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Porter's Five Forces Analysis of Zanzibar's Seaweed Industry

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Aim: This study intended to analyse the Zanzibar seaweed industry's (ZSI) profitability potential by adopting Porter's five forces industry analysis framework. The objective was to identify factors in its structure contributing to the industry's ongoing primary challenge of low returns.
Methodology: The study was conducted on Zanzibar island in the United Republic of Tanzania. A case study design approach was adopted. The study's sample consisted of seaweed farmers, exporters and officials from government institutions linked to the industry. Seaweed farmers were selected through multistage and quota sampling. Exporters were chosen based on experience, i.e. at least five years of operations and above. Government officials were selected through purposive and convenience sampling. The study utilised both primary and secondary data. A triangulation approach was adopted for data collection. Data analysis was done through thematic analysis, descriptive statistics and literature review. Results were adapted into Porter's framework for further analysis. The threat level for each Porter's force was determined by weighing their corresponding driving factors, and respondents rated the final results based on the perceived threat level.
Results: The study found that the Zanzibar seaweed industry has low profitability potential. Threats emanate from the industry's lack of entry barriers, several available cheap and high-performing substitutes, low switching costs and high bargaining power of buyers and suppliers. The government's role in promoting the industry's activities is almost non-existent. Similarly, the

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industry's production methods were found to be still traditional. Innovative activities were found to be minimal. In terms of opportunities, the industry remains a viable economic alternative for the rural Zanzibarians due to its low capital entry requirements and short production cycles. The potential for increased income and improved health and nutrition exists if domestic markets are established. The growing global demand for *carrageenan* also signals the industry's revenue and income growth potential. Similarly, the ZSI is also a source of economic gender empowerment for rural Zanzibari women.

Conclusion: Zanzibar's seaweed industry's low profitability potential is a result of its structure, production system and the absent role of the Revolutionary Government of Zanzibar (RGoZ). Due to the unique nature of ZSI challenges, Porter's generic strategies were found unsuitable. Hence, this study recommends creating a guiding industry business strategy and marketing plan to guide its activities. The industry's customer base should also be diversified to expand buyer options and minimise risks associated with the global *Rhodotypa* market's oligopolistic conditions. The creation of domestic and regional demand is also crucial. The Revolutionary Government of Zanzibar should also step in to give the necessary support, primarily through creating industry policy. Additionally, diversification of ZSI export products through establishing *carrageenan* extraction industries in Zanzibar is vital.

Keywords: Porter's five forces; Zanzibar seaweed industry (ZSI).

1. INTRODUCTION

Zanzibar's seaweed industry (ZSI) is Africa's leading producer and exporter of seaweeds and holds the fourth position in the global red seaweeds (Rhodophyta) market. The seaweed farming industry is the most significant aquaculture sub-sector in the United Republic of Tanzania (URT). The industry is also the leading producer of seaweeds in the URT. ZSI exports two varieties of *Rhodotypas*, i.e. *Eucheuma Denticulatum (spinosum)* and *Kappahycus Alvezerii (cottonii)*. Seaweeds from Zanzibar have been exported since the 1930s as wild harvests to Europe [1]. However, due to the depletion of its natural wild stock (owing to over-harvesting), commercial cultivation experiments were initiated in 1989 in Unguja (Msuya, 2009). Successful experimental cultivation in Unguja led to the expansion of the farming practice to Pemba island and other parts of mainland URT, i.e. Bagamoyo, Tanga, Mafia, Mtwara, Lindi and Kilwa [2]. Exports of cultivated seaweeds from Zanzibar commenced in the 1990s [3].

ZSI's production is mainly for exports and is the second leading cash crop export to cloves [4]. The industry is also the third largest source of revenue for the Revolutionary Government of Zanzibar [4]. The industry has existed for over thirty-three years and employs about 25,000 seaweed farmers, of which women make up more than ninety per cent of the total number of farmers [5]. The farming practice has significantly improved the livelihoods of its rural farmers, especially women [6,7,2,8,9,10,5] (Msuya, 2009). Despite its economic and socio-economic contributions, especially in improving the livelihoods of rural farmers, the industry has failed to tap into the growing global demand for red seaweeds, thus underperforming compared to competitors in Asia [11].

ZSI's current challenges include failed production, especially on Unguja island and low returns [6,11,5] (Msuya, 2009; Songwe et al., 2017). Production challenges have been attributed to severe ecological changes on the island that have led to poor thallus growth, epiphytes, diseases (ice-ice) and high die-offs [1,12]. The low returns challenges have been attributed to the unfavourable demand conditions in the global seaweed market and limited product utilisation properties [11,8,5]. The challenges of production and low returns have led to diminishing production and export trends on the island [11]. For instance, between 2015 and 2020, production declined by 47.5%, from 16,724 t in 2015 to 8784.6 ts in 2020 (RGoZ, 2020). Similarly, the industry has been facing seaweed farm abandonment challenges by its producers to pursue other viable economic opportunities. This change does not originate from the dislike for seaweed farming but is compelled by need due to low returns [7].

The challenge remains that rural Zanzibar remains underdeveloped, with limited economic opportunities, leaving its inhabitants predisposed to unemployment and poverty [13]. The declining industry trends directly impact exports and pose a significant challenge to

revenue and income losses on the island. Further, the trends compromise farmers' livelihoods, especially women farmers. Additionally, the trends retrocede towards achieving Sustainable Development Goals 1, 2, 5, 8 and 10 and the Zanzibar Development Agenda 2050. Several studies have been conducted on the industry, but most have focused on its socio-economic impact and production challenges. The remaining lot has focused on the industry's working conditions and enhancing its competitive position. Limited studies have examined ZSI's ongoing primary challenge of low returns. Therefore, this study intended to add to the existing literature and address the industry's leading challenge of low returns by examining its attractiveness and profitability potential. The aim is to identify factors in its structure contributing to its low returns and thus recommend suitable strategies for its improved performance.

Even though one could argue that the profitability potential of any business is a product of an interplay among a myriad of factors, Porter (1979) viewed it as a result of the nature and intensity of competition in its external environment. The five forces framework is a qualitative industry analysis tool coined by Porter in 1979 aimed at analysing factors that determine competition intensity and profitability potential of an industry. Although several industry analysis tools exist to analyse business environments, there remains a consensus among authors that Porter's five forces framework remains the most widely applied [14,15,16,17,18] (Wellner and Lakotta, 2020). The five forces framework has found applications across several industries, for instance; in higher education [16,18]; Cooperative banks [17]; railway industries (Wellner and Jakotta, 2020); natural gas [19]; airport industries [20]; manufacturing industry [21] and, tourism education [22].

Objectives – This study aimed to address the challenge of low industry returns faced by Zanzibar's seaweed industry. The profitability potential of ZSI was analysed using Porter's five forces framework and suitable strategies recommended.

2. LITERATURE REVIEW

2.1 Porter's Five Forces Framework for Industry Analysis

Porter (1979) considered an industry as a business's immediate environment and defined it as an arena where several firms/businesses offering products or services of close substitution compete [23]. As proposed by him, the five competitive forces shaping the industry's competitive rivalry and profitability potential are; the threat of potential entrants, buyers' bargaining power, suppliers' bargaining power, the threat of substitute products and competitive rivalry. The model owes its origin to industrial organisation theory [14]. Considering that industries differ widely in their structures, Porter found that the forces shaping competition intensity and profitability potential for each industry remained the same [23]. Porter's five forces model is considered a simplified version of microeconomic theory summarised in five main factors suitable for predicting the long-run returns of industries [15].

Among the criticisms received, the framework was said to view the industry as static and ignored the vital role of government and complementary goods [24,18,25]. Further, the framework over-emphasised macro-environmental analysis at the industry level rather than the specific product/services category at the micro-analysis level [15]. The highlighted criticism led to Porter adding four additional forces in 2008, i.e. the rate of industry growth, the government role, technology and innovation and the role of complementary goods.

In testing the applicability of Porter's framework in contemporary times, Narayanan and Fahel [26] tested Porter's Framework in emerging economies' institutional context. Their study found that the model's transaction costs, rivalry rules, and capital flow qualifying assumptions did not hold for the economies. The authors concluded that businesses in emerging economies adopt unique strategies to suit their unique institutional context rather than deriving from Porter's framework. Karagiannopoulos, Georgopoulos and Nikolopoulus [14], studying the suitability of Porter's model in the internet era, concluded that the model could be enhanced by considering adding innovation intensity. However, Dälken [24] hold that the model still applies in modern times. In their studies, the author investigated the role of deregulation, globalisation and digitisation in the new internet era. His findings concluded that the new forces change industry structures but do not restructure the original Porter's model.

Porter posits that business strategies should organically emerge from a deep understanding of

the structure of an industry within which a business/firm exists. Three generic industry strategies were proposed by Porter in his 1979 work, i.e. low-cost production, differentiation and focus. A low-cost strategy involves production on a large scale, enabling businesses to exploit economies of scale and thus be able to price their products/services relatively cheaper than competitors. On the other hand, a differentiation strategy is achieved by providing products with quality and branding, which commands strong customer recognition, sustained promotion, and wide distribution, ensuring the firm's wide availability of products. Lastly, a focus strategy, in contrast, is adapted to serve a specific target market well by focusing on a particular segment of the business's product line, buyer/ buyer group, or geographic market [23].

2.2 Porter's Five Forces Explained

Bargaining power of buyers: Porter defines the bargaining power of buyers as the number of buyers in the industry and their power to influence the price. According to him, buyers' influence is expressed in their ability to command low prices in the industry. Powerful buyers bargain for high-quality products and services and compete with one another at the expense of the industry. Determinants of high buyer power include; few buyers, low switching costs, high volume/quantity purchased, the possible threat of buyers' backward integration, undifferentiated products or services, and price significance to the buyer [23,27].

Bargaining power of suppliers: According to Porter, certain circumstances may render suppliers powerful. For instance, when they are few and concentrated; when the supplier does not depend heavily on the industry for its revenue; when buyers face high switching costs when switching suppliers; and when suppliers' products are differentiated. Additionally, suppliers may become powerful when there are no close substitutes to the supplier's products, and the likelihood of the supplier's forward integration exists [23,27].

The threat of substitute products: According to Porter, the threat of substitutes limits the industry's profit potential by placing a ceiling on prices. In contrast, industries producing unique products or services tend to enjoy higher or supernormal profits due to limited or absent competition [23,27]. Porter points out that the industry's threat of substitutes is high when high-performing substitute products (price, quality) and low buyer-switching costs exist.

The threat of new entrants: The threat of new entrants to an industry brings new capacity and erodes profitability [23,27]. According to Porter, when new entrants' threats are high, industry incumbents boost their investments and lower prices to discourage potential entrants from joining the industry. Major entry deterrents include; product/service differentiation, supply-side economies, network effects/demand-side economies, incumbency advantages irrespective of size, capital requirements/costs of entry, access to inputs and distribution channels, switching costs and existing government regulations [23,27].

Competitive rivalry: Porter asserts that the degree to which rivalry drives down an industry's profit potential depends on two significant factors, i.e. the intensity and the basis with which businesses compete. The intensity of competition is high if; competitors are numerous and equally balanced, the industry growth rate is slow, and exit barriers are high. The basis with which businesses compete also drives rivalry if; companies offer homogenous/undifferentiated products, marginal costs are low and fixed costs increased, and the product is perishable [23,27]. Porter further elaborates that non-price factors such as product attributes, branding, support services, and delivery time impact the intensity of competition because they tend to improve customer value and command higher price margins [23,27].

The industry forces can either be strong or weak with regard to the level of threat to the industry's competition and profitability potential. A weak competitive force may serve as an opportunity, while a strong force may threaten the industry. For instance, Porter posits that low industry profits are associated with the strong bargaining power of suppliers and buyers, intense rivalry, low entry barriers, and cheap but high-performing substitute products. On the other hand, he points out that high industry profits are associated with weak buyer and supplier power, high entry barriers, little or no rivalry, and few opportunities for substitutes [27].

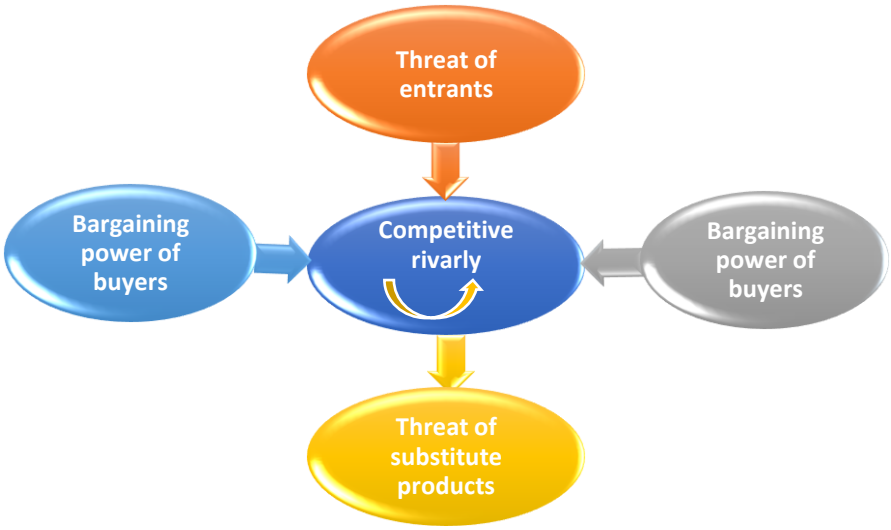

Fig. 1. Porter's five forces

3. MATERIALS AND METHODS

For the study, an industry is defined as "*an arena where several producers of seaweeds compete*". Industry producers, in this case, are the seaweed farmers from Zanzibar. This study was conducted on Zanzibar island. Zanzibar is located off the Indian Ocean coast in East Africa. It is a part of the United Republic of Tanzania (URT), about 30 km from the mainland. The island has two major sub-islands; Unguja and Pemba.

A case study approach was adopted to develop a deeper understanding of the industry. Twenty-four villages from North, West, Central and South Unguja were surveyed. Similarly, twenty-five seaweed farming villages in Pemba from Micheweni, Wete and Mkoani regions were investigated. The villages were selected through a multistage and quota sampling based on the information furnished by the Department of Fisheries development - seaweed section, Ministry of Blue Economy and Fisheries, Zanzibar. Other participants in the study included three seaweed exporters and nine government representatives from institutions linked to the Zanzibar seaweed industry. Exporters were chosen based on experience, i.e. five years of operations and above. Government officials were selected through purposive and convenience sampling.

A triangulation approach was adopted in the study, where multiple data sources were used. Industry entry criteria, buyers' and suppliers' data for the farmers, were collected through open-ended questions in group interviews. The same details were collected through semi-structured interviews with exporters. Data regarding the number of existing producers and varieties produced were collected through a review of past literature and the Department of Fisheries development - seaweed section, Ministry of Blue Economy and Fisheries, Zanzibar. Data for available substitute products was obtained through discussions with exporters and a review of past literature. Three additional factors were added to the study, i.e. role of the Revolutionary Government of Zanzibar, the industry's production system and innovation activities. Descriptive statistics and thematic analysis were applied to analyse the data sources.

The driving factors of Zanzibar's seaweed industry profitability potential were identified through thematic analysis of converged data sources. Their parameters were adapted from Porter's 2008 work. The threat level for each driving factor was adapted from Dobbs's (2014) guidelines. To determine the threat level on Zanzibar's industry profitability potential, weights were assigned for each driving factor; 5-high, 3-neutral and 1-low and the study's participants were asked to rate them accordingly. Only those factors considered as a high threat to the industry's profitability potential were included in the results. Zanzibar seaweed industry's profitability potential was determined by considering the consolidation of all the five forces and their threat level.

4. RESULTS AND DISCUSSION

4.1 Applying Porter's Five Forces Framework in the Zanzibar Seaweed Industry

The study findings revealed that the Zanzibar seaweed industry is in perfect competition, where numerous farmers produce the same variety. The industry also faces; high threats of potential entrants, high bargaining power of buyers and suppliers, available low-priced and higher-performing substitutes, and intense rivalry.

4.1.1 The threat of new entrants

It was found that the threat of potential entrants originates from; low capital entry requirements, limited (or an almost absent/silent) role of government, low buyer-switching costs, lack of branding and low supply-side economies of scale. Porter [27] posits that capital requirements serve as a barrier to entry if the capital is unrecoverable and it is difficult to finance expenditures. However, he cautions that if industry returns appear attractive and are expected to remain so, and if capital markets are efficient, entrants may secure the investment from interested investors.

In the case of the ZSI, capital and entry requirements of the industry were found to be attainable. For instance, a potential entrant (farmer) requires a minimum capital of about US$ 117[1] and the ability to locate an unfarmed seashore line. Most farmers accumulate capital through bootstrapping methods, self-help groups, and spousal support. However, given the economic background of rural Zanzibar, where poverty is at 40.2% [13], even with minimal capital requirements, potential entrants may still face difficulties raising the amount required to establish their activity; thus, in that aspect, capital requirements may pose as a deterrent.

Further threats arise from the industry's lack of brand identity and product differentiation. According to Porter [27], branding and differentiation create barriers to potential entrants by forcing them to invest heavily in thwarting existing customer loyalties. Hence with a lack of industry branding and limited differentiation, price and profit margins are affected due to a high buyer propensity to seek substitutes (low switching costs). ZSI produces two species of seaweed, *Eucheuma Denticulatum* (*Spinosum*) and *Kappaphycus Alvarezii* (*Cottonii*). Both species possess similar utilisation capacity, i.e. used to extract *carrageenan,* a binding agent used in meat, dairy, cosmetics, pharmaceuticals and industries. However, *Cottonii* fetches a better price than *Spinosum* due to the quality of the hydrocolloid it produces (*kappa-carrageenan*) being superior to *Spinosum's iota carrageenan.* However, since 2012, *cottonii* has failed to grow on the island due to ecological changes, primarily raised oceanic-water temperatures and salinity due to rains (Msuya et al., 2022).

The industry is also characterised by low supply-side scale economies mainly experienced in Unguja. According to Porter [27], producing on large scales reduces average unit costs of production. As a result, supply-side economies of scale deter potential entrants by forcing them to enter as mass producers or accept cost disadvantages. In the case of Zanzibar's seaweed industry, production is very low compared to competitors in Asia. The low-scale economies in the case of Zanzibar are attributed to the island's factor conditions.

Potential entrants may also be deterred by existing first-mover advantages/incumbency cost advantages. According to Porter [23], cost advantages may arise from; favourable access to raw materials, favourable locations, government subsidies, learning/experiential curves and proprietary product technology (p.11). Porter expounds that the cost advantages enjoyed by incumbents may not be replicable by potential entrants of whichever size or attained economies of scale. In the case of the ZSI, farmers enjoy first-mover advantages from access to farming locations, raw materials, learning curve experiences, and government/non-governmental assistance, e.g. inputs. Hence, the farmers' first-mover advantages can be considered a deterrent to entry.

4.1.2 The threat of high bargaining power of buyers

The threat of the high bargaining power of buyers in ZSI stems from; undifferentiated industry output, low switching costs, few large-volume buyers and price sensitivity. Seaweed produced in Zanzibar is mainly an export crop (to about 99%) used as industrial raw material. Only about one per cent is consumed domestically for value addition (Msuya et al., 2022). Thus, buyer power for the industry comes from the few existing exporters (eight) against many seaweed

[1] *Estimations from study survey results*

Table 1. Sources of threat to the industry's profitability potential and competitive rivalry

S/N	Porter's forces	Driving factors
1	The threat of new entrants	• Low buyer switching costs • Low capital entry requirements • Limited government intervention in the industry • Lack of branding • Low supply-side economies of scale
2	Bargaining powers of buyers	• Few and concentrated buyers • Seasonal buyers • High buyer information • Low switching costs
3	The threat of substitute products	• Low switching costs • High buyer information • Low-priced substitutes • Available high-performing substitutes
4	Bargaining power of suppliers	• The seaweed industry is not considered an important customer • Suppliers' inputs are crucial to the industry's production process
5	Rivalry among existing competitors	• Numerous and similar competitors • Lack of branding • Lack of product differentiation

Source: Primary data

suppliers (25,000). The farmer's primary buyers are collection centres of seaweed exporters found in nearly every seaweed farming village. The collection centres buy on set quotas as allocated by the exporters determined by existing demand conditions at the global level. Therefore, exporters pre-determine prices and volume to be purchased, and farmers have no negotiating leverage.

At the time of this study, it was found that the number of exporters had reduced from fifteen [28] to about eight [2] companies (Source: Seaweed section-Department of Fisheries Development, Ministry of Blue Economy and Fisheries, Zanzibar). The reduction of exporters has been explained as mainly due to the seaweed export business's highly unpredictable nature, primarily due to hostile demand conditions in the international seaweed market. At a global level, there are also exists only a few buyers of Zanzibar seaweed, i.e. Denmark, Spain, the USA, China, France, Chile, Belgium and to a small extent, the Philippines, Czech Republic and Korea Rep. The buyers are seasonal, buy in bulk and also purchase similar produce from Zanzibar's competitors in Asia, i.e. Indonesia, the Philippines and Malaysia. They also possess complete market information. The Asian producers supply about 98.8% of global red seaweeds and export them in dry and value-added forms [29,30].

Hence, left to market conditions, Zanzibar is in an unfavourable position due to its scale of production, lack of export product differentiation, higher-buyer power and proximity to buyers (Zanzibar being further compared to competitors). Moreover, the industry also faces the high-buyer (exporters) propensity to switch when individual farmers do not accept price offers at the farm gate. Since farmers offload at the same time due to storage challenges, they face competition and a potential reduction in profitability should buyers decide to drop buying prices further. Further, even if farmers are to find alternative buyers in Zanzibar, the nature of the product act as a constraint. Red seaweeds obtain their commercial value through their utilisation properties. They are mainly used as industrial raw materials. With the lack of seaweed processing industries in the URT, the industry's potential to expand its profits is constrained. No processing industries have been established in Zanzibar yet, even though efforts were made to collaborate with UNIDO and RGoZ

[2] *The companies identified [2] by this survey are Zanea Seaweed Co. ltd, C-Weed Corporation Co ltd, Zanque Aquafarm, SM Rashid Co. ltd, Maabadi International Exporter Co ltd, Selt-Marine Co. ltd, Ledo Co ltd, and Hamad Enterprises. Of these, only Zanea Seaweed co ltd and C-Weed corporation co ltd are the dominant and most frequent buyers on the island of Unguja and Pemba, respectively*

[28]. However, to date, such efforts have not materialised.

However, there exists a different set of buyers (domestic) for the farmers, i.e. small-scale seaweed processing groups, passing tourists and, to some extent, individual buyers from mainland Tanzania; however, they are seasonal and purchase in small volumes. This challenge is intensified by the lack of established domestic demand in both Zanzibar and mainland Tanzania. Domestic consumption is less than one per cent of the total industry production.

4.1.3 The threat of substitute products

The study established that substitute products exist at domestic and international levels. Red seaweeds have various nutritional, medical and industrial benefits. Nutritional-wise, they can be used as human food, providing both micro and macronutrients (Zinc, Sodium, Phosphorous, Potassium etc.), protein, vitamins and polyunsaturated fatty acids. *Carrageenan*, its principal extract, is used as a bio-fertiliser/bio-stimulant, a binding agent in the dairy, meat, pharmaceuticals and cosmetics industries [31,32,29,30]. Recent studies, such as those of Ismail, Alotaiibu and El-Sheekh (2020), have established therapeutic benefits related to red seaweeds. The authors also recommend that red seaweeds can be sources of natural ingredients that contribute to a broad range of bioactivities, such as anti-inflammatory agents, cancer therapy, and acetylcholinesterase inhibitory.

Hence, the industry faces threats from products/foods that offer similar utilisations as outlined above. However, since domestic consumption is almost non-existent, the threat of substitutes is observed in the global market. At an international level, Zanzibar's *spinosum* seaweed competes mainly with *cottonii* species that have failed to grow locally but are produced in abundance in Asia. Similarly, seaweeds from Zanzibar compete with other species in utilisation, e.g., *Nori/Porphyra* and *Kelp* in human foods and *Sargassum* in bio-fertilisers [29,30].

They include; *Chondrus crispus*, which produces *kappa* and *lambda carrageenan*; *Gigartina skottsbergii*, which makes mainly *kappa* and, to some extent, *lambda carrageenan*; and; *Sarcothalia crispate*, which makes a mixture of *lambda* and *kappa-carrageenan* [31]. According to Porter, the threat of substitutes is high when price-performing substitutes (cheap) and low switching costs exist for buyers. In this case, it can be concluded that both conditions apply in Zanzibar's seaweed industry context.

4.1.4 The threat of high bargaining power of suppliers

Porter [23] explains that suppliers are considered a threat when they are few and concentrated since they can raise prices or reduce quality. Additionally, they may pose a threat when the industry supplied to is considered an unimportant customer of the supplier's business or offers supplies thought an essential input to the customer's business. Other factors may include supplier groups, built-up switching costs such as differentiation in inputs (quality) and the absence of contending products (p.27).

In the case of the ZSI, inputs are obtained from local shops, RGoZ through its ministry of Blue Economy and Fisheries, some exporters and other non-governmental institutions. Local input suppliers are many and widely available in rural and urban areas, but supplies (tieties, ropes) differ in quality and price. Prices also vary widely between local shops and those located in Zanzibar-urban. However, the seaweed industry is considered an unimportant customer to suppliers' business lines as inputs purchased by the industry have multiple competing uses. In addition, the suppliers' inputs are regarded as the most crucial resources for the industry's production process. Hence, suppliers of inputs to the industry are considered a threat.

4.1.5 The threat of intense competitive rivalry

There is intense rivalry in Zanzibar's seaweed industry due to numerous producers offering undifferentiated and unbranded products. At the time of this study, it was found that approximately 25,000 seaweed farmers on the island produced only two varieties of seaweeds, i.e. *spinosum* and, to some extent, *cottonii*. Value-addition activities are also scant. Thus, due to a lack of differentiation and industry branding, farmers face low buyer-switching costs, which predisposes them to low price margins.

4.2 Additional Factors Affecting Zanzibar's Seaweed industry's Profitability Potential

4.2.1 The role of the Revolutionary Government of Zanzibar

Porter [23] posits that government can limit or even foreclose entry to the industry by imposing controls such as limited access to raw materials

and licensing requirements. Governments can also aid industry trade and protect producers or consumers against exploitation. Considering that 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. Unfortunately, Zanzibar's seaweed business is still an individual affair despite its existence for more than thirty-three years.

4.2.2 The industry's production systems

Cultivation of Seaweed in Zanzibar is implemented using a peg-line method (also known as the off-bottom method), where suspended lines derived from wooden stakes are driven onto the seafloor and are used to plant the crop [28]. All surveyed villages adopted the same planting technique but with minimal variations. However, off-bottom farming exposes seaweed plants to environmental attacks and destruction by other aquaculture activities, e.g. fishing boats. The result is epiphytes, diseases and high die-offs, reducing the industry's output. Farmers specially mentioned these challenges in Unguja (n= 15/24 villages Equiv. 62%) than in Pemba (n=10/25 villages Equiv. 40%), implying that farmers in Unguja need immediate environmental intervention methods from experts.

Among the solutions to counteract rapidly rising environmental challenges in Zanzibar was the proposed shift from off-bottom to deep-water farming/tubular-nets technology (Brugere et al., 2021). Several pilot experiments on tubular-nets technology have been conducted on the island, and outcomes revealed that the technique was resilient to the environment's adverse environmental changes [33]. Yahya, Mmochi and Jiddawi, 2020 found that both species' growth increased; however, Eucheuma bi-mass development was relatively higher on average than fish in deep waters. However, tubular-net technology requires swimming skills and the use of specialised boats. However, considering that the Zanzibar seaweed industry's producers are predominantly women and the local culture, the application of this technology is constrained [34].

Interestingly, when asked if they would be willing to use the new farming technology, most women farmers were excited and responded positively; however, they requested training and financial assistance, especially to acquire farming boats and other necessary inputs.

4.2.3 industry's innovation activities

Innovation activities in the ZSI are scant (Msuya et al., 2022). This study found no innovation activities in the villages surveyed except for ongoing small-scale value-addition (n=5/49 villages Equiv. to 10.2%) practised by some small farmers groups. Similarly, in their study, Songwe et al., 2016 also found that about seventy per cent of seaweed farmers in Zanzibar did not apply value-addition techniques. When asked why there is no innovation in the industry, most farmers casually answered, " *tutamuuzia nani*? …*mwani hauna thamani,unadharaulika*", translated to "*where/to whom can we sell?.....seaweed has no value; it is looked down upon*." However, some factors that impede innovation and upscaling of value-addition were identified, including; are lack of seed capital, limited demand, lack of facilities to carry innovation/value-addition, and limited knowledge and training in descending order.

5. CONCLUSION

Therefore, based on the study findings, it is established that Porter's framework can be used to explore the profitability potential of the aquaculture industry in developing countries. However, additional factors crucial to the industry were also considered to have a thorough understanding, including; production systems and level of innovation. The five forces analysis revealed that Zanzibar's seaweed industry has low profitability potential. The industry is in perfect competition market condition, with numerous producers of homogenous seaweed products. Further, it has no entry barriers and faces high buyer and supplier power.

The industry also faces low switching costs and cheap, high-performing substitutes. The role of the Revolutionary Government of Zanzibar in aiding the industry's activities was found to be limited and almost non-existent. The government's activities in the industry were limited and almost non-existent. Similarly, the industry's production methods were found to be still traditional. Innovative activities were found to be almost non-existent in the industry. Overall, it can be commented that the industry may continue to experience a further drop in profits *ceteris paribus.* Due to the nature of the

problems identified in this study being unique, Porter's generic strategies were found unsuitable.

In terms of opportunities, the industry remains a viable economic alternative for the rural coastal inhabitants due to low capital entry requirements and short production cycles. Additionally, since the domestic market is almost untapped, the potential for increased income and improved health and nutrition should be explored and pursued. Msafiri [9] highlights a growing demand for seaweeds at the global level due to the increased demand for cosmetics products; hence the seaweed industry in Zanzibar can strategically position itself to tap into this growing trend. Similarly, the ZSI is also a source of economic gender empowerment for rural coastal women.

6. RECOMMENDATIONS

Although several studies from the URT recommend upscaling production to remedy the challenge of low returns in ZSI, the findings of this study contradict their recommendations. This is because even though production challenges exist due to ecological changes, upscaling production would not guarantee demand should conditions remain the same. Hence, this study recommends that the industry's customer base be diversified to expand buyer options and minimise risks associated with the oligopolistic market conditions at the global level. This can be achieved by creating a guiding industry business strategy to guide its activities. Clear industry vision, short and long-term objectives should be set in place. Similarly, an industry marketing plan should be developed to identify potential target markets and how they will be reached and served.

The Revolutionary Government of Zanzibar should step in to give the necessary support, especially by creating necessary supportive policies. Further, diversifying ZSI's export products by establishing *carrageenan* extraction industries is crucial. Porter also stresses that only those businesses with home-based competitors can compete effectively in international markets. Therefore, establishing domestic and regional demand is critical for the industry's performance improvement and sustainability. This can be achieved by strategically positioning the seaweed industry in the domestic food industry (vegetable and fruits) and other industries that can utilise *carrageenan* as raw material. Lastly, further research on tubular net technology and other coping strategies against existing production challenges should be implemented, and findings incorporated into the industry. The industry scientists and the Revolutionary Government of Zanzibar should cooperate to ensure the deep-water farming technology implementation.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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