

# Original Research Article

## ***Marketing challenges faced by seaweed farmers in Zanzibar, Tanzania***

### **Abstract**

**Aim/purpose:** This study was conducted to identify the marketing challenges faced by Zanzibar's seaweed producers and to recommend suitable strategies.

**Methodology:** A case study approach was adopted. The study combined semi-structured questionnaires and informal group discussions with the farmers as tools for primary data collection. A total of 592 seaweed farmers from both Unguja and Pemba participated in the study. The farmers were selected through multistage sampling. Analysis of challenges was done through the Garrett ranking method.

**Results:** It was found that the leading marketing challenges for seaweed farmers are the absence of minimum selling price (MSP), limited buyers and the inability to set prices. The absence of MSP was linked to the absence of the industry's supporting policies. At the same time, limited buyers emanated from the lack of the industry's business strategy, limited linkage to the domestic market and lack of export differentiation. Farmers' inability to set prices was found to be a result of exporters' setting buying prices. Similarly, the study found that the farmers face intense competition due to limited production variety and being large in number. Farmers also were found to have limited marketing and promotional skills and lacked business strategies.

**Conclusion:** Several interventions are required to support the seaweed farmers in Zanzibar. First, the creation of guiding industry's business and marketing/product strategies. Further creation of the industry's guiding and supporting policies is crucial. Second, establishing domestic demand and linking the industry to its potential users at individual and industrial levels is critical for the survival of Zanzibar's seaweed industry. Third, the establishment of *carrageenan* extraction industries to establish export product differentiation. Capacity-building training is vital for farmers in agri-business and financial management areas. Government procurement and provision of storage facilities to minimise the offloading challenge are also needed to lessen the effect of same-time offloading, which exposes farmers to low prices. Lastly, financial assistance should also be provided to promote and upscale seaweed value-addition activities on the island.

**Originality/value** – Examination of marketing challenges faced by seaweed farmers in Zanzibar was conducted using the Garrett ranking technique, and suitable recommendations were proposed.

**Keywords:** Marketing challenges, Zanzibar's seaweed farmers

## 1.0 Introduction

Zanzibar is the leading producer and exporter of seaweeds from the United Republic of Tanzania (URT) and Africa. Zanzibar's seaweed industry produces more than ninety-eight per cent of exported seaweeds from the URT. The island holds a fourth-world position in the global red seaweed market (Cai et al., 2021). The seaweed industry is also the leading aquaculture sector for the United Republic of Tanzania (URT) and the Revolutionary Government of Zanzibar (RGoZ). The industry is the third largest revenue generator for the RGoZ and its second-leading cash crop exporter (OCGS, 2021). Commercial cultivation of seaweeds commenced in 1989 on the island and expanded to other parts of the island and mainland Tanzania (Msuya, 2002). Despite its existence for over three decades, the industry remains largely untapped.

The seaweed industry in Zanzibar is mainly for export and provides employment, livelihood and alternative income (fishermen and other aquaculture farmers) to its rural inhabitants (Msuya, 2002; Msuya, 2010; Songwe et al., 2016; Msafiri, 2021). The industry employs about 25,000 predominantly women farmers (about 90%) (Msuya et al., 2022). Thereby, significant contributions of seaweed aquaculture are more pronounced among its women farmers than men giving them the ability to construct their own houses, pay children's school fees, and meet personal needs without relying on spousal support (Kalumanga, 2018). However, despite its significant contributions, the seaweed industry in Zanzibar has failed to expand and generate substantial profits for its producers despite the growing world demand for seaweeds. The industry faces production and returns challenges that signal a looming collapse (REPOA, 2018).

The challenge of seaweed farmers' low returns in Zanzibar has been linked to unpredictable demand conditions in the international seaweed market and limited export product variety (Msuya, 2012; Msuya, Muumin, Hamed, 2016; Songwe et al., 2016; REPOA, 2018; Msafiri, 2021; Shimba, Magombola and Ibrahim, 2021; Charisiadou et al., 2022; Msuya et al., 2022). Zanzibar exports two raw varieties of red seaweeds, i.e. *spinosum* and *cottonii*. Red seaweeds derive their commercial value from carrageenan extraction. *Carrageenan* is applicable in various industries as a thickening agent (pharmaceuticals, pet food, cosmetics). *Kappa-carrageenan* from *cottonii* fetches higher prices in the international markets than *iota-carrageenan* from *spinosum*; however, *cottonii* has been production failures in Zanzibar since 2012 due to severe environmental and climate conditions (Charisiadou et al., 2022; Msuya et al., 2022).

Similarly, limited linkage exists between the domestic market and Zanzibar's seaweed industry. Domestic consumption is reported to be less than one per cent of its total

production (Msuya et al., 2022). Porter (2004) stresses that only those businesses with home-based competitors can compete effectively in international markets. However, in the case of the Zanzibar seaweed industry, it inorganically matured to global markets without first establishing a domestic market. Thus, low industry returns and production challenges have led to farm abandonments (Songwe et al., 2016) and declining production trends (Msafiri, 2021). Farmers have been seeking and pursuing alternative economic opportunities on the island, except they are scarce. Rural Zanzibar, where seaweed farming is practised, still faces higher poverty rates and limited infrastructural development than urban Zanzibar (World Bank, 2015). Similarly, the rural inhabitants' education levels remain relatively lower than urban dwellers (World Bank, 2015). Agricultural workers (especially women) in Zanzibar generally face higher poverty levels and unequal employment opportunities than any other group (World Bank, 2015).

Research studies on the Zanzibar seaweed industry remain limited. For instance, no studies have examined the factors behind the URT's almost non-existent domestic seaweed market nor documentation on efforts implemented to establish the same. Hence this study attempts to bridge the existing gap in knowledge by examining current marketing challenges faced by the industry producers constraining their linkage to the domestic market, and recommending suitable strategies. The study adapts the Garrett ranking technique to study the challenges which have found applications among a myriad of research works, e.g. in Dhanadhan, 2016; Thulasiram and Alagumani, 2018; Aleeswari, Merline and Martin, 2019; Angayarkanni, 2021; and, Paul and Ushadevi, 2022.

## **2.0 Materials and methods**

This study was conducted in Zanzibar, Tanzania using a case study approach. Details regarding seaweed farming villages were obtained from the seaweed section, department of Fisheries Development, Ministry of Blue economy and Fisheries, Zanzibar. The study surveyed 24 seaweed farming villages from North, South, Central and West Unguja and Micheweni and; 25 villages from Wete and Mkoani regions from Pemba. A total of 592 farmers from 49 seaweed farming villages in Zanzibar. 291 farmers were selected from Unguja and 301 from Pemba.

Participants for the study were selected through multistage sampling. The multistage sampling technique was adopted to capture the island's administrative and geographical clusters of seaweed farming villages. Semi-structured questionnaires and informal group discussions were adopted to collect primary data from the farmers. An exploratory study was conducted on a few selected farmers to capture the marketing challenges. Analysis of the

same was done, and results were used to develop the semi-structured questionnaires. Analysis of challenges was done through the Garrett ranking method.

## 2.1 Garrett's ranking technique explained

In this technique, seaweed farmers were asked to rank the marketing challenges presented as appropriate. Their ranks were thereby converted into score values, and final values were ranked with the help of the following formula:

$$\text{Percent position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

Where,

$R_{ij}$  = Rank given for the  $i^{\text{th}}$  variable by  $j^{\text{th}}$  respondents

$N_j$  = Number of variables ranked by  $j^{\text{th}}$  respondents

Factors with the highest mean value are considered the most important.

## 3.0 Results and findings

### 3.1 Socio-economic profile of the seaweed farmers in Zanzibar

The socio-economic profile of respondents reveals several significant findings. First, there is limited participation of youth in the farming practice (2.74% and 3.98% in Unguja and Pemba, respectively) (source: table 1). The limited participation observed is attributed to the perception of the industry's unattractiveness due to low returns. Hence, most youths opt to engage in other higher-paying economic pursuits. However, since seaweed aquaculture in Zanzibar is practised in rural areas, with limited development in such areas, the youth are left with few economic alternatives. Most would migrate to Zanzibar-urban for jobs such as tour guides or construction. As a result, the island's rural areas are affected by the loss of an active working force. This is especially noted in the seaweed aquaculture practice because farmers require labourers during planting and harvesting. This is because seaweed aquaculture is labour-intensive. Hence, they are forced to pay more for daily hires because of limited labour options, increasing farm operational costs.

Secondly, it can also be observed that the majority of farmers are female (more than 80%), thus confirming the work of previous researchers such as (Msuya, 2009; Msuya, 2010; Valderrama et al., 2015; Songwe et al., 2016; Kalumanga, 2018; Msafiri, 2021). Because of its low capital requirements and short production cycles, rural coastal women can easily engage in the activity and earn income regularly. Farmers expressed that income from seaweed farming has enabled them to pay school fees, construct houses, and meet their personal and financial needs (source: study survey, 2021).

Third, most farmers lived in extended family settings (92.1% Unguja and 95.35% Pemba) (source: table 1). Most farmers lived with three to five dependents (grandchildren, own relatives, husband's relatives). This challenge negatively affects the farmers' income

due to the financial implications that arise from raised household expenditures and other economic burdens that the farmers should meet (source: table 1).

Fourth, it was found that the highest level of education for farmers from both islands was secondary education. Most farmers from Unguja and Pemba (45.70% and 38.87%, respectively) were found to have attained primary education, while only about 40.55% and 21.26% from both islands, respectively, had attained secondary education (source: table 1). The discrepancy in education levels is attributed to Unguja being more developed than Pemba.

**Table 1: Summary of the socio-economic profile of the seaweed farmers in Zanzibar**

Variables	Sub-variables	Islands			
		Unguja		Pemba	
		N	%	N	%
Age groups	20-30	8	2.74	12	3.98
	30-40	179	61.51	256	85.05
	40-50	71	24.4	13	4.32
	50-60	33	11.34	20	6.64
	<b>Sub-total</b>	<b>291</b>	<b>100</b>	<b>301</b>	<b>100</b>
Gender	Male	19	6.53	38	12.63
	Female	272	93.47	263	87.38
	<b>Sub-total</b>	<b>291</b>	<b>100</b>	<b>301</b>	<b>100</b>
Family Background	Nuclear family	23	7.90	14	4.65
	Extended/Joint family	268	92.10	287	95.35
	<b>Sub-total</b>	<b>291</b>	<b>100</b>	<b>301</b>	<b>100</b>
Education background	Illiterates	31	10.65	64	21.26
	Primary education	133	45.70	117	38.87
	Secondary education	118	40.55	115	38.21
	Short courses	9	3.09	5	1.67
	<b>Sub-total</b>	<b>291</b>	<b>100</b>	<b>301</b>	<b>100</b>

Source: Study survey, 2021

### 3.2 Production and marketing of Zanzibar's seaweeds

Zanzibar's seaweed industry remains primitive despite the industry being in existence for over three decades. Seaweed farmers use the traditional off-bottom/peg and line farming method practised in shallow waters with a production cycle of 45-60 days. Hence farmers can harvest seaweeds up to six times a year. Msuya (2012) posits that the seaweed farmer's earnings are mainly determined by the growing season and how long a farmer collects seaweed before selling it (farmers' efforts).

A plot of seaweed farm in Unguja produces about 50 kgs of dried *spinosum* in Unguja (source: study survey, 2021). In contrast, in Pemba, a seaweed plot produces up to 100 kgs of dried seaweeds (source: study survey, 2021). Production differences are attributed to differences in factor conditions. Unguja faces more severe ecological challenges than Pemba ((Yahya, Mmochi and Jiddawi, 2020; Makame et al., 2021; Charisiadou et al., 2022). The cost of production per one plot of seaweed ranges between US\$ 111 and 122 per production cycle (source: study survey, 2021). The differences in production costs are caused by inputs' (e.g. ties) cost differences among villages and islands (Unguja vs Pemba). The average number of plots owned ranges between one and eight seaweed farms (source: study survey, 2021).

Collection centres pay farmers in Unguja between TZS 700-800 (US\$0.30-0.35) per kg of dried *spinosum* seaweed and TZS 2,000 (US\$ 0.86) per kg for dried *cottonii* (source: study survey, 2021). Farmers in Pemba receive about the same price per kg of dried *cottonii* but a relatively lower price per kg of *spinosum*, i.e. TZS 500 (US\$0.22) (source: study survey, 2021). The difference in the price paid between the two varieties is because *cottonii's carrageenan* is considered higher quality than *spinosum's*. Pemba island attracts low-price offers of *spinosum* compared to Unguja due to oversupply and buying company conditions. Exporting companies involved in the buying process also affect the amount paid to farmers. For instance, ZANEA seaweed co ltd is the primary buying company in Unguja, while C-Weed co ltd is the primary buyer for Pemba island.

Hence, income from seaweed farming ranges between TZS 35,000 (US\$ 15) and TZS 280,000 (US\$ 120) in Unguja and between TZS 50,000 (US\$ 21.4) and TZS 400,000 (US\$ 171.4) in Pemba per production cycle (source: study survey, 2021). A seaweed farmer can have an income of up to TZS 1,680,000 (US\$ 720) (Unguja) and TZS 2,400,000 (US\$ 1,028.6) (Pemba) per year (source: study survey, 2021).



Figure 1: Seaweed farm in Jambiani, Unguja



Figure 2: Drying of seaweed in Jambiani, Unguja

### 3.2.1 Production and export volume trends of Zanzibar's seaweed industry

Figure 3 presents the production and export trends of the industry between 2010 and 2020. It can be observed that the volume exported has remained consistently lower for the industry during the mentioned period, with the exception of 2018. Hence, the seaweed farmers in Zanzibar have been facing the challenge of surplus produce, which ties in capital for subsequent production cycles and loss of income. With the challenge of limited seaweed domestic consumption in the URT, farmers are left helpless. They are also disposed to incur debts to obtain farm operational funds for subsequent production cycles and growth capital for the expansion of the farms. The tying in the capital due to lack of markets also constrains farmers' value-addition and entrepreneurial prospects.

The seaweed industry in Zanzibar exports only raw dried seaweeds and competes with Asian producers (Indonesia, the Philippines and Malaysia), who contribute to 98.8% of the world's production (Cai et al., 2022). The Asian producers contribute to about 98.8% of the world's red seaweed production. The Asian competitors can be said to have attained their global competitive positioning due to favourable factor conditions (e.g. the number of islands, population, farming techniques) as opposed to Zanzibar. The Asian competitors also export differentiated export products in raw and value-added forms (Ferdouse et al., 2018). In addition, they are geographically close to the buyers, unlike the Zanzibar seaweed industry.

Similarly, globally, *carrageenan* extractors are limited. Main buyers for the URT's seaweeds include extractors from Chile, Denmark, the USA, Belgium, China, Spain and

France (ITC, 2022). The buyers have high bargaining power due to; being few, low switching costs, possessing complete market information and high volume purchases. Hence, considering the oligopsonistic state of the global red-seaweed industry, lack of export product differentiation and proximity factors, Zanzibar is left disadvantaged. Its exporters are left with no choice but to price their exports below prevailing global market prices to sell. This challenge, in turn, translates to relatively lower prices paid to farmers.

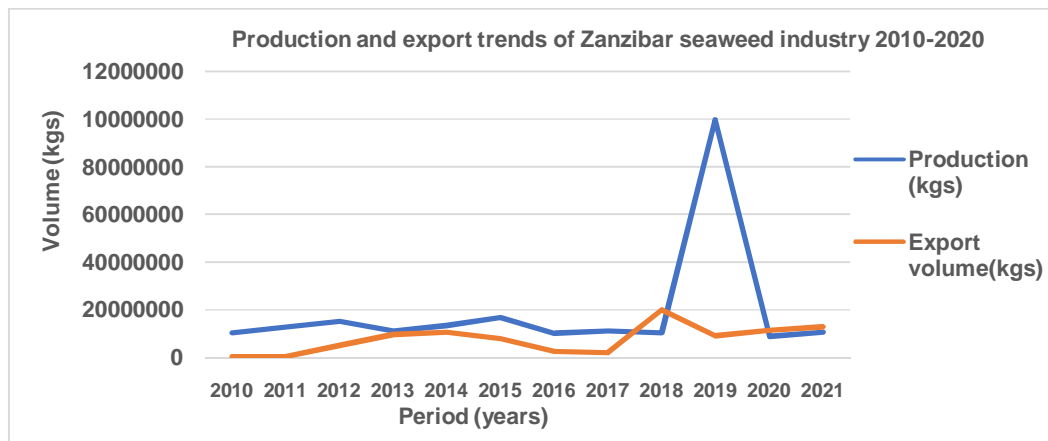


Figure 3: Production and export trends of Zanzibar's seaweed industry (sources: Production data - seaweed section, Department of Fisheries Development, Ministry of Blue economy and Fisheries, Zanzibar. Export data - Tanzania revenues Authority (TRA) )

### 3.3 Marketing channels of Zanzibar's seaweed industry

The main actors in Zanzibar's seaweed industry's marketing chain are farmers, collection centres and seaweed exporters. About 25,000 estimated seaweed farmers on the island produce *spinosum* to a large extent (especially in Unguja) and *cottonii* to a limited extent (Msuya et al., 2022). The seaweed section at the department of Fisheries Development ministry of Blue economy and Fisheries, Zanzibar, does not have an actual number of seaweed farmers on the island. The figures provided are based on estimations. However, efforts are to conduct a census of the farmers on the island. Farmers produce and transport dried seaweeds to collection centres. Farmers get paid by collection centres. However, they also sell (but to a limited extent and on an individual basis) to small-scale seaweed farmers, processors and passing tourists. These buyers are seasonal and buy on low volume.

Collection centres are representatives of seaweed exporters found in most seaweed farming villages. They weigh, pack and transport seaweed load to exporters located in Zanzibar-urban. Exporters clean, sort, and balance seaweed loads according to the buyer's specifications. Exporters perform no value-addition. When this study was taken in 2021, there were about eight exporters identified by the ministry of Blue economy and Fisheries,

Zanzibar. However, only two (ZANEA and C\_Weed co ltd) are the leading consistent buyers on the island (source: study survey, 2021). The remaining six exporters were found to be seasonal. The number of exporters had reduced from fifteen companies recorded in 2013 by Msuya and Neish (2013). Exporters ship to foreign *carrageenan* extractors located in Europe and Asia.

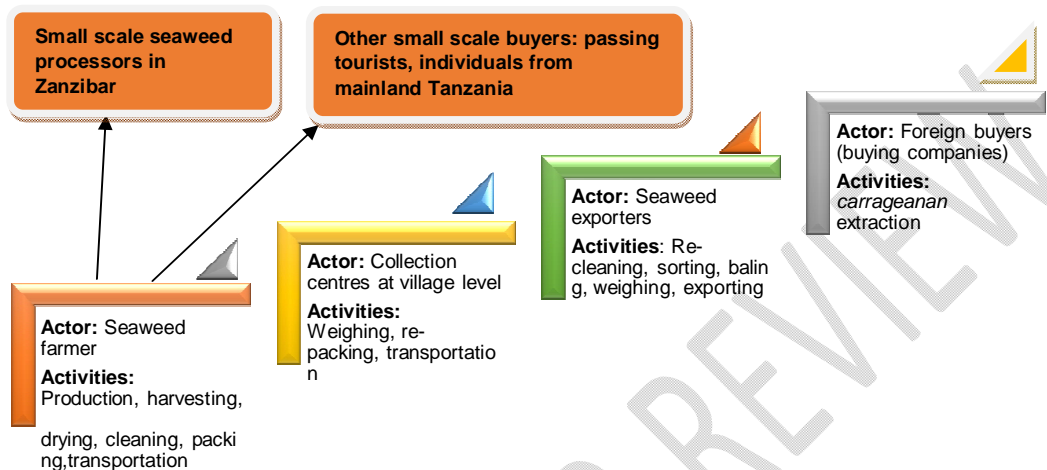


Figure 4: Marketing channel chain map of the Zanzibar seaweed industry (source: Study survey, 2021)

### 3.4 Marketing challenges faced by seaweed farmers in Zanzibar

The industry's most significant marketing challenge is the lack of a minimum selling price (MSP). Seaweed farmers in Zanzibar expressed that they are in no position to refute low price offers set by collections centres' officials since there is no guiding industry policy. Seaweed exports are the primary source of income for Zanzibar seaweed producers through local collecting centres at village levels. However, the price for dried seaweeds is determined by exporters and not producers based on prevailing global market demand conditions. The lack of MSP is attributed to a lack of industry's guiding and supporting policies. Zanzibar's international trade is ninety-eight per cent from sea-based activities; efforts have been put in place in Zanzibar to support the Blue economy activities, e.g., creating Zanzibar Blue Economy 2020, taking into consideration Zanzibar's Development Agenda 2050. However, specific policies and mandates for the seaweed industry are yet to be pronounced.

The seaweed farmers ranked the challenge of limited buyers as the second highest market challenge. As already highlighted, the farmers' main buyers are collection centres of seaweed exporters based in Zanzibar-urban. The number of exporters is less than

numerous existing producers. With few buyers, farmers are left with no negotiating leverage, thus being disposed to low-price offers. Additionally to this challenge is that farmers produce similar variety and offload simultaneously, which poses them with even further lower prices in oversupply conditions. Considering the industry's history and activities, the challenge of limited buyers can be summarised as being caused by a lack of industry business strategy, marketing plan, limited domestic demand, limited industry value-addition activities and limited export product variety. No business or marketing strategy was found to guide the industry's activities.

Similarly, farmers were not found to have individual business goals and plans. For most farmers, seaweed farming is conducted based on historical and socio-cultural perspectives rather than being treated as a business. Most engage in the activity due to proximity to the beaches, ease of establishment, running, and peer pressure. Songwe et al. 2016 comment that the industry is not commercially run due to seaweed farmers' low entrepreneurship and capacity skills. In their study, they found limited agri-business skills among farmers from Unguja and Pemba, with financial management being the least (2.81%), entrepreneurship (25.1%), and sales and marketing (28.1%).

No seaweed cooperation was found on the island. However, seaweed farmers' associations were found in both Unguja (JUWAMWAZA<sup>1</sup>) and Pemba (JUWAMPE<sup>2</sup>). REPOA (2018) reports three key measures the Zanzibar Ministry of Blue Economy and Fisheries put into place to support and strengthen the presence of farmers' associations on the island. These are; Zanzibar Seaweed Project and the Marine and Coastal Environment Management Project (MACEMP), Zanzibar Seaweed Cluster Initiative (ZaSCI) and Seaweed Centre Zanzibar. The three institutions mobilise farmers in different villages to form groups to access technical, financial and other related entrepreneurial support (REPOA, 2018). Most farmers were found not to be members and indicated no interest in becoming so. When asked about challenges faced in joining the associations, most of the farmers expressed "*hatuoni faida yake*", which translated to "*we can not see their benefit*". Thus, the activity remains a personal affair.

Furthermore, domestic demand for seaweeds on the island is minimal (less than 1% consumption) (Msuya et al., 2022). The nearly non-existent domestic customer base is underscored by limited awareness of the benefits of seaweeds and a lack of the industry's marketing and promotional activities. Regarding domestic consumption, seaweed value-addition is the most noteworthy contribution; however, it is practised on a limited scale.

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<sup>1</sup> Jumuiya ya Walima Mwani Zanzibar translated to *Association of seaweed farmers Zanzibar*

<sup>2</sup> Jumuiya ya Walima Mwani Pemba translated to *Association of seaweed farmers Pemba*

Value-added seaweed products attract higher price margins than raw seaweeds; for instance, seaweed flour can be sold for TZS 10,000 (US\$ 4.32) and soap up to TZS 3,500 (US\$ 1.51) (source: study survey, 2021). Expansion of the activities is constrained by limited seed and growth capital, lack of physical resources, e.g. machinery, training on packing and labelling, processing sites, availability of inputs and narrow distribution channels (source: study survey, 2021). The value-addition market remains untapped.



Figure 5: Value-addition site in Kidoti, Unguja



Figure 6: Value-added seaweed products in Kidoti,

Further, it was found that the marketing challenges faced by the industry's producers are also linked to limited marketing and promotional skills. Most farmers expressed that they cannot identify markets for their products and rely almost entirely on fellow farmers and exporters through village collection centres. Most farmers from Unguja Island (138/291) rated themselves as having weak marketing skills compared to 34.4% from Pemba (104/301) (source: study survey, 2021). About 30.7% of seaweed farmers from Unguja (89 farmers) rated themselves as having very weak marketing skills compared to 16% of farmers in Pemba (48 farmers) (source: study survey, 2021).

Similarly, about twenty-five per cent of farmers from both Unguja (73 farmers) and twenty-seven per cent from Pemba (81 farmers), respectively, rated themselves neutral regarding marketing skills levels (source: study survey, 2021). Lastly, a few farmers from Unguja (29 farmers) and Pemba (29 farmers) (Equiv to. 9.9% and 9.5% respectively) rated themselves as having strong marketing skills (source: study survey, 2021). In a similar study conducted by Songwe et al. (2016) assessing Zanzibar's seaweed industry's competitive

potential for innovation and growth, only 28.1% of 592 farmers surveyed had sales and marketing skills.

Lastly, farmers lack storage facilities for harvested seaweed, leading to offloading challenges which prone them to low prices. Most farmers store dried seaweeds in their homes. The farmers also face transportation challenges to and from the production and collection centres. Farmers in most surveyed areas use cart transport to carry harvested loads from the production site to home and collection centres. Transportation costs per production cycle amount to about TZS 20,000 (US\$ 8.57), which erodes their already limited incomes (source: study survey, 2021).

**Table 2: Marketing challenges faced by farmers**

Challenges	Unguja		Pemba	
	Average	Rank	Average	Rank
a. Absence of minimum selling price policy	79	1	82.7	1
b. Limited buyers	33.44	2	35.58	2
c. Inability to set prices	30.86	3	29.72	3
d. Limited value-addition	15.16	7	17.2	7
e. Logistics challenges	13.36	8	12.15	9
f. Limited promotional skills	10.2	10	11.24	10
g. Intense competition	29.28	4	30.14	4
h. Lack of market planning skills	27.8	5	27.8	5
i. Limited market information sources	25.36	6	23.38	6
j. Lack of business strategy	12.26	9	11.68	8

Source: Study survey, 2021

#### 4.0 Conclusion

This study attempted to identify and examine marketing challenges facing seaweed farmers in Zanzibar, leading to low returns. The study found that the leading marketing challenges for seaweed farmers are the absence of minimum selling price (MSP), limited buyers and the inability to set prices. The absence of MSP was linked to the absence of the industry's supporting policies. At the same time, limited buyers emanated from the lack of the industry's business strategy, limited linkage to the domestic market and lack of export differentiation. Farmers' inability to set prices was found to be a result of exporters' setting buying prices.

Similarly, the study found that the farmers face intense competition due to limited production variety and being large in number. Farmers also were found to have limited marketing and promotional skills and lacked business strategies. Hence, if there are no

immediate interventions for the industry, it can be said that current trends signal a further deterioration of the industry's activities which would translate to loss of revenues, employment, income and livelihoods in future.

### **Consent**

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

### **Recommendations**

Several interventions are required to support the seaweed farmers in Zanzibar. First, the creation of guiding industry's business and marketing/product strategies. Further creation of the industry's guiding and supporting policies is crucial. Second, establishing domestic demand and linking the industry to its potential users at individual and industrial levels is critical for the survival of Zanzibar's seaweed industry. Third, the establishment of carrageenan extraction industries to establish export product differentiation. Capacity-building training is vital for farmers in agri-business and financial management areas.

Government procurement and provision of storage facilities to minimise the offloading challenge are needed to lessen the effect of same-time offloading, which exposes farmers to low prices. Financial assistance should also be provided to promote and upscale seaweed value-addition activities on the island. Lastly, further investment in infrastructure in rural Zanzibar is needed to alleviate or minimise farmers' transportation hassles.

### **Competing interests**

Authors have declared that no competing interests exist.

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