The impact of seaweed farming on the socioeconomic status of coastal communities in Zanzibar, Tanzania

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The economic importance of seaweed farming in Tanzania began in the 1930s when seaweed was harvested from the wild and exported to European and U.S. markets. By the 1950s some 4,000 t of dry seaweed were exported mainly to France, the U.S. and Denmark (Mshigeni 1973). This trade, however, collapsed during the late 1970s when the wild stocks were depleted. It was then that Tanzania started looking at possibilities of farming seaweed. The first experiments on farming seaweed were conducted during the mid-1980s and later. In 1989, commercial cultivation of *Kappaphycus alvarezii* (commercially known as cottonii, Figure 1a) and *Eucheuma denticulatum* (commercially known as spinosum, Figure 1b) started. The two species were imported from the Philippines when the local variety of *Eucheuma* could not survive under cultivation. The local variety can still be obtained in some areas in the country. The commercial cultivation started on the Zanzibar Islands in 1989 and then spread to mainland Tanzania around 1994. The first commercial farms were positioned in two villages, Paje and Jambiani, on the East Coast of Zanzibar (Zanzibar is located between latitudes 5°40' and 6°30' South and longitude 39° East). Seaweed farming is now an important industry contributing significantly to the economy of the Zanzibar Islands. Its contribution on the mainland economy is still minimal, thus there is potential to increase production. The industry employs about 15,000-20,000 farmers, most of whom are women. The current production is about 11,000 t of dry seaweed annually. The seaweed is exported to the U.S., France, Denmark, Spain, China and Chile.

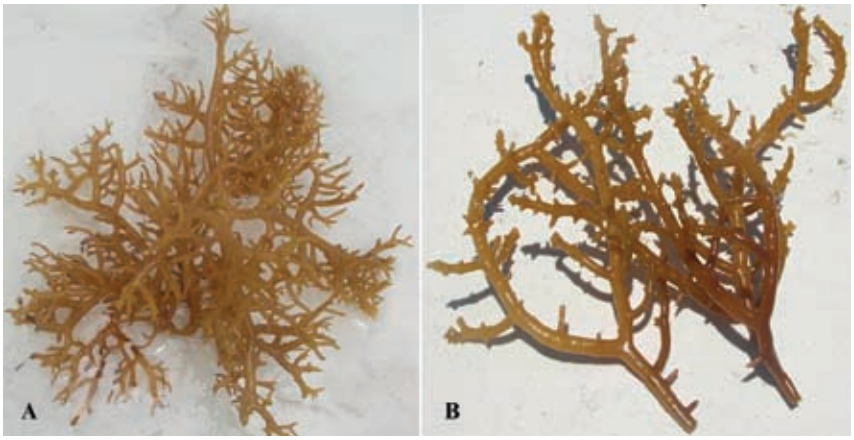

Fig. 1. The two seaweed species farmed in Zanzibar. Cottonii (a) and Spinosum (b). (Photo by Flower E. Msuya)

Seaweed farming contributes greatly to the economy of the Zanzibar Islands of Tanzania. There are three main industries that bring most of the foreign money in Zanzibar. In order of significance, they are tourism, seaweed farming and the clove trade. Apart from being the second most important foreign money earner, seaweed farming contributes above 90 percent of Zanzibar's marine export products.

Farming Methods

The method of farming seaweed in Tanzania is the peg and line or off-bottom method carried out in shallow intertidal areas. In this method, nylon ropes with seaweed are tied between two wooden pegs (Figure 2). The pegs are from mangroves or land-based plants. The seaweed branches, usually about 100 g, are tied to the lines and allowed to grow for six weeks before they are harvested. When harvesting, farmers remove the lines and the seaweed and then tie-in new seaweed branches. Recently, however, other methods have been developed. These include the deep-water floating line technique (Msuya 2006a) where the seaweeds are planted in water of 2-5 m, depending on the tidal range, and the cast method where the seaweeds are bound to rocks using rubber bands and allowed to attach and grow. The latter method is still in the experimental stage.

Benefits of Seaweed Farming

Since its start, seaweed farming has become a very important economic activity of the costal people, enabling them to purchase essential needs for their daily lives. The income from seaweed farming has empowered farmers to improve their standard of living by paying for school needs for their children, including fees and uniforms; buy household items, such as furniture; improve their houses and even build new ones; as well as get food for the families (Pettersson-Löfquist 1995, Msuya 2006b). This has given the women recognition and power within the family and the society by joining the

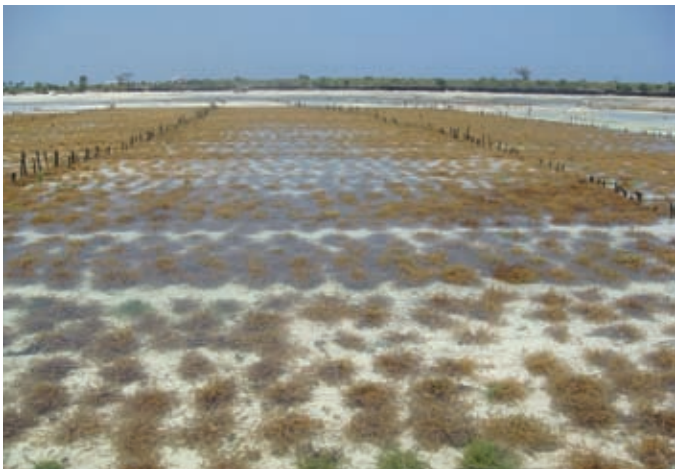

Fig. 2. The off-bottom method of farming seaweed, Pemba, Zanzibar. (Photo by Flower E. Msuya)

men in becoming bread winners. While the husbands were sceptical of the idea of their wives farming seaweed, they became more supportive when they saw the results of their wives efforts. Although most men do not farm seaweed, they help their wives in such activities as harvesting when there are large amounts of seaweed to be harvested, carrying wet seaweed from the farms to the drying places and carrying dry seaweed to the points of sale. Children help in such activities as tying branches to lines at home or harvesting during weekends and school holidays. Thus, seaweed farming is more of a family activity than the work of an individual. This gives the women more courage to continue with the seaweed farming business.

Recent Changes in World Seaweed Market and Prices

The world market currently prefers cottonii over spinosum. This preference is based on the fact that when exported, seaweeds are processed to extract carrageenan, which is used as an emulsifier, stabilizer and gelling substance in the food, pharmaceutical and cosmetics industries. The gel extracted from cottonii, kappa carrageenan, is stronger than that extracted from spinosum, iota carrageenan. As a result, the price of cottonii in Tanzania is 300-500 Tanzanian shillings (Tsh., approximately US$0.2-0.3) while that of spinosum is 200 Tsh. (approximately US$0.1). Coupled with the seaweed prices is the problem of failure of cottonii to grow in areas where it used to because of changes in environmental conditions including rise in seawater temperatures, epiphytism and fouling. Such events have been reported in other countries as well; e.g., the Philippines and Brazil (Hurtado *et al*. 2006, Largo *et al*. 1995). While this problem is not unique to Tanzania, it has a frustrating impact on the farmers and has negatively affected the Tanzanian seaweed industry.

Results of Changes

In spite of the failure of the higher priced species cottonii to grow, some farmers have kept trying to farm it with little success. Other farmers, without much enthusiasm, have started to farm the lower paying spinosum, while still others have stopped farming, especially men who have more alternatives for employment than women. Men can go fishing or work in construction boosted by development of tourism in Tanzania, but these jobs are usually not for women in Zanzibar. The men explain that seaweed farming is women's work and that men need to get cash immediately when they are done with the work; for example, after fishing they sell the fish and get cash. Men also feel that even the work done by their wives or female relatives is not equal to the money that the women are paid when selling the seaweed, and they, therefore, pity them and express their bad feelings about it. This attitude is most common in Zanzibar and less so in Pemba Island, the sister island of Zanzibar. In Pemba, many men still farm seaweed. This is most probably because of lack of alternatives on that island compared with Zanzibar Island, where the more developed tourism industry provides increased alternatives to the people. There is also the aspect of Pemba people having been described as more hard-working than those in Zanzibar.

To try to ease the hardship on the farmers, different stakeholders have come in to help the farmers with alternatives to the seaweed farming industry, in general. One such alternative is innovation of the seaweed farming activity by adding value to the seaweed through production of value-added products. The idea of adding value to Tanzanian seaweed goes back to 1983. During 1983/84, Prof. Keto Mshigeni and Dr. Flower Msuya, who was then a student of Mshigeni, used extracts from the seaweed *Gracilaria* as a fertilizer for bean plants. Their initial trials paved the way for further examination of the alternative properties and uses of seaweeds by the same scientists, including the Zero Emissions Research and Initiatives (ZERI), coordinated by Prof. Mshigeni and the Seaweed Cluster Initiative (ZaSCI), coordinated by Dr. Msuya. Whereas ZERI did not work directly with seaweed farmers in Tanzania, ZaSCI has involved seaweed farmers from the beginning and the farmers are the main actors in the initiative. Other efforts that are yet to reach the communities are extractions of the gel carrageenan by universities and research institutions in Tanzania, such as the University of Dar es Salaam, Sokoine University of Agriculture and the Tanzania Industrial Research Development Organization, mostly for medical experiments.

Value Addition as an Alternative to the Tanzanian Seaweed Industry

Tanzania has been farming seaweed and exporting it in bulk since the start of the industry in 1989. Farmers have depended solely on the price paid by the exporting companies for a kilo of dry seaweed. The farming process is based on agreements that involve the farmers being given farming inputs (mainly ropes) by the seaweed exporting companies and farmers are required to sell the seaweed to the provider of inputs. This way, farmers have no negotiating power over seaweed prices. This had been the only way of gaining income from seaweed farming until 2008 when the first seaweed value-added product was produced under the ZaSCI

Fig. 3. Wet seaweed, dry seaweed, and seaweed powder. (Photo by Flower E. Msuya)

initiative. Working under the Innovation Systems and Cluster Programme (ISCP-Tz), seaweed value-added products are produced with the aim of adding value to the low-priced spinosum.

Products that have been produced so far are seaweed soaps (with or without spices), seaweed powder, massage oil, body cream, cakes, cookies, jam, puddings and salads. Of these products soaps, body creams and powder are marketed commercially. The products were produced starting in 2008. Table 1 summarizes the types of the value-added products and the years that they were produced. Before the start of ZaSCI there were no seaweed value-added products produced by seaweed farmers in Tanzania but by 2009 there were 15 such products.

Sales of Seaweed Powder as a New Product

One of the most remarkable results of adding value to seaweed is the production and sale of seaweed powder. Under ZaSCI, a group of women in Kidoti, northern Zanzibar, is now selling seaweed powder to many users in Tanzania. One kg of seaweed powder is sold at 10,000 Tsh. (~US$6.7). When this is compared with the price of the low priced seaweed, spinosum, which is used to produce the powder, this is a very high increase in value.

The powder is produced by using a diesel engine powered machine acquired through ZaSCI. Even if the costs of grinding the seaweed are included, including the grinder, the diesel fuel, the engine, the time spent and some loss of the seaweed during the grinding process, there will still be a very high percentage of increase in the value of the seaweed. This is a very pronounced result of innovation in the seaweed industry, from a seaweed farm, to dry seaweed, to seaweed powder (Figure 3). The group is the only source of seaweed powder in the country. This is a boost to the income of

Table 1. Seaweed products produced by seaweed farmers in Zanzibar, Tanzania.

Product name Dry seaweed	Type	Year of production Up to 2006
Seaweed bar soap (1 type)	Seaweed only	2008
Seaweed desserts	Cold process products, Maha Blanca, Gulaman, Halua ya mwani)	2008
Seaweed bar soap (3 types)	Seaweed with cinnamon, lemon grass and lime (citrus)	2009
Seaweed body creams (3 types)	Seaweed only, seaweed with lemon grass, seaweed with cinnamon	2009
Seaweed puddings (2 types)	Seaweed with fruit chops	2009
Seaweed gels (2 types)	Seaweed with fruit concentrate	2009

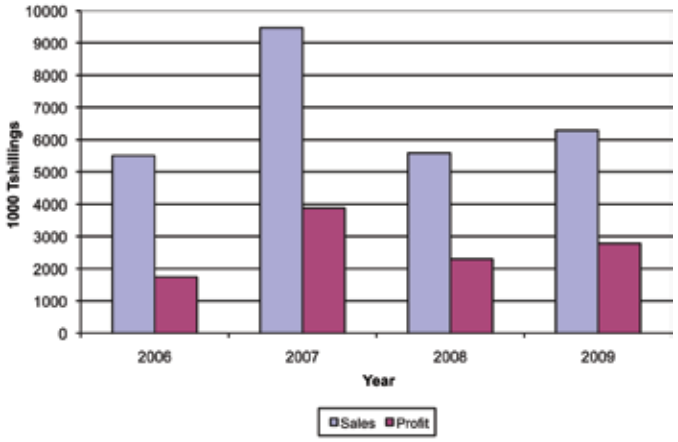

Fig. 4. Annual sales and profit for the Kidoti Firm.

the seaweed farmers and an encouragement that may keep them in the industry and probably bring men back to the seaweed industry in Zanzibar.

Increased Annual Profit of Some Farmers

The involvement of seaweed farmers in innovation and clustering under ZaSCI has opened opportunities to the farmers that include markets, contacts and so on. In so doing, some farmers have increased their annual sales and profits in seaweed and seaweed related products. The Kidoti womens group, for example, significantly increased its sales and net profit from its products from TZs1.5 million in 2006 when it joined the cluster initiative to TZs2.7 million in 2009 (Figure 4). The profit was realized after deducting the production costs, including the cost of renting work space. After joining the cluster initiative, the farmers in the group attended training, meetings, trade fairs and exhibitions that have opened their minds to the importance of contacts and market acquisition. The number of markets and market outlets, as well as the products that needed to be sold, have increased as have annual sales and profits.

A Lady Seaweed Farmer and Seller

One seaweed farmer in Bweleo village in the west coast of Zanzibar has become a seller of seaweed in Zanzibar. After joining the seaweed cluster initiative and being exposed to trading and marketing ideas, value addition and such other issues, she started to buy seaweed from the village and sell it to buyers in Zanzibar town. Rather than waiting to only farm seaweed and sell it at Tsh.200/kg, she has been buying seaweed at that price and selling at Tsh.240/kg. Her annual sales are 40-50 t seaweed worth about US$6,500. She earns from US$150-170 monthly.

The lady, Amina Khamis, is using the income from seaweed sales to cover her children's school fees, uniforms and books. She has improved her house by changing the worn out doors and windows and she has even bigger plans for her future and that of her family. Being a member of ZaSCI, she was able to participate in a business competition called Business Development Gateway where she received US$2,500 to consolidate her business. She is a unique case of a seaweed farmer and entrepreneur in Tanzania, thanks to training and advice from ZaSCI.

Institutional Collaboration in Value Addition

Other institutions are joining forces with ZaSCI in adding value to seaweed in Tanzania. Chalmers School of Entrepreneurship in Sweden, in collaboration with ZaSCI is constructing a Seaweed Center (www.seaweedcenter.com) in Zanzibar. The Center is equipped with facilities to dry seaweed, especially during the rainy season, and produce value-added products. When completed, the Center will be equipped with a seaweed soap factory kitchen to cook seaweed food to visitors and a shop to sell the seaweed value-added products as well as traditional products.

The United Nations Industrial Development Organization (UNIDO) has recently started working with ZaSCI and the Ministry of Tourism, Trade and Investment in Zanzibar to train in seaweed value addition and production of value-added processes. Three training sessions have been conducted and a number of value-added products have been produced by seaweed farmers in a number of villages.

Concluding Remarks

It is obvious that seaweed farming has made a major contribution to improving the living standards of coastal Zanzibar citizens. It has changed the tradition of coastal women who spent their days indoors to those who go out to farm seaweed, earn cash and contribute to the needs of their families. Despite this success, because of the world preference of cottonii over spinosum and the failure of the higher priced cottonii, some farmers are discouraged by the fact that most of them cannot farm the higher priced cottonii. Thus, the future of seaweed farming in Zanzibar and Tanzania will depend on innovations in the farming techniques and adding value to seaweed.

Value addition has proved to be a viable innovative move to enhance the economic returns of the farmers and their communities. Seaweed farmers have started to produce and market seaweed value-added products, as well as become traders of seaweed. There is a need to support such efforts and encourage the coastal people to engage more in innovations for the Tanzanian seaweed industry. Collaborative efforts to add value and market value-added products should be promoted.

Notes

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