Gendered Value Chain Opportunities and Challenges in Seaweed Aquaculture: The Changing Gender and Socio-Economic Dynamics in Mwazaro and Kibuyuni Villages, South Coast Kenya

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ABSTRACT

Globally, seaweed aquaculture is a key economic activity in coastal regions. It has emerged as a livelihood source in Kibuyuni and Mwazaro at the coast of Kenya, fostering economic resilience and gender empowerment. This study examined gender-associated opportunities and challenges within the seaweed value chain, emphasizing labor distribution, economic contributions, and barriers to participation. A mixed-methods approach was employed, incorporating both qualitative and quantitative data from 155 respondents. The findings indicate that women dominate the activity engaging at different levels of the value chain from farming to processing while men largely control marketing. Seaweed farmers earn an average of USD 56 per 45-day production cycle. Seaweed farming however faces challenges such as lack of technology, poor farming techniques, ineffective resource management, environmental factors, inadequate knowledge and skills, inadequate financial support, and inadequate farm inputs. Despite these challenges, the study established that the economic and social benefits outweigh the challenges. The findings suggest that targeted interventions addressing financial and market disparities can significantly enhance gender equity and sustainability. Additionally, these patterns highlight the gendered nature of labour division in the seaweed value chain. It is concluded that gender-based economic empowerment and sustainable development interventions are necessary to foster inclusive growth, resilience in coastal communities and strengthening women's participation in seaweed value chain. Seaweed aquaculture can contribute to inclusive economic growth in coastal communities.

Key Words: Seaweed, value chain, gender, empowerment, dynamics

INTRODUCTION

Globally, seaweed aquaculture is responsible for 51.3% of the total aquaculture production from marine and coastal aquaculture (Chopin and Tacon 2021). It has been acknowledged that seaweed farming is particularly gender-inclusive, and nutrition-sensitive, and offers a chance to support women and families (Obiero et al., 2021). Studies have shown that almost 90% of female fish workers worldwide engage in fish processing, which makes women's participation in seaweed aquaculture crucial for the various duties along the value chain (Monfort 2015; Siles et al., 2019). In addition, participation of women's participation has been observed to be crucial at the various nodes of the value chain in other high-value industries, such as cosmetics and cooking among others (Buschamann et al, 2017).

According to FAO (2018), in responding to the issue of the decline in fish stocks, it acknowledged aquaculture

as one of the most dynamic food industries globally. The benefits associated with seaweed farming in Kenya have been rigorously examined (Mirera et al., 2020; Odhiambo et al., 2020). Seaweed cultivation contributes to the employment and economic development of coastal communities, hence, small-scale aquaculture is an important driver of this industry (Gallardo- Fen'andez & Saunders, 2018). Since seaweed farming targets the pro-poor, it has the potential to help fulfill Sustainable Development Goals (SDGs) like reducing hunger, improving water quality, mitigating climate change, protecting the ocean, and gender equality which emphasizes its ecological relevance (Garcia-Poza et al., 2022). As the seaweed industry expanded in Kenya (Obiero et al., 2021; Mirera et al., 2020), there is a need to have an in-depth understanding of its relevance to addressing underlying issues of gender equality that have been rarely addressed in studies from East Africa.

The current global development agenda and constantly changing political and economic conditions of coasts and oceans highlight the need for critical as well as constructive social science studies, according to the Manifesto for the Marine Social Sciences (Bavinck and Verrips 2020). This involves highlighting the various realities faced by small-scale aquaculture fishermen, their gender dynamics, and their community (Bavinck et al., 2018). Interestingly, women, unlike their male counterparts, have substantial contributions to make at different nodes of the agricultural and off- farm value chains even though their efforts are sometimes undervalued or constrained due to societal norms (Quisumbing et al., 2021). Yet, while most research on aquaculture's problems, policies, and tactics raises serious questions about the industry's environmental sustainability (Krause et al. 2015), it does not address important aspects of social sustainability and gender relations, such as gendering resource access issues, inequitable distribution of benefits, benefits not being connected to local needs, and ecosystems being negatively impacted in ways that endanger livelihoods and conditions for resource production.

Further, there is a clear gender gap in the industry regarding labour division, with fewer women engaged in harvest-related tasks (Monfort 2015; Nabuyanga et al., 2021). In particular, although seaweed farming is not lucrative, it gives women greater flexibility, autonomy, and independence—aspects of their jobs that are just as important to them as taking care of household chores due to their tidally dependent seaweed farming (Fernandez et al., 2018; Mirera et al., 2020). As a result, women have traditionally worked in the seaweed industry and may be considered an asset to the labour and money that male fishermen provide (Weeratunge-starkloff & Pant 2011). Nonetheless, very little is known about the causes of gender inequalities, even though gender gaps have caused policymakers to become concerned and have become the focus of many development programmes (Ramirez et al., 2020).To better understand the gendered socio-environmental dynamics and implications in small-scale seaweed aquaculture, this paper examines seaweed production in the Kenyan coastal towns of Mawazaro and Kibuyuni. It interrogates the gendered range of sustainability issues that the seaweed aquaculture communities in the South Coast are confronting. We attempt to investigate how socio-environmental dynamics and gendered effects associated with seaweed cultivation affect overall productivity as well as the socio-economic empowerment of communities, particularly women. We specifically focus on how tenure, market links and dynamics, and gender have affected the way aquaculture is currently evolving on Kenya's South Coast, using a Feminist Political Ecology method (FPE). We will contend that prejudices related to gender differences influence decision-making processes at different nodes of the seaweed production value chain due to sociocultural factors. Furthermore, the psychosocial characteristics that are innate to the people of Mwazaro and Kibuyuni have an impact on their sociocultural conceptions. These conceptions are typical of men or women, depending on the range of behaviours and attitudes that are desired or expected by society for a particular individual based on that person's biological or perceived sex in those communities.

MATERIALS AND METHODS

Study Area

Mwazaro and Kibuyuni villages are located in the south coast of Kenya and the climate is generally tropical with two distinct rainy seasons: long rains (March to May) and short rains (October to December). The villages are located within reach of coral reefs, seagrass beds, and mangrove forests. These ecosystems support marine biodiversity and serve as important resources for the community's livelihoods through fishing, seaweed farming, and eco-tourism. The villages are in close proximity to the Kisite-Mpunguti Marine National Park, which protects from the strong wave action and biodiversity conservation. Conversely, it brings restrictions on fishing practices in certain areas that call for provision of alternative livelihoods to support the communities.

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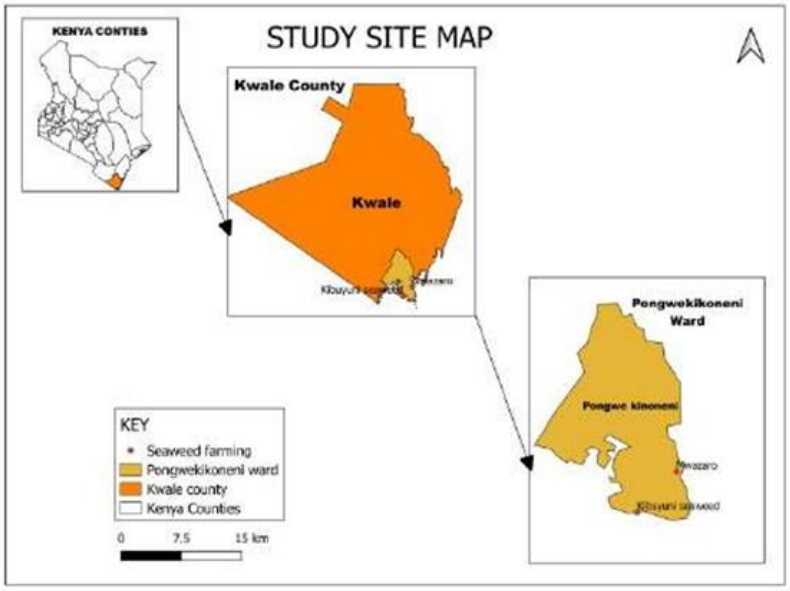

Figure 1: Map of Kenya showing Kwale County and the location of the two villages (Mwazaro and Kibuyuni)

A mixed research design was employed, which included both exploratory and explanatory methods. According to Bazeley (2024), mixed methods enable the researcher to produce statistically significant and contextually relevant findings that apply to real-world settings. The mixed designs provided flexibility and thus allowed for adjustments based on initial findings, i.e. when the exploratory segment revealed unexpected themes or insights, the explanatory segment was tailored to include additional variables or questions, providing adaptability to the research design. This flexibility helped refine the research focus based on empirical evidence rather than assumptions (Creswell & Plano Clark, 2017). The mixed research design further expanded the breadth and depth of the study by further combining the strengths of qualitative and quantitative methods (Creswell et al., 2014). The findings were more valid and reliable because the mixed- methods design combined both qualitative and quantitative approaches. According to Johnson and Onwuegbuzie (2004), integrating these two data types helps mitigate the weaknesses inherent in each method. Specifically, qualitative data added depth and context to the quantitative findings, while quantitative data offered generalizability to the qualitative insights. This complementary relationship enhanced the overall robustness and credibility of the research outcomes.

Sampling

The study targeted key stakeholders within the seaweed value chain as its population, including active seaweed farmers, chairpersons of the seaweed corporations/groups, and extension or research officers involved in seaweed farming activities. Stratified random sampling was employed, with respondents selected from a list of stakeholders provided by Kenya Marine and Fisheries Research Institute (KMFRI) field officers. This list was cross-verified against databases maintained by group leaders of seaweed farming communities in the respective villages to ensure accuracy and representation. To further enhance representativeness, particularly regarding gender, stakeholders in the seaweed value chain were stratified into gender sub-groups ("strata"). A random sample was drawn from each stratum (men and women) to reduce bias and improve control over the data collection process, thereby ensuring greater accuracy of the information obtained (Sharma, 2017; Acharya et al., 2013; Kelley et al., 2003). The method allowed each individual in the population to have an equal probability of being selected as a representative (Acharya et al., 2013). The sample size was determined with the assistance of presiding officers responsible for maintaining records of the seaweed farming groups.

The target sample size “n” was computed using a simplified formula proposed by Kuswanto et al., 2020; Israel, 1992; Yamane, 1967. Using Yamane’s Formula, which consists of

$$n = \frac{N}{1 + N(e)^2}$$

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N represents the population you are selecting from. This is the requirement for your sample to reflect.

e represents the allowable margin of mistake. The accepted norm is 5%; therefore, input

0.05.n represents the sample size necessary for conducting the surveys.

The Kibuyuni sampling frame is 137 active farmers; therefore n=N/ (1+N (e) 2

=137/ (1+137(0.05)2

=137/ (1+0.343)

=137/ (1.343)

=102

Mwazaro sampling frame is 70 active farmers, therefore n=N/(1+N(e)2

=70/ (1+70(0.05)2

=70/ (1+0.13)

=70/ (1.33)

=53

The snowball method was utilized to sample key informants in the seaweed stakeholder value chains. According to Parker & Geddes (2019), networking and referral aspects are essential in snowball sampling, which is a commonly used qualitative sampling technique. Initial contacts, or "seeds," who met the study's criteria were identified and invited to participate. The snowball sampling process, continued until the desired sample size or saturation point (whereby information was repeating itself) was reached, at which point the sampling process was concluded. Snow balling could promote lack of representativeness but this was improved by combining snowball sampling with stratified or random sampling.Additionally the study ensured to start snowball chains from diverse entry points (e.g., different age groups, professions, villages).

Data Collection Instruments

A multi-faceted array of approaches was employed to elicit the primary data from the designated respondents (Creswell and Garret, 2008) to enhance the comprehensive and profound comprehension of the phenomenon. The primary data was acquired through the implementation of (i) a semi-structured interview, (ii) a key informant interview, (iii) a checklist, and participant observation. In the semi-structured interview, participants were taken through a questionnaire on the seaweed value chain and gender, in addition to respondents' attitudes and perceptions (Fink, 2003). The questionnaires were distributed to active seaweed farmers. This enabled the collection of qualitative and quantitative data. Respondents were described in detail, including their demographics, access to resources, barriers, and potential in the seaweed value chain.

The key informant interview technique was employed to gather in-depth information from stakeholder representatives who possessed expert knowledge and insights on the topic (Lokot, 2021). This included the community leaders of the seaweed farming villages, seaweed management professionals'/extension agents, and community leaders and identified individuals with indigenous knowledge of the connection between the seaweed value chain and gender issues. Participant observation technique is the most important and diverse research technique in the social sciences and it includes observation and documentation of interactions and relationships (Ciesielska et al., 2018) During the data collection period, a task checklist was created and used to track men's and women's tasks and responsibilities at the group level. Participation in this important activity helped build relationships with farmers. Additionally, male and female interactions were also observed at the group level.

Procedure

The present study utilized both quantitative and qualitative methods through the use of semi- structured

interviews and key informant interviews. The fieldwork took place in three stages between 2022 and 2023. The first stage (October 2022 to May 2023) involved the collection of data from the seaweed cultivators using semi-structured interviews. The semi-structured interview encompassed both closed-ended and open-ended inquiries, supplemented by a series of pivotal interviews. This process was conducted through face-to-face interviews.

The respondents included 155 cultivators, representing nearly three-quarters of the total 207 granted concessions to individuals in the Mwazaro and Kibuyuni sites areas. The second stage involved three key interviews that were conducted with participants from different backgrounds to ensure exposure to different perspectives. The final stage involved the observation grid that provided a detailed breakdown of gender participation across various stages of seaweed farming and its associated activities.

Data Analysis

Both quantitative and qualitative information were collected. Data was coded, compiled and cleaned in MS Excel for consistency. Two methods were used to analyse the data: (i) descriptive statistics and (ii) content analytical statistics. Descriptive statistics provided concise summaries of the sample and key observations (Cooksey & Cooksey, 2020). They were used to outline the characteristics of various variables, including the number and proportion of seaweed actors involved in the value chain per study site, demographic profiles, levels of experience, gender representation, estimated financial benefits, as well as the legislative and operational challenges encountered. Additionally, descriptive statistics helped present proposed recommendations for improving and promoting seaweed-based livelihoods. Data analysis was conducted using Excel 2016 and IBM SPSS Version 22.

Content analytical statistics were applied to systematically interpret qualitative data obtained from interviews and open-ended responses. This method involved identifying patterns, themes, and recurring issues related to stakeholders' experiences, perceptions, and suggestions. By coding and categorizing this information, content analysis enabled the researchers to derive meaningful insights that complemented the quantitative findings, thereby enriching the overall interpretation of the data.

RESULTS

Participant Response rate

A total of 155 active farmers from the villages of Mwazaro (53) and Kibuyuni (102) participated in the interviews, representing 75% of the total population. According to Babbie (2011), a response rate exceeding 60% is generally considered adequate for research purposes, underscoring the reliability of the data collected in this study. Similarly, Holtom et al. (2020) and Fincham (2008) emphasize that a 60% response rate is the benchmark often expected by journal editors and reviewers, further highlighting the significance of achieving such a rate in academic research. Therefore, the response rate attained in this study not only strengthens the credibility of the findings but also meets widely accepted scholarly standards. As illustrated in Table 3.1 below, each key interview respondent was coded to preserve the privacy of the people whose quotes are included in this paper. The open-ended interviewing method allowed for gradually adding new questions derived from previous interviews. The subjects were informed before the upcoming interviews to maximize effective data collection. The process allowed participants to schedule their time and activities at their convenience. Face-to-face interviews were conducted with respondents at their homes or workplaces on the agreed-upon days and times.

Table 3.1 Key Informant, Respondent, and Response Rate

Variable	**Total (%)**	**Male (N=29, 19%)**	**Female (N=126, 81%)**
Marital Status			
Single	12%	70%	31%
Married	62%	7%	72%

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Variable	Total (%)	Male (N=29, 19%)	Female (N=126, 81%)
Separated	4%	0%	4%
Divorced	5%	3%	5%
Widow/er	10%	3%	11%
Education Level			
Low Education Level	95%	96%	94%
Higher Education	5%	4%	6%
Position in the Household			
Head Only	3%	7%	2%
Head and Breadwinner	38%	72%	29%
Breadwinner Only	9%	17%	7%
Supportive Spouse	49%	0%	61%
Dependant	1%	3%	1%
Main Occupation			
Casual Jobs	6%	15%	7%
Farming (Crops)	3%	17%	0%
Fish Vendor	1%	0%	2%
Fishing	4%	19%	0%
Seaweed Farming	70%	56%	73%
Small Business	4%	0%	4%
Teacher	1%	0%	1%

Demographic and socio-economic characteristics of respondents

This section presents the basic demographic characteristics of the study participants. The demographics of participants include gender, age, marital status, education level, household status, and religion. Out of the 155 surveyed cultivators, 29 were men (19%) and 126 were women (81%). This distribution reflected the gender proportion among concession holders, with almost 29 % of the original concessions granted to women as heads and breadwinners of families.

In the current study, the majority of the population (68%) falls within the 18 to 47 age group, comprising 55% of men and 71% of women. The second largest group consists of individuals aged between 48 and 77 years, accounting for 31% of the population, while only 1% is above 78 years old. The high proportion of younger individuals, especially women, indicates that the population is relatively youthful and economically active (Table 3.2).

Table 3.2: Demographic characteristics of the respondents by gender

Variable	Total (N=155)	Male (N=29, 19%)	Female (N=126, 81%)
Marital Status			
Single	12%	31%	7%

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Married	70%	62%	72%
Separated	4%	0%	4%
Divorced	5%	3%	5%
Widow/er	10%	3%	11%
Education Level			
Low Education Level	95%	96%	94%
Higher Education Level	5%	4%	6%
Position in Household			
Head Only	3%	7%	2%
Head and Breadwinner	38%	72%	29%
Breadwinner Only	9%	17%	7%
Supportive Spouse	49%	0%	61%
Dependant	1%	3%	1%
Main Occupation			
Casual Jobs	6%	19%	3%
Farming (Crops)	15%	7%	17%
Fish Vendor	1%	0%	2%
Fishing	4%	19%	0%
Seaweed Farming	70%	56%	73%
Small Business	4%	0%	4%
Teacher	1%	0%	1%

Marital Status of the Respondents

Most of the seaweed farmers (70%) are married, with a higher proportion of females (72%) compared to males (62%). About 12% of the farmers are single, with a disproportionately high rate among males (31%) compared to females (7%). Widowhood is more prevalent among female farmers (11%) than their male counterparts (3%)(Table3.2).

Education Level of the Respondents

As shown in Table 3.2, the vast majority of the population (95%) has a low level of education, which includes individuals with no formal education or those who have only attended religious schools (madrassa) or primary school. There are minimal gender differences within this group. Only 5% of the population has attained higher education qualifications, such as secondary or tertiary education, with a slight gender disparity 6% of women compared to 4% of men. Qualitative findings on the education achievement of the seaweed community: -

“Men dominate the marketing and processing stages of the seaweed value chain because they are perceived to have more education and knowledge about business and society. Women are primarily involved in the earlier stages of production but lack representation in these higher-value activities.” (CSG)

The findings indicate that both educational and societal barriers contribute to the gender imbalance observed in the more financially rewarding stages of the seaweed value chain. This disparity underscores the need for

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targeted educational and capacity-building programs aimed at empowering women, thereby enhancing their participation in marketing, value addition, and business management activities.

Position in the Household of the Respondent

Only 3% of the total population are considered sole decision-makers within their households. In contrast, 38% serve as both the head of the family and the primary breadwinner, with men (72%) assuming this dual role far more frequently than women (29%). The supportive spouse category, where women dominate (61%), reflects traditional gender roles in which women are responsible for meeting household needs without being the primary breadwinner.

Main Occupation of the Respondents

Seaweed farming is the most common occupation (70%), particularly among women. In contrast, few men are engaged in the seaweed farming though predominantly focus in fishing and casual jobs While women are more likely to work in agriculture and operate small-scale businesses.

Religion of the Respondents

The population is overwhelmingly Muslim (99%), with only 1% identifying as Christian. Religious homogeneity suggests a culturally unified population, which might reduce conflicts based on religious differences. The high Muslim majority in the population offers opportunities for cohesive, culturally respectful development programming. However, success depends on how well religious norms and institutions are integrated into policy, planning, and implementation frameworks. Inclusive, context-sensitive, and faith-informed approaches will be essential to ensure the acceptance, sustainability, and effectiveness of socioeconomic interventions.

Level of income of the seaweed farmers

Table 3.3 below demonstrate the income levels of seaweed farmers in two coastal Kenya villages Kibuyuni and Mwazaro. The analysis takes into account the number of farmers, average income, and the size of the income range.

Table 3.3: Average Income of the respondents per village

Metric	Kibuyuni (N=88)	Mwazaro(N=53)	Comparison / Comment
Average income	6,508	12,781	Mwazaro's average income is nearly double Kibuyuni's
Maximum income	36,400	36,400	Both have the same maximum income
Minimum income	300	550	Mwazaro has a higher minimum income

Village	Number of People	Average Income	Maximum Income	Minimum Income
Kibuyuni	88	6,508	36,400	300
Mwazaro	53	12,781	36,400	550

The average income of Mwazaro seaweed farmers (KSh 12,781; 93 USD) is almost double that of Kibuyi (KSh 6,508; 48 USD). This suggests that seaweed cultivation is more profitable in Mwazaro than it is in Kibuyuni. This could be due to higher individual motivation for working in Mwazaro. The maximum income is the same in both villages (KSh 36,400; 266 USD), suggesting that some farmers can achieve high yields, possibly because of larger holdings or more efficient farming practices. The minimum income in Mwazaro (KSh 550; 4 USD) is higher than that in Kibuyuni (KSh 300; 2.5 USD), indicating more income inequality compared to Mwazaro.

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The gender roles and empowerment on the nodes of the seaweed value chain

The objective was to document gender empowerment activities across the various nodes of the seaweed value chain. In presenting these findings from southern Kenya, it is essential to break down each node of the value chain and describe the specific tasks performed, the gender distribution within each task, and the forms of empowerment observed such as equal participation or the nature of involvement in decision-making and execution. The analysis offers a detailed account of gender roles and empowerment dynamics throughout the value chain, as summarized in Table 3.4.

Table 3.4: Gender Empowerment Activities in the Seaweed Value Chain

Code	Nodes	Activity	Male = ♂ N=29	Female = ♀ N=126	Both ♂ ♀	How is the activity done? (Indicate 'Mechanized' or 'Manual' as applicable)
1	Production node	Seaweed plowing	100%	100%	♂ ♀	Manual
2		Sowing	100%	100%	♂ ♀	Manual
3		Weeding	100%	100%	♂ ♀	Manual
4	Harvesting node	Harvesting	100%	100%	♂ ♀	Manual
5		Transport by boat	100%	100%	♂ ♀	80% Mechanized, 20% Manual
6	Transportation	Transport of produce from farm to drying rack	100%	100%	♂ ♀	30% Mechanized, 70% Manual
7	Marketing node	Preparation of produce from drying rack to market	100%	100%	♂ ♀	20% Mechanized, 80% Manual
8		Preparation of storage facility	100%	100%	♂ ♀	Manual
9		Looking for buyers	5%	1%	KS	Mechanized (via Cooperative, Agents)
10		Negotiating for prices	5%	1%	KS	Mechanized (via Cooperative, Agents)

The findings of the study displayed in Table 3.4 illustrate the various gender empowerment activities in the seaweed value chain nodes: -

Production Node

The production node entails manual work consisting of the seaweed plowing, sowing, and weeding, which are 100% male and 100% female. Gender equality and participation are demonstrated by this node. Men and women participate equally in manual plowing, indicating shared labor responsibilities at the outset of the production process. This is an important part of empowerment since it ensures that women can work in jobs that pay.

In the plowing activity, both men and women are equally involved, with 100% participation in the labor-intensive task of manual weeding an effort that not only highlights shared labor but also reflects gender empowerment through equal access to income-generating opportunities. The weeding activity involves intensive manual labor. In the seeding process, both men and women are fully engaged, with 100% participation. This equal involvement not only highlights gender inclusivity but also reflects empowerment, as women actively participate in the critical

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task of planting on an equal footing with men. This level of equality suggests that both men and women have equal access to labor responsibilities and shared community resources, such as seedlings. In the plowing activity, both men and women demonstrate full participation, with 100% involvement in the labor-intensive task of manual weeding. This shared responsibility reflects a balanced gender dynamic and highlights equal access to income-generating opportunities an important indicator of empowerment through inclusive participation in weeding initiatives.

Harvesting Node

The participation of men and women is 100% and they are engaged in manual labour (Table 3.4). As regards to empowerment, equal participation in harvesting underlines the inclusive approach at one of the key stages in the seaweed value chain. This provides economic opportunities for the farmers and further enables them to become financially independent. Transport of seaweed from the farms to the shows of the ocean is by using boats: participation by men and women is 80% percent manual and 20 % mechanical. As regards empowerment, while transport is somewhat mechanized, gender equality in participation ensures that neither gender is disproportionately burdened. Mechanical processes can increase efficiency and reduce physical demands on transport, indirectly empowering both genders through productivity gains.

Marketing Node

Gender participation in the transport of products from drying racks to the market is 100%, with both men and women taking part, and the process is 80% manual and 20% automated(Table 3.4). In the case of empowerment, both sexes are involved; this provides for shared opportunities to deliver the final product to the market. However, minimal mechanization means that labour is still very intensive and mechanization, which could further empower both genders, especially women, by reducing manual labour.

With mechanized operationalization, Kibuyuni Seaweed Cooperative and agents dominate the market for buyers, with 5% of buyers being men and 1% being women. A stark gender gap in empowerment is evident at this node, where men are primarily responsible for sourcing buyers. The limited involvement of women in this critical aspect of decision-making highlights a serious lack of empowerment and control over market access. To address this imbalance, targeted gender empowerment interventions such as capacity-building, education, and support programs can be introduced to enable women to take on more active and influential roles in the commercial segments of the seaweed value chain.

Only 5% of men and a mere 1% of women primarily represented by Kibuyuni Seaweed and cooperative agents are involved in price negotiations through mechanized operational processes. Similar to the buyer-seeking stage, price negotiation is predominantly male-dominated, reflecting a continued gender imbalance in key decision-making roles. This limited involvement of women underscores their restricted influence over critical commercial aspects of the value chain. Empowering women to actively participate in price negotiations would not only enhance their control over income but could also lead to significant social and economic benefits for both individuals and the wider community.

Gender Roles and Participation in the Seaweed Value Chain

This study emphasizes how men and women participate in different phases of seaweed production, highlighting areas where gender disparities occur, like marketing (which is dominated by men) and value addition (which is mostly done by women). The observation checklist provided (Table 3.5), a detailed breakdown of gender participation across various stages of seaweed farming and its associated activities. The following gender patterns emerge from the documentation.

Table 3.5: Gender participation observed in the seaweed value chain

Activity	Observed Audience (Individuals)
Seaweed farming	Male and Female

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Activity	Observed Audience (Individuals)
Seaweed harvesting	Male and Female
Seaweed drying	Male and Female
Seaweed storage	Male and Female
Seaweed value addition	Female
Seaweed marketing	Majority male with few women

The above checklist (Table 3.5) illustrates that seaweed farming activities within the production and harvesting nodes are generally shared equally between men and women. However, specific stages of the value chain show gendered patterns, with value addition being predominantly female-dominated, while marketing activities are largely led by men. These patterns highlight the gendered nature of labor division within the sector, which could have crucial implications for economic empowerment, gender equality, and sustainable development interventions to foster inclusive growth in coastal communities. Gender- responsive policies that address these disparities, particularly by enhancing women's participation in marketing and other income-generating roles, could lead to more equitable outcomes.

Gendered opportunities encountered in the seaweed value chain

The figure(2) presents findings on opportunities for gender empowerment in seaweed production, categorized by four main benefits: acquisition of skills and knowledge (34%), improvement of living standards (4%), enabling the catering of basic needs (26%), and serving as a source of livelihood (36%) (Figure2).

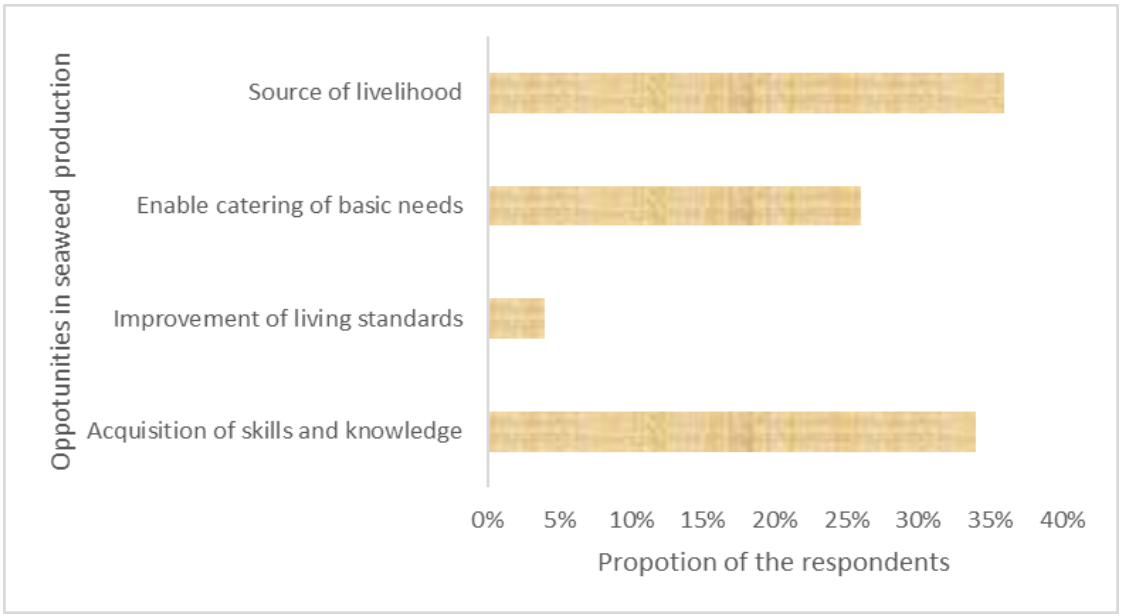

Figure 2: Gender empowerment opportunities in the seaweed value chain

As shown in Figure 2, the research findings are that more than a quarter, 34%, view seaweed production as a way to gain valuable skills and knowledge. This indicates that seaweed production is a platform for skill development, potentially boosting farmers' confidence and professional capacity in the value chain. Only 4% noted improved living standards, highlighting a potential gap in how the work translates to tangible quality-of-life improvements. The low percentage suggests that while seaweed production may empower farmers in various ways, it does not necessarily lead to substantial changes in income or overall economic status for many. However, the fact that 26% of respondents recognize seaweed farming as helping them meet their basic needs highlights the activity's practical and immediate economic benefits. This indicates that, although not transformative for all, seaweed farming provides a reliable source of livelihood for a portion of the community. However, this moderate percentage suggests that for a significant portion of both, men and women involved,

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their earnings from seaweed production may only cover essential needs, with limited room for savings or additional expenses. The largest proportion (36%) views seaweed production as a source of livelihood.

Qualitative analysis with concern to opportunities in seaweed production from the document presents several key findings with supporting quotes:

“Economic Growth and Improved Incomes: Seaweed farming offers a stable and enhanced income for producers. The finding highlights that "sale of 2kg of raw dry seaweed is 50 Ksh; USD, 0.4, after processing into powder it sells at 900 Ksh; USD 6.6" illustrating the potential for significant profit through value addition (CKC)”.

“Market Stability and Expansion: Establishing "consistent markets" is noted as a vital opportunity, providing a dependable demand base for seaweed products. Entering "new markets" further expands economic potential, positioning seaweed as a scalable industry (SAS)”.

“Diverse Livelihoods and Reduced Risk: Seaweed farming contributes to "diverse livelihoods," offering alternative income sources that reduce economic vulnerability. This diversity strengthens financial resilience for individuals and communities dependent on coastal resources (CSF)”.

Overall, seaweed production presents promising opportunities for economic upliftment, market expansion, income diversification, and enhanced profitability through value addition. The industry's potential to create sustainable livelihoods and access new markets positions it as a valuable economic activity, particularly for coastal communities reliant on marine resources.

Gendered empowerment challenges in the seaweed value chain

The seaweed value chain in Kibuyuni and Mwazaro, two coastal villages in Kenya, presents significant potential for improving rural livelihoods. However, several bottlenecks limit productivity, profitability, and sustainability. Based on the provided data, the key challenges include low production, loss of motivation, inadequate knowledge, lack of inputs, and financial constraints. (Figure3)

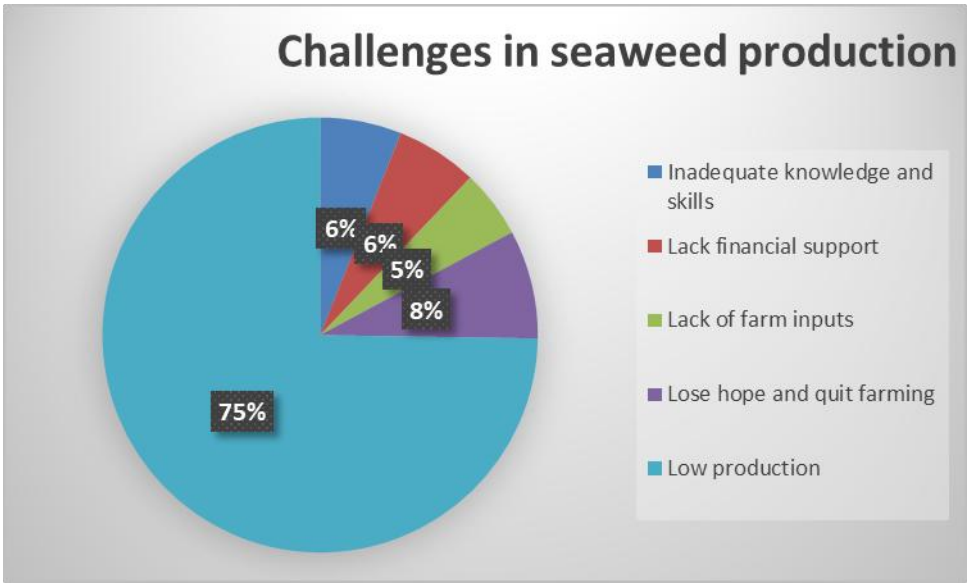

Figure 3: Challenges encountered in seaweed farming

As indicated in Figure 3, an overwhelming statistic (74%) suggests that the seaweed farming industry is plagued by inefficiency or suboptimal conditions that significantly hinder productivity. Low production is the most significant constraint, affecting nearly three-quarters of seaweed farmers. It results from suboptimal farming techniques, lack of access to high-quality seedlings, and climate variability (e.g., seaweed bleaching due to temperature rise). According to Msuya & Hurtado (2017), improving farming techniques can significantly enhance seaweed yield and resilience to climate stress.

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Action:

- **Introduce climate-smart seaweed farming practices** such as selecting **resilient seaweed strains** and optimizing planting depths.
- Promote **intertidal zoning** and **seasonal calendars** to align farming with favorable environmental conditions.
- Encourage farmer-led innovation through **demonstration farms**.

Many farmers abandon seaweed farming due to inconsistent incomes, market volatility, and poor post-harvest handling. Kamau et al., (2020) stress the importance of community-led approaches to retain participation and motivate youth and women in coastal enterprises.

Action:

- Develop **support networks** and mentorship programs.
- Facilitate **value addition training** (e.g., seaweed soap, cosmetics, food products).
- Highlight successful local farmers as role models.

Farmers often lack knowledge about best farming practices, value addition, and environmental management. Mshale et al., (2019) argue that equipping seaweed farmers with technical and business skills leads to better outcomes across the value chain.

Action:

- Provide **continuous capacity-building** through local extension services, NGOs, and academic institutions.
- Collaborate with researchers for **knowledge co-production**.

Farmers face difficulties accessing credit or financial services to invest in gear, drying equipment, or boats. Kariuki & Place (2005) suggest that community savings schemes can significantly boost rural livelihoods and investment capacity.

Action:

- Link farmers to microfinance institutions, SACCOs, or revolving funds.
- Promote group-based savings and lending schemes.

Inputs like planting lines, drying racks, and quality seedlings are often limited or unaffordable. Wells et al. (2010) found that access to quality inputs is a key driver of productivity in coastal aquaculture systems.

Action:

- Encourage the formation of cooperatives to bulk purchase and distribute inputs.
- Engage county governments and NGOs for input support programs.

Qualitative findings indicated that farmers face significant challenges in scaling production due to market limitations and a lack of inputs and equipment. Addressing these constraints could improve production levels and profitability, encouraging more participation from men who traditionally engage in quicker-return activities. Women's participation is hindered by multiple factors, including other economic activities, household responsibilities, and cultural norms where husbands may not permit them to engage fully in seaweed farming.

."Production of raw and products is low due to low market, low price of raw material, insufficient equipment for products, lack of farm inputs, and lack of support."(SAS)

"Climate change causes shift to venture in deep seaweed farming, less manpower and no support in mobilization of communities and creating awareness on seaweed farming." (CSG)

"Quantity decreased in 2021 due to climate change, drought and warm waters. Since 2023, improved quantities in the production supporters' value chain. "Women are involved in activities that are time-consuming like child upbringing and are not granted permission by their husbands." (CKG)

DISCUSSION

The study explored the percived opportunities and challenges in the Kibuyuni and Mwazaro seaweed value chain. The findings from the indictae that women predominate in the study sample, as evidenced by this notable gender disparity. The findings imply that women might participate in informal economic activities at a higher rate. Men's underrepresentation could also be a sign of migration brought on by other sociocultural or professional factors that affect the dynamics of the male population. This result aligns with the findings of Odhiambo et al., (2020), who discovered that women make up 90% of mariculture initiatives. Additionally, 75%seventy- five percent of seaweed farmers in Kenya are women (Mirera et al., 2020). The limited participation of men in seaweed farming is largely attributed to their preference for fishing, which offers daily income opportunities. In contrast, seaweed farming follows a 45-day cycle from planting to harvesting, delaying financial returns. This finding aligns with Juma et al. (2021), who observed that many individuals particularly men perceive aquaculture and small-scale farming as risky ventures due to environmental variability and uncertain economic outcomes. In contrast, the higher participation of women in seaweed farming reflects their patience and resilience, shaped by limited alternative employment opportunities in coastal fishing communities. According to Ochiewo (2004), the scarcity of diverse livelihood options has contributed to increased fishing pressure, threatening the sustainability of marine resources. Similarly, with few viable income alternatives, seaweed farming has emerged as a promising livelihood option that could help ease the strain on wild-caught coastal fisheries (Songwe et al., 2016).

Regarding the age distribution of seaweed farmers, the findings show that the majority are at their productive age, which may lead to a high demand for social services and jobs among young adults. It's crucial to note that older female farmers are also taking part, as is the growing proportion of men in a program that was initially intended for female farmers. This illustrates a livelihood that can be adjusted and used by people across ages and genders. Seaweed farming is often highlighted as a sustainable and profitable activity that can improve household income and provide a steady source of income for farmers, especially women. This is supported by Fitriana (2016), who emphasizes that seaweed cultivation is a beneficial process for household business as it allows farmers to generate sufficient income to meet their daily family needs

The study reveals low levels of education, indicating limited access to educational resources/services or that immediate economic activities take precedence over formal education. This could hinder social mobility and contribute to persistent poverty, particularly among women, who have slightly higher levels of education. Enduring poverty may still face structural barriers to equal opportunities in more formal sectors. This is because low literacy rates among residents of coastal areas are associated with greater dependence on predominantly locally accessible resources. This is consistent with a study by Robinson, (2016)., which observed similar results illustrating problematic scenarios, particularly among resource-dependent people who are disadvantaged when trying to obtain essential services such as education.

In the present study men are typically viewed as the primary breadwinners, while women tend to assume supporting roles within the household. This distribution reinforces traditional gender norms to which men are more likely to conform to assuming the role of primary breadwinner and head of the household. Women’s economic empowerment programs could help address this imbalance, enabling them to become more independent and less reliant on male household heads. This finding is consistent with Gideon's (2023) study, which states that the traditional patriarchal structure in Kenya views men not only as heads of families and community decision-makers but also as the sole arbiters of power. However, women are excluded from

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managing fisheries resources because of the long- standing assumption that men should direct and control all operations. This belief affects the management status of fishing communities and denies women equal opportunities.

The findings found that although seaweed growing is a source of income in Kibuyuni and Mwazaro, there are significant income inequalities. Addressing structural and market problems could help farmers to maximize their potential income and improve their livelihoods, given the high variability of income. Farmers in both villages are exposed to economic insecurity. However, the higher average income in Mwazaro suggests that farmers there may be more resilient to market fluctuations. Previous studies of seaweed farming in Kenya have highlighted the importance of improved farming practices, government support and cooperative marketing strategies for increasing income stability (Msuya et al., 2013; Wakibia et al., 2011).

From the study, the economy appears to rely heavily on seaweed farming, which are more accessible to women. However, male dominated fishing and casual labor roles may indicate gender differences in economic activities. In order to improve economic resilience, focus on diversifying income sources for both men and women and creating opportunities in sectors beyond agriculture and fishing. Similar findings from Larson et al., 2021 suggest that men acquire majority of their money undertaking traditional fishing activities; however, in seaweed cultivation, women can benefit economically by participating in activities along the entire chain, from harvest to sale. A similar study by Obura et al. (2017) reported that many coastal communities are involved in seaweed

farming which improve food security in local households and create livelihoods for thousands of men and women. This is due to the relatively simple cultivation methods, low capital, locally available material inputs, and fast production cycles (Cai et al., 2021). In addition, the results of this study were supported by previous studies, such as a study conducted by Cuaton (2019) that showed that women can support their families and themselves through active participation in seaweed production.

In the seaweed value chain along the south coast of Kenya, both men and women are equally engaged in physically demanding tasks such as plowing, sowing, weeding, and harvesting, with each gender contributing 100% of the workforce. However, the few men who participate in seaweed farming predominantly occupy market-facing roles, such as finding buyers and negotiating prices. Notably, 5% of men are involved in these activities, compared to only 1% of women, highlighting a gender imbalance in access to key commercial functions within the value chain. Women are significantly underrepresented in decision-making roles, particularly in activities that directly impact income, such as seeking buyers and negotiating prices (Suyo et al., 2020). Addressing this gender imbalance through training, education, or cooperative-based empowerment programs could provide substantial economic benefits to women. Women are significantly underrepresented in decision-making roles within the seaweed value chain, particularly in activities that directly impact income, such as seeking buyers and negotiating prices. Addressing this gender imbalance through training, education, or cooperative-based empowerment programs could provide substantial economic benefits to women (Suyo et al., 2021).

The opportunities presented by seaweed farming as an empowerment venture suggest that it serves as a reliable source of income for many participants, making it a vital component of their economic survival. This indicates a strong dependency on the sector for financial stability particularly among women, who often have limited access to alternative employment opportunities in coastal communities (Larson et al., 2021). The outcomes are consistent with those of Obura et al., who claimed in 2017 that seaweed farming has been practiced by numerous coastal communities, which could improve food security and provide income for many women and men. The study's results also align with research conducted by Mirera et al. (2020) and Odhiambo et al. (2020) which has demonstrated that seaweed farming has socioeconomic benefits for the local communities and that more stakeholders are becoming interested in the practice Seaweed farming is important for coastal communities because it gives many families a substantial income and can supplement or replace fishing earnings (Suyo et al., 2020). Growing seaweed is considered a sustainable small-scale aquaculture method. Furthermore, Rimmer et al. (2021) highlight that it is economical for families to earn money and sustain their way of life. Furthermore, Larson et al. (2021) highlight that seaweed farming offers a range of social benefits, including strengthened community ties, enhanced teamwork, preservation of cultural heritage, and increased awareness of health and wellness.

The findings indicate that climate change is a major constraint on seaweed farming, adversely affecting growth conditions productivity and sustainability (Msuya &Porter 2014). Additionally, herbicides and "ice-ice" diseases negatively impact production. Additionally, the findings reveal challenges related to limited capacity building, inadequate access to funding, and insufficient resources all of which are critical for effective seaweed farming. The absence of these essential inputs suggests that marginalized groups, particularly women, may lack the necessary tools, training, and support to fully benefit from opportunities in the sector.

The findings align with previous studies by Msuya and Hurtado (2017) and Kronen et al. (2010), which also identified several challenges that disadvantage seaweed farmers in the seaweed farming industry. These include financial constraints, limited management capacity, and environmental challenges, compounded by the multiple roles women often balance, such as caregiving and responsibilities as mothers and early childhood educators.

CONCLUSION

The study concludes that while seaweed farming presents clear economic benefits, several setbacks continue to hinder full gender participation—particularly limiting women's involvement in higher-value activities such as marketing and processing. Social norms and practical barriers, such as the lack of childcare support, restrict women's ability to engage fully in the value chain. Empowerment programs that address these structural and societal challenges are crucial to promoting inclusive participation.

Seaweed farming offers promising opportunities for gender empowerment, as evidenced by the study's findings. Key benefits include skill acquisition, income generation, and improved living standards, with women having the potential to fulfill basic needs and achieve economic security. However, targeted interventions are needed to maximize these benefits for women, especially regarding long-term economic stability and resilience. Training, improving access to credit, and enhancing market opportunities are vital to empower women further, allowing them to take on more profitable roles in the industry.

The primary challenges in the seaweed value chain include low productivity, limited training, and resource constraints. Addressing technical and psychological challenges, such as inadequate knowledge, financial support, and structural inequalities, and persistent structural inequalities, is critical. Doing so will not only enhance women's empowerment but also strengthen production outcomes and retention rates across the seaweed farming communities.

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REFERENCES

1. Acharya, A. S., Prakash, A., Saxena, P., & Nigam, A. (2013). Sampling: Why and how of it. Indian journal of medical specialties, 4(2), 330-333.
2. Agnes Quisumbing, Jessica Heckert, Simone Faas, Gayathri Ramani, Kalyani Raghunathan, Hazel Malapit (2021) Women's empowerment and gender equality in agricultural value chains: evidence from four countries in Asia and Africa. Food Security (2021) 13:1101–1124 https://doi.org/10.1007/s12571-021-01193-5 / Published online: 3 September 2021
3. Bazeley, P. (2024). Conceptualizing Integration in Mixed Methods Research. Journal of Mixed Methods Research, 15586898241253636.
4. Barrientos S. Gender, flexibility and global value chains. IDS Bull. 2001; **32**(3): 83-93. doi:10.1111/j.1759-5436.2001.mp32003009.x
5. Bavinck, M., and J. Verrips. 2020. Manifesto for the marine social sciences. Maritime Studies. https://doi.org/10.1007/s40152-020-00179-x.
6. Bavinck, M., S. Jentoft, and J. Scholtens. 2018. Fisheries as social struggle: A reinvigorated social

science research agenda. Marine Policy. https://doi.org/10.1016/j.marpol.2018.04.026.
7. Bosma, R.H., Nguyen, TD., Calumpang, L.M. & Carandang, S.A. (2019) Gender action plans in the aquaculture value chain: what's missing? Reviews in Aquaculture (2019) 11, 1297–1307 https://doi.org/10.1111/raq.12293
8. Buschmann AH, Camus C, Infante J, et al. Seaweed production: overview of the global state of exploitation, farming and emerging research activity. Eur J Phycol. 2017;52(4):391-406. doi:10.1080/ 09670262.2017.1365175
9. Besta, N. (2013). Seaweed farming and intra-household gender relations on Songo Songo Island, Tanzania. University of East Anglia. Doctoral thesis https://ueaeprints.uea.ac. uk/id/eprint/47905.
10. Buschmann, A. H., Camus, C., Infante, J., Neori, A., Israel, ´A., Hern´andez- Gonz´alez, M. C., Pereda, S. V., Gomez-Pinchetti, J. L., Golberg, A., Tadmor- Shalev, N., & Critchley, T. (2017). Seaweed production: Overview of the global state of exploitation, farming and emerging researchactivity.EuropeanJournalofPhycology,52(4),391–406. https://doi.org/10.1080/09670262.2017.1365175
11. Creswell, J. W., & Garrett, A. L. (2008). The "movement" of mixed methods research and the role of educators. South African journal of education, 28(3), 321-333.
12. Chopin, T., and A. Tacon. (2021) Importance of seaweeds and extractive species in global aquaculture production. Reviews in Fisheries Science & Aquaculture. https://doi.org/10.1080/23308249.2020.1810626.
13. Creswell, J. W., & Clark, V. L. P. (2017). Designing and conducting mixed methods research. Sage publications.
14. Creswell, J. D., Pacilio, L. E., Lindsay, E. K., & Brown, K. W. (2014). Brief mindfulness meditation training alters psychological and neuroendocrine responses to social evaluative stress. Psychoneuroendocrinology, 44, 1-12.
15. Ciesielska, M., Boström, K. W., & Öhlander, M. (2018). Observation methods. Qualitative methodologies in organization studies: Volume II: Methods and possibilities, 33-52.Science- Policy Nexus for Enhancing the Seaweeds and Algae Farming. Global Blue Economy, 309-340.
16. Cooksey, R. W., & Cooksey, R. W. (2020). Descriptive statistics for summarizing data. Illustrating statistical procedures: Finding meaning in quantitative data, 61-139.
17. Cuaton, G. (2019). A post-disaster gendered value chain analysis on seaweed farming after super typhoon haiyan in the philippines. Journal of Enterprising Communities People and Places in the Global Economy, 13(4), 508-524. https://doi.org/10.1108/jec-11-2018-0091
18. Duarte, C. M., Bruhn, A., & Krause-Jensen, D. (2022). A seaweed aquaculture imperative to meet global sustainability targets. Nature Sustainability, 5(3), 185-193
19. FAO. 2017. Towards gender-equitable small-scale fisheries governance and development- a handbook. In support of the implementation of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, by Nilanjana Biswas.Rome:FoodandAgriculturalOrganizationoftheUnitedNations. https://www.fao.org/3/i7419e/i7419e.pdf.
20. FAO. 2020. The State of World Fisheries and Aquaculture. Sustainability in action. Rome: Food and Agricultural Organization of the United Nations. https://doi.org/10.4060/ca9229en
21. Fink, A. (2003). The survey handbook. Sage.
22. FITRIANA, R. (2016). Gendered participation in seaweed production-examples from Indonesia. Gender in Aquaculture and Fisheries: Engendering Security in Fisheries and Aquaculture, 245.
23. Garcia-Poza, A., & Tschakert, P. 2022. Intersectional subjectivities and climate change adaptation: An attentive analytical approach for examining power, emancipatory processes,and transformation.Transactions of the Institute of British Geographers, 47(3): 651–665. https://doi.org/10.1111/tran.12529.
24. Gallardo-Fernández GL, Saunders F. "Before we asked for permission, now we only give notice": Women's entrance into artisanal fisheries in Chile. Maritime Studies. 2018; **17**(2): 177-188. doi:10.1007/s40152-018-0110-z
25. Monforabayunga t MC. The Role of Women in the Seafood Industry. FAO; 2015.
26. NS, Matolla G, Shitotte Z, Kubiriza GK. Gender roles in thevalue chain of farmed tilapia (Oreochromis niloticus) in Kakamega County, Kenya. Africa Environ Rev J. 2021;4(2):13-27.17. Msuya, F. E. (2013).

Social and Economic Dimensions of Seaweed Farming in the Western Indian Ocean. World Aquaculture Society.

27. Mirera, D. O., Kimathi, A., Ngarari, M. M., Magondu, E. W., Wainaina, M., & Ototo, A. (2020). Societal and environmental impacts of seaweed farming in relation to rural development: The case of Kibuyuni village, south coast, Kenya. Ocean & coastal management, 194, 105253.
28. Suyo, J. G. B., Le Masson, V., Shaxson, L., Luhan, M. R. J., & Hurtado, A. Q. (2020). A social network analysis of the Philippine seaweed farming industry: Unravelling the web. Marine Policy, 118. https://doi.org/10.1016/j.marpol.2020.104007
29. Suyo, J. G. B., Le Masson, V., Shaxson, L., Luhan, M. R. J., & Hurtado, A. Q. (2021). Navigating risks and uncertainties: Risk perceptions and risk management strategies in the Philippine seaweed industry. Marine Policy, 126, 104408. https://doi.org/10.1016/j.marpol.2021.104408
30. Siles J, Prebble M, Wen J, Hart C, Schuttenberg H. Advancing Gender in the Environment: Gender in Fisheries—A Sea of Opportunities. IUCN and USAID; 2019.
31. Weeratunge-starkloff N, Pant J. Gender and Aquaculture: Sharing the Benefits Equitably. The WorldFish Center; 2011.19.
32. Wakibia, J. G., Bolton, J. J., Keats, D. W., & Ruck, K. E. (2011). Economic Feasibility and Socioeconomic Impact of Seaweed Farming in Kenya. Aquaculture International, 19(3), 537-552.