report align with practical market opportunities given the current state of development of Tanzania's seaweed sector. In the next five years, the sector should focus on improving the quality of farmed seaweed, increasing farmgate prices for producers, strengthening local value addition, and ensuring the sustainability of the supply chain. These efforts will enhance the competitiveness of Tanzanian seaweed in export markets and support the development of ZASCO and other small-scale processors. In the long term, the establishment of medium- and large-scale processing industries will be critical for the sector's growth.

5.1 Recommendations

Table 9: Recommendations

ACTION	COMMENTS	TIME FRAME	RESPONSIBLE ENTITIES
Policy and institutional climate			
Develop specific policies or a national strategy tailored to the seaweed sector	Provide clear guidelines for farming practices, management strategies, and trading regulations.	Medium term (2–3 years)	Ministry of Blue Economy and Fisheries (Zanzibar), Ministry of Livestock and Fisheries (mainland)
Establish a national seaweed strategy	Establish a dedicated national seaweed strategy to guide sector development.	Medium term (2–3 years)	Ministry of Blue Economy and Fisheries (Zanzibar), Ministry of Livestock and Fisheries (mainland)
Develop a national branding strategy for seaweed products	Establish a certification and branding mechanism to promote Tanzanian seaweed products in high-value markets. This includes obtaining international certifications and developing a traceability system.	Long term (3–5 years)	Ministry of Trade and Industrial Development, exporters, private sector
Establish a multi-stakeholder platform	Coordinate efforts among the government, the private sector, academia, and NGOs to monitor and guide sectoral growth. Create a specialized administrative unit to facilitate efficient investment allocation.	Short term (1–2 years)	ZaSCI, Ministry of Trade and Industrial Development, development partners
Harmonize tax frameworks	Streamline taxation and eliminate overlaps among the Tanzania Revenue Authority, the Zanzibar Revenue Board, and local authorities to reduce exporters' burdens.	Medium term (2–3 years)	Tanzania Revenue Authority, Zanzibar Revenue Board, Ministry of Finance, Tanzania Exporters Association

ACTION	COMMENTS	TIME FRAME	RESPONSIBLE ENTITIES
Research, test, and promote the adoption of hybrid and climate-resilient varieties	Investigate and domesticate hybrid and climate-resilient varieties of species such as <i>spinosum</i> and <i>cottonii</i> to increase yield and reduce risks.	Long term (3–5 years)	Research institutes (for example, Tanzania Fisheries Research Institute, Zanzibar Fisheries and Marine Resources Research Institute, and Tanzania Commission for Science and Technology), private sector
Strengthen biosecurity measures and enhance capacity building	Implement stringent quarantine protocols to mitigate the risk of introducing pests and diseases through imported seaweed species. Develop and disseminate standard operating procedures for processing and packaging seaweed. Help stakeholders obtain international certifications.	Medium term (2–3 years)	Government, development partners
Strengthen public investment in extension services	Expand extension services across the entire seaweed value chain, including training on modern farming techniques, quality control, value addition, and market access. Enhance government capacity by recruiting aquaculture-specific extension officers, providing training, and improving equipment for extension agents.	Short term (1–2 years)	Ministry of Blue Economy and Fisheries (Zanzibar), Ministry of Livestock and Fisheries (mainland), local governments
Develop and implement spatial zonation of marine resources	Plan marine space to minimize conflicts between tourism, seaweed farming, fisheries, and conservation, ensuring optimized and sustainable use of marine resources.	Medium term (2–3 years)	Ministry of Blue Economy and Fisheries (Zanzibar), Ministry of Livestock and Fisheries (mainland), local governments
Production			
Introduce deep-water farming technologies	Replace off-bottom farming with innovative methods to improve yields and climate resilience.	Short term (1–2 years)	Research institutes, private sector, farmer groups, development partners
Train farmers in disease management	Train farmers to recognize early disease signs and implement preventive measures like using disease-free seeds.	Short term (1–2 years)	Government, NGOs, farmer cooperatives
Develop sea-based nursery farms and tissue labs	Develop nurseries and tissue culture labs for disease-free seed supply.	Short term (1–2 years)	Government, research institutes, private sector

ACTION	COMMENTS	TIME FRAME	RESPONSIBLE ENTITIES
Provide solar dryers	Install high-volume solar dryers to support seaweed drying during rainy seasons.	Short term (1–2 years)	NGOs, private sector
Establish seasonal farming guidelines	Train farmers on optimizing production during cooler months and reducing risks during high-temperature periods.	Short term (1–2 years)	Government, NGOs, farmer cooperatives
Develop early warning systems	Establish systems to monitor environmental conditions, disease outbreaks, and market trends, providing timely alerts to farmers.	Medium term (2–3 years)	Government, research institutes
Provide gender-sensitive amenities	Develop designated spaces for women such as childcare centers, children's play areas, and a designated area for lactating mothers at landing sites to enhance participation in seaweed farming.	Medium term (2–3 years)	Government, NGOs, private sector
Provide WASH facilities	Establish WASH facilities at landing sites to ensure proper hygiene during post-harvest handling.	Medium term (2–3 years)	Government, NGOs, private sector
Promote integrated multi-trophic aquaculture	Facilitate adoption and scaling of IMTA by seaweed farmers to improve ecosystem resilience and diversify incomes. Provide financing support to develop local IMTA setups near high-production zones.	Medium term (2–3 years)	Research institutes, private sector, NGOs, government
Invest in storage, drying, and logistics infrastructure	Develop proper storage, drying, and logistics facilities at landing sites to reduce post-harvest losses and improve seaweed quality.	Medium term (2–3 years)	Government, NGOs, private sector
Develop centralized quality control and testing facilities	Establish a national center for seaweed quality control to ensure adherence to processing and packaging standards, facilitating access to international markets.	Medium term (2–3 years)	Government, private sector, development partners
Aggregation			
Establish grading standards	Implement quality standards to differentiate seaweed and ensure premium pricing for higher-quality products.	Medium term (2–3 years)	Government, exporters, NGOs
Improve community storage facilities	Provide shared drying and cleaning facilities to reduce post-harvest losses.	Medium term (2–3 years)	NGOs, farmer associations, local governments

ACTION	COMMENTS	TIME FRAME	RESPONSIBLE ENTITIES
Processing			
Establish processing units	Establish cooperatives with centralized processing centers to enhance product consistency and scalability.	Medium term (2–3 years)	Private sector, NGOs
Provide standard operating procedure guidelines	Develop and train farmers on standardized procedures for processing and packaging seaweed products.	Short term (1–2 years)	Government, NGOs, exporters
Collaborate with packaging entrepreneurs	Develop innovative, eco-friendly packaging to enhance product appeal and marketability.	Long term (3–5 years)	Private sector, development partners
Conduct public awareness campaigns	Educate young entrepreneurs on seaweed's nutritional benefits and business potential.	Short term (1–2 years)	NGOs, media organizations, government
Enhance youth participation in seaweed value addition	Provide training, start-up grants, and business development services to encourage youth engagement in seaweed-based enterprises such as cosmetics, bioplastics, and fertilizers.	Medium term (2–3 years)	NGOs, government, private sector
Provide government incentives for small- to large-scale industries	Establish financial and policy incentives (for example, tax breaks, grants, subsidies, technical support, and training) to encourage the development of SMEs and large-scale industries involved in seaweed-based products such as fertilizers, carrageenan-based ancillary industries, animal feed, cosmetics, and bioplastics.	Long term (3–5 years)	Ministry of Trade and Industrial Development, Ministry of Finance, development partners, private sector
Enhance access to finance for seaweed farmers and SMEs	Identify and engage with financial institutions, financial regulatory authorities, and microfinance institutions to develop loan products tailored to seaweed farmers and processors.	Medium term (2–3 years)	Government, private sector
Exporters			
Promote export branding	Enhance branding to access premium markets.	Long term (3–5 years)	Government (Tanzania Revenue Authority, Zanzibar Revenue Board, local authorities)

5.2 Coordination Mechanism

5.2.1 Current Coordination Mechanisms

There is no dedicated industry association for seaweed value chain actors. The primary platform facilitating coordination in Tanzania's seaweed industry is the Zanzibar Seaweed Cluster Initiative (ZaSCI). It serves as a pivotal multi-stakeholder platform in Zanzibar, uniting various actors to bolster the seaweed industry's growth and sustainability. Established in 2006 under the Pan African Competitiveness Forum and coordinated by the Tanzania Commission for Science and Technology, ZaSCI operates across multiple villages in Zanzibar and mainland Tanzania.

Key Objectives of ZaSCI

- Enhance productivity: Implement advanced farming techniques to increase seaweed yield.
- Promote value addition: Develop and market seaweed-based products, including food, body cream, and soap.
- Strengthen market access: Facilitate connections between farmers and international markets to boost exports.
- Empower women: Support women-led seaweed farming associations.

Stakeholder Composition

ZaSCI's multi-stakeholder framework encompasses:

- Government entities: Ministries responsible for agriculture, livestock, fisheries, and trade.
- Academic and research institutions: Organizations conducting research to advance seaweed farming practices.
- Private sector: Seaweed farmers, buyers, exporters, and small-scale processors.

Strengths

- Comprehensive stakeholder engagement: ZaSCI effectively integrates a diverse range of stakeholders, facilitating collaboration among producers, academia, and government entities. This inclusive approach promotes shared learning and resource pooling, which are essential for addressing complex challenges in the seaweed industry.
- Promotion of value addition: The initiative has been instrumental in encouraging the production of value-added seaweed products, moving beyond the traditional export of raw seaweed. This strategy has led to higher market prices and increased income for local communities.
- Capacity building and training: ZaSCI provides training programs for farmers and processors to enhance their skills in sustainable farming practices and product development. Such capacity-building efforts contribute to improved productivity and product quality.
- Research and innovation: Collaborating with research institutions enables ZaSCI to drive innovation in farming techniques and product diversification, ensuring the sector remains competitive and resilient to challenges such as climate change.

Weaknesses

- Resource constraints: Despite its achievements, ZaSCI may face limitations in financial and human resources, potentially affecting the scale and sustainability of its activities.
- Market access challenges: While efforts have been made to add value, accessing international markets remains a hurdle due to factors like stringent quality standards, lack of certification, and competition from established producers.
- Coordination complexity: Managing a diverse group of stakeholders can lead to coordination challenges, including potential conflicts of interest and communication gaps.

5.2.2 Action Plan for a Multi-stakeholder Platform

Table 10: Action Plan for a Multi-Stakeholder Platform

ACTIVITIES	DESCRIPTION	TIME FRAME
Preliminary study to identify challenges and opportunities	Conduct an in-depth study to identify the key challenges and opportunities in the seaweed sector in Tanzania. This will include examining constraints such as limited market access, lack of infrastructure, inadequate financial resources, and barriers to technology adoption. The study will also explore opportunities, such as the potential for value addition, emerging export markets, and innovation in sustainable seaweed farming techniques. The study will involve collecting quantitative and qualitative data through surveys, interviews, and focus group discussions with farmers, processors, traders, and other stakeholders. Findings from this study will provide a foundational understanding to inform the objectives and structure of the multi-stakeholder platform.	Done (study in question)
Assessment of existing interventions and institutions	Review and analyze similar multi-stakeholder platforms, interventions, and institutions operating in Tanzania, focusing on those that have relevance to the seaweed or broader agricultural sectors. This includes assessing their objectives, governance structures, implementation strategies, successes, and challenges. The study will help identify lessons learned and best practices that can inform the setup of the multi-stakeholder platform. Furthermore, it will provide insight into any overlaps with existing platforms and how they can complement or collaborate with the new multi-stakeholder platform. This activity will ensure that the multi-stakeholder platform is not duplicating efforts but rather building on existing knowledge and infrastructure. Since ZaSCI is already a recognized entity in the seaweed sector, an in-depth evaluation will be conducted to assess its structure, functionality, and impact. This will include reviewing its governance model, stakeholder engagement processes, and funding mechanisms. The evaluation will identify strengths and weaknesses in ZaSCI's operations and determine whether it could serve as the basis for the new multi-stakeholder platform. If ZaSCI is deemed limited in its scope, alternative approaches for creating a new platform will be explored, taking into account the unique needs of the sector and the lessons learned from ZaSCI's experience.	1–2 months
Meetings with partner institutions	Organize a series of meetings with the identified partner institutions, such as relevant government ministries, development agencies, private sector representatives, NGOs, and civil society organizations. These discussions will explore the synergies between the new multi-stakeholder platform and existing interventions, ensuring the platform addresses gaps in current efforts. The discussions will cover collaboration mechanisms, resource sharing, and coordination to avoid redundancy with other ongoing initiatives. A key component of these meetings will be negotiating potential contributions (both financial and non-financial) from each partner and discussing the governance structure and leadership roles within the multi-stakeholder platform.	1–2 months

ACTIVITIES	DESCRIPTION	TIME FRAME
Organize a stakeholder meeting	Organize a large, inclusive meeting for all identified stakeholders to discuss the formation of the multi-stakeholder platform. The meeting will aim to establish consensus on the platform's governance structure, decision-making processes, and operational guidelines. Key decisions will include defining the roles and responsibilities of each stakeholder, determining leadership roles within the platform, and agreeing on a common vision and mission. The meeting will also address the legal and institutional framework that will underpin the multi-stakeholder platform, ensuring that it is legally recognized and supported by relevant policies.	1 month
Define multi-stakeholder platform objectives and responsibilities	Convene a series of collaborative workshops to clearly define the objectives and responsibilities of the multi-stakeholder platform. These workshops will engage all stakeholders in discussions to set both short-term and long-term goals for the platform. Key objectives might include increasing seaweed production, improving market access, and fostering innovation in sustainable practices. Stakeholders will also agree on the governance and operational responsibilities of the multi-stakeholder platform, including financial management, monitoring and evaluation, and communication strategies. This activity will ensure that all stakeholders have a shared understanding of the multi-stakeholder platform's purpose and how they will contribute to its success.	1–2 months
Determine support mechanisms for multi-stakeholder platform	Develop a comprehensive framework for the support mechanisms needed to ensure the platform's effective operation. This includes determining both monetary and non-monetary support from donor organizations, which may include financial resources, technical expertise, training, access to market networks, knowledge transfer, and policy advocacy. This activity will involve consultations with stakeholders to ensure that the multi-stakeholder platform's needs are met, both in terms of immediate operational funding and long-term sustainability. The support mechanisms will also include monitoring and evaluation systems to track the progress and impact of the platform's activities.	1–2 months

ACTIVITIES	DESCRIPTION	TIME FRAME
Establish administrative team	Recruit potential candidates and create a dedicated administrative team to manage the daily operations of the multi-stakeholder platform. This team will be responsible for coordinating activities, managing communications, ensuring stakeholder engagement, and overseeing the implementation of the platform's objectives. The team will be permanently employed to ensure continuity and stability. A key part of this activity is the recruitment of qualified personnel with expertise in governance, project management, stakeholder coordination, and managing initiatives directed toward seaweed sector development. The team will be tasked with developing a detailed work plan for the platform's first year of operation and establishing clear reporting lines and responsibilities. Over the next five years, the team will play a pivotal role in implementing the platform's strategic objectives, monitoring progress, adapting to emerging challenges, and ensuring that the platform delivers measurable impact in strengthening the seaweed sector.	1–2 months
Monthly review meetings	Organize monthly meetings to review the progress of the various initiatives and assess the development of the seaweed sector. These meetings will serve as a platform for stakeholders to discuss challenges, share progress, and make necessary adjustments to the multi-stakeholder platform's activities. A structured agenda will be established to ensure that key topics are discussed, such as financial management, project implementation, and stakeholder engagement. These meetings will ensure transparency, foster accountability, and enable continuous feedback for improving the platform's effectiveness.	Monthly
Semi-annual and annual reviews	Conduct formal semi-annual and annual reviews to assess and report on the progress and outcomes of initiatives managed through the multi-stakeholder platform to donor organizations. These reviews will evaluate whether the initiatives are meeting their intended objectives, examine financial performance, and assess their overall impact on the seaweed sector. The reviews will ensure that donor-supported projects remain impactful, transparent, and aligned with sector priorities, while offering an opportunity to strengthen collaboration among stakeholders.	Semi-annually, annually

5.2.3 List of Stakeholders

Table 11: List of Stakeholders

NO.	NAME	DESCRIPTION
1	Ministry of Blue Economy and Fisheries	Develops strategies for seaweed industry growth and value addition in Zanzibar
2	Ministry of Livestock and Fisheries	Oversees seaweed industry development and policy making in mainland Tanzania
3	Ministry of Trade and Industrial Development	Works with UNIDO and Nutri-San to enhance seaweed value addition
4	Vice President's Office Division of Environment	Ensures environmentally sustainable seaweed farming practices
5	Tanzania Coastal Management Partnership Support Unit	Supports sustainable coastal and marine farming practices, including seaweed cultivation
6	Institute of Marine Sciences	Conducts research an
7	Zanzibar Fisheries Research Institute	Conducts research on sustainable seaweed farming practices and disease management
8	State University of Zanzibar	Provides research and extension services for seaweed farming and processing
9	University of Dar es Salaam	Engages in seaweed research on disease management and climate adaptation
10	Karume Institute of Science and Technology	Designs seaweed solar dryers, baling machines, and aquatic product processing equipment
11	Sokoine University of Agriculture	Conducts research on seaweed's role in biofertilizers and on agricultural productivity
12	C-Weed Corporation	Major exporter that provides inputs to farmers and manages seaweed aggregation for export
13	Zanzibar Agro-Seaweed Company Limited	Processes and exports seaweed globally
14	Zanzibar East Africa Seaweed Company (ZANEA)	Exporter focusing on high-quality seaweed for global markets
15	Multipack Commodities	Exporter engaged in seaweed aggregation and quality assurance for global markets
16	Hamad Seaweed Enterprise	Exporter involved in raw seaweed procurement and quality assurance for export
17	Kido Seaweeds	Major exporter focusing on competitive pricing and market access
18	Kai Trading	Seaweed exporter handling procurement and logistics for international markets
19	King David Foundation	Exporter handling seaweed for global markets
20	Inovo Company Limited	Handles export logistics and raw seaweed procurement
21	Ledo Biashara	Exports and trades Tanzanian seaweed

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An underwater photograph showing a dense patch of bright green, leafy seaweed in the foreground. Sunlight rays stream down from the surface, creating a blue and green color palette. The word "ANNEX" is written in white, sans-serif capital letters in the upper right area.

ANNEX

ANNEX 1. EXAMPLES OF EXISTING PROCESSORS IN TANZANIA

ENTERPRISE/ GROUP	ACTIVITIES	KEY PRODUCTS	SALE PRICES (USD)	SALES AND MARKET	CHALLENGES
Sus Blue Shop	- Purchases seaweed from farmers (at \$1.20–\$1.60/kg) - Resells seaweed - Sells seaweed-based products	Raw seaweed	\$4/kg	95 percent of sales occur offline 75 percent of customers are tourists - Tour guides receive 10 percent commission	Sales are mostly offline
		Seaweed soap	\$1.20		
		Seaweed powder	\$20/kg		
Furahia Wanawake Group	- Grows Spinosus variety - Processes all seaweed into value-added products	Dry seaweed	\$0.80/kg (15–30 kg sold per order)	- Annual profit: \$240 - Products sold mainly to tourists	- Climate change - High operational costs
		Bleached seaweed	\$1.20/kg		
Ahsam Tea	Produces seaweed-based herbal tea	Seaweed masala tea (65 percent seaweed)	\$0.80 (260 g), \$0.08 (10 g)	Monthly sales: \$2,248 (tea), \$80 (masala)	High packaging costs
	Produces masalas	Herbal tea (15 percent seaweed)	-	Primary market: Pemba	High transport costs
	Purchases seaweed powder from farmers (at \$2/kg)	-	-	Secondary market: Dar es Salaam	
	Informal exports	-	-	Exports to Kenya and Democratic Republic of Congo	
Ukweli Ni Njia Safi Group	Farms spinosum	Packaged dry seaweed	\$2/500 g	Monthly sales: 80–90 kg seaweed	Seasonal shortages require buying seaweed from others
	Processes seaweed into food products	Bleached seaweed	-	Monthly sales: 400–600 kg powder	
	Produces cosmetic products	Unpackaged dry seaweed	\$2–\$2.40/kg	-	
	-	Seaweed powder	\$8/kg	-	

ENTERPRISE/ GROUP	ACTIVITIES	KEY PRODUCTS	SALE PRICES (USD)	SALES AND MARKET	CHALLENGES
Isha Products Group	Youth cooperative farming spinosum	Dry unbleached seaweed	\$4/kg	Monthly sales: 50 kg seaweed	Market demand
	Processes seaweed into various products	Bleached seaweed	\$8/kg	Monthly sales: 100 kg powder	Quality control
	Sells domestically and internationally	Soap, shampoo, lip balm, scrub	Up to \$4 each	-	Packaging material issues
Chokocho Farmers Focus Group	Produces seaweed and sea cucumber products	Processed seaweed (soaps and lotions)	\$0.16 (plastic bottle packaging)	Limited product diversification	High transport costs
			\$2.40 each (other bottles)		Lack of packaging materials
Kihogoni Cooperative	Produces seaweed-based soap and lotion	Soap	\$0.40 per piece (175/month)	Markets: Pemba, Zanzibar, Dar es Salaam, southern Tanzania	Lacks a dedicated processing facility
		Lotion	\$1.20 per piece (40/year)		No Zanzibar Bureau of Standards certification
	Owens an 8 million Tanzanian shillings seaweed grinder	-	-	-	Low production capacity
Healthy Seaweed Café	Social enterprise adding value to seaweed for food	Processed seaweed food products	-	Sources seaweed from Zanzibar for better quality	Dependent on Zanzibar for high-quality supply
	Buys seaweed from farmers	Packaged dried seaweed	-	-	
Zanzibar Maisha Bora Foundation	Provides support equipment	Boats, grinders, ropes, life jackets	-	Works with 18 groups, 300 farmers	Some farmers struggle to maintain boats
	Plans to establish a seaweed processing facility	-	-	-	

ANNEX 2. POTENTIAL INVESTORS FOR THE SEAWEED SECTOR

NO.	NAME	TYPE	RELEVANCE
1	Aga Khan Development Network (AKDN) ³⁸	Development agency	Supports coastal community initiatives, including agribusinesses and sustainable resource management
2	Food and Agriculture Organization (FAO)	Development agency	Through its Hand-in-Hand Initiative, FAO invests in sustainable aquaculture to support low-income communities and unlock untapped market potential
3	United Nations Development Programme (UNDP) ³⁹	Development agency	Sponsors the FUNGUO Innovation Programme, which supports innovative companies like Healthy Seaweed Co. Ltd in the Tanzanian seaweed sector
4	Tanzania Investment Centre (TIC)	Government agency	Promotes investments in Tanzania's agriculture and fisheries sectors, facilitating connections between local projects and international investors
5	Zanzibar Economic Empowerment Agency (ZEEA)	Government agency	Facilitates local business development, particularly in the blue economy sector
6	Aqua-Spark ⁴⁰	Impact investor	Focuses on sustainable aquaculture investments, including seaweed. Known for impact financing and developing vertically integrated farming hubs
7	responsAbility ⁴¹	Impact investor	Specializes in investments in sustainable agriculture and inclusive economic growth, with a focus on emerging markets
8	Triodos Investment Management ⁴²	Impact investor	Focuses on financing sustainable agriculture, aquaculture, and environmental projects that drive social and environmental benefits
9	International Finance Corporation (IFC)	International financial institution	Engages in high-ticket size debt and equity investments
10	International Fund for Agricultural Development ⁴³	International financial institution	Focuses on improving rural livelihoods and aquaculture productivity in Tanzania
11	Global Environment Facility (GEF) ⁴⁴	International financial institution	Provides funding for projects that align with environmental sustainability, including marine resource conservation and sustainable aquaculture initiatives
12	World Bank	Multilateral development bank	Supports initiatives in the blue economy and sustainable value chains globally, including in Tanzania
13	African Development Bank (AfDB) ⁴⁵	Multilateral development bank	Supports sustainable agribusiness projects, with programs aligned to improve value chains, including aquaculture

38. For more information, see <https://the.akdn/en/where-we-work/eastern-africa/tanzania/agriculture-and-food-security-tanzania>.

39. For more information, see <https://www.undp.org/tanzania/stories/pioneering-tanzanias-blue-economy-sustainable-innovation>.

40. For more information, see <https://aqua-spark.nl/news/a-sea-tractor-harvests-and-replants-carbon-capturing-seaweed-at-this-floating-farm/>.

41. For more information, see <https://www.responsability.com/en/investment-themes>.

42. For more information, see <https://www.triodos-im.com/articles/2024/investment-triodos-food-transition-europe-fund---ocean-rainforest>.

43. For more information, see <https://www.ifad.org/en/w/rural-voices/tanzania-s-seaweed-farmers-bring-the-ocean-s-bounty-to-the-world>.

44. For more information, see <https://www.thegef.org/projects-operations/country-profiles/tanzania>.

45. For more information, see <https://www.afdb.org/en/news-and-events/press-releases/tanzania-african-development-bank-grants-129-million-loan-agricultural-project-generating-decent-jobs-young-people-74336>.

NO.	NAME	TYPE	RELEVANCE
14	Asian Development Bank (ADB)	Multilateral development bank	Provides technical and financial support for coastal and marine resource management in Africa
15	Blue Natural Capital Financing Facility (BNCFF)	Multinational initiative	Focuses on blue economy projects, including seaweed farming, to support marine ecosystem restoration
16	Seaweed Biorefineries Initiative	Multinational initiative	Develops integrated seaweed processing facilities for diversified product generation
17	World Wildlife Fund (WWF) ⁴⁶	NGO	Invests in sustainable aquaculture initiatives, including seaweed farming, with an emphasis on environmental sustainability and community engagement
18	Global Seaweed Coalition ⁴⁷	NGO	Supports biosecurity, traceability, and sustainability in seaweed farming to enhance sector resilience
19	SWEN Blue Ocean Capital Partners ⁴⁸	Private capital	Focuses on sustainable aquaculture and ocean-friendly innovations, potentially relevant to seaweed processing and value addition
20	FAIRR Initiative ⁴⁹	Private capital	Advocates sustainable aquaculture investments, including seaweed farming, through environmental, social, and governance principles
21	Ocean 14 Capital ⁵⁰	Private capital	Specializes in sustainable ocean-based investments, including aquaculture and related value chains, which aligns with seaweed sector needs
22	United Nations Industrial Development Organization	Development agency	Supports seaweed value addition in Tanzania through trainings in value addition and commercialization of some seaweed products

46. For more information, see <https://www.worldwildlife.org/press-releases/world-wildlife-fund-announces-investment-in-seaweed-farming-through-ocean-rainforest>.

47. For more information, see <https://www.safeseaweedcoalition.org/supported-projects/>.

48. For more information, see <https://www.blueoceanspartners.com/>.

49. For more information, see <https://www.fairr.org/about/network-members>.

50. For more information, see <https://ocean14capital.com/investment/>.

ANNEX 3. CASE STUDIES

YOUTH INVOLVEMENT IN VALUE CHAIN DEVELOPMENT

Youth groups, such as Isha Products in Bweleo village and Refasha Products in Mwanyanya, consisting of four to six young women each, buy seaweed from farmers and other processors to make various food and cosmetic products, including soap, hair oils, and body cream. These groups see seaweed value addition as a promising business for young people, despite the challenges. They have suggested improvements to make the business more rewarding.

Challenges

- **Lack of knowledge:** Insufficient knowledge in processing and farming seaweed.
- **Old finishing methods:** Using outdated methods, such as handheld tools for cutting soap instead of proper machinery.
- **Digital market access:** Inability to penetrate online markets due to lack of digital marketing knowledge.
- **Recordkeeping:** Difficulty in maintaining proper records of purchases, usage, sales, profit, and loss.

Opportunities

- **Market training:** Provide training on market access, emphasizing digital marketing.
- **Product quality training:** Offer training on producing high-quality value-added products.
- **Recordkeeping training:** Conduct training on effective recordkeeping practices.
- **Innovative farming training:** Provide training on innovative seaweed farming methods.

SEAWEED KIOSK AT DARAJANI, ZANZIBAR

An example of users/sellers of seaweed and seaweed products is a kiosk seller in Darajani, Zanzibar. This kiosk owner buys packaged seaweed and seaweed powder from processors rather than directly from farmers due to the cleanliness factor, despite the higher cost involved. Clean seaweed commands a price range of 3,000 to 5,000 Tanzanian shillings per kilogram, whereas “unclean” seaweed is sold at 800 to 1,000 Tanzanian shillings per kilogram.

The seaweed is repackaged with the kiosk’s branding and contact information and sold alongside seaweed-based soaps. The kiosk also serves customers in mainland regions, including Mbeya, Mtwara, and Kigoma.

Challenges

- **High input costs:** Buying clean, processed seaweed increases production costs, which affects the pricing competitiveness.
- **Limited processing capacity:** The kiosk relies on external suppliers and lacks in-house processing infrastructure.
- **Market saturation risks:** Competition from other vendors offering lower-priced, unprocessed products.
- **Brand visibility:** Limited reach in digital and urban markets beyond established mainland outlets.

Opportunities

- **Brand development:** Expansion of branded packaging and marketing to enhance product appeal.
- **Market diversification:** Growing customer base in mainland Tanzania presents new sales channels.
- **Product line expansion:** Opportunity to introduce additional seaweed-based products beyond soap and powder.
- **Partnership potential:** Possibility to collaborate with youth groups or processors for co-branding and supply assurance.



