Msuya F.E. 2005. Seaweed Farming in Tanzania: Farming Processes and Interactions Between Farmers and other Stakeholders (*Proceedings of the National Stakeholders Workshop on Establishment of an Innovation Systems and Clusters Programme in Tanzania, Bagamoyo, January 24-25, 2005, pp. 195-206*)

Introduction

The idea of farming seaweeds in Tanzania was developed by Prof. Mshigeni of Botany Department, University of Dar es Salaam who did substantial research on possibilities of farming seaweeds in the 1970's (Mshigeni 1973, 1976). In mid 1980's he set up experimental plots in Zanzibar, Pemba, and Tanga, and came up with good results (Mshigeni 1985). Following these efforts, commercial seaweed farming started in 1989 in Zanzibar, when private entrepreneurs established experimental farms at the East Coast in Paje and Jambiani villages. Two species of red seaweeds namely *Eucheuma denticulatum* (*E. spinosum*) and *Kappaphycus alvarezii* (*E. cottonii*) were imported from The Philippines for the commercial farming when the local varieties of the same species failed to grow. From Zanzibar, seaweed farming expanded to the mainland (Msuya 1995, 1996), and is now farmed in Tanga, Lindi, Mtwara, Bagamoyo, and Dar es Salaam (Kigamboni, Fig. 1). Seaweed farming contributes significantly to the economy of Zanzibar where it contributed 15% and 27% of Zanzibar exports in 1993 and 1994 (Msuya et al. 1996). Seaweed farming has also greatly improved the living standards of the people. Studies have shown that seaweed farmers have managed to buy clothes, household items, school uniforms and books, paying school fees. The number of children suffering from malnutrition has also decreased in those villages (Eklund and Patterson 1992, Mshigeni 1992, Msuya et al. 1994, Shechambo et al. 1996). Of the farmers, about 90% are women.



Fig. 1. Map of the coast of Tanzania showing the areas of seaweed farming.

Farming Processes and Agreements

The seaweed is bought by local companies that are branches of overseas companies. The buyers establish buying stations in the villages and hire local people to oversee the farming and to buy the seaweed. The buyers then provide the farmers with

farming material that are nylon ropes, “tie tie” (thin nylon ropes), and initial seed (cuttings). The provision of farming materials becomes a binding factor for the farmers to sell the produced seaweed to the provider of the farming materials. The buyers thus establish monopoly over the farmers.

Seaweed is farmed by stretching 4 m nylon ropes between two pegs. The lines are placed 30 – 45 cm apart. In each line, about 11 cuttings of seaweed are tied using tie tie, and the distance between the cuttings is about 20 cm. A typical seaweed “plot” or farm (Fig. 2) has about 50 ropes. Each farmer has more than one plot. In 1996, it was estimated that some farmers had up to 1,000 ropes and that a farmer gets between 9,000 and 100,000 Tanzanian shillings per month depending on the number of plots or ropes that a farmer has (Msuya 1996).

Operational Structure

The operational structure is such that the farmers sell the seaweed to local buyers who export it raw to overseas companies that process the seaweed and sell to interested countries. Therefore, seaweed is farmed in Tanzania for export only, although there are isolated occasion where some people make salads out of it. The seaweeds are processed to extract a phycocolloid called *carrageenan* that is used as a gell and emulsifier in a number of industries including pharmaceutical (e.g. making toothpaste), cosmetic, textile, and food (e.g. in ice cream, yogurt etc.). The channels of the marketing is summarised in figure 3. There are reversible interactions between the farmers, local buyers, and the government. There is little relationship between the governments and the world market.



Fig. 2. A seaweed farm in intertidal areas of Paje village, Zanzibar, Tanzania (Photo by F.E. Msuya).

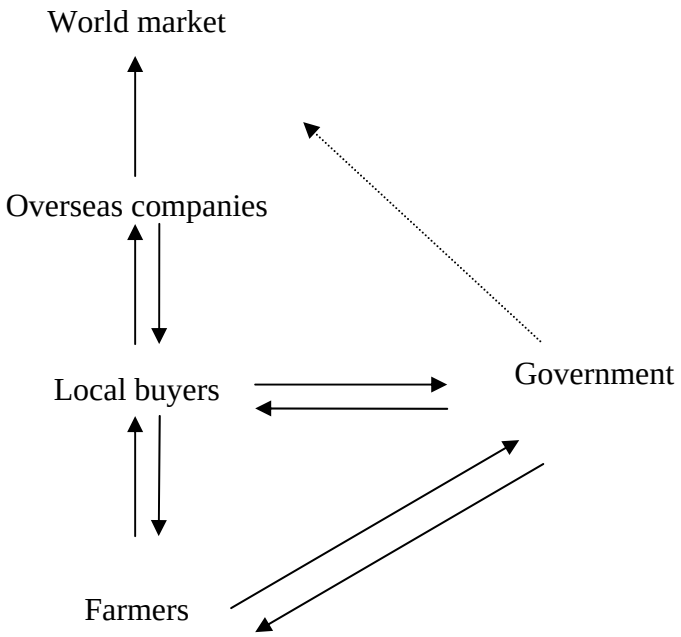


Fig. 3. Seaweed farming operational structure.

There are five main seaweed buyers who export the seaweed to mainly Denmark, USA, and France. These are Zanzibar Agro-Seaweed Co. Ltd (ZASCOL), Zanzibar East Africa (ZANEA), C-weed, and Birr (see fig. 4).

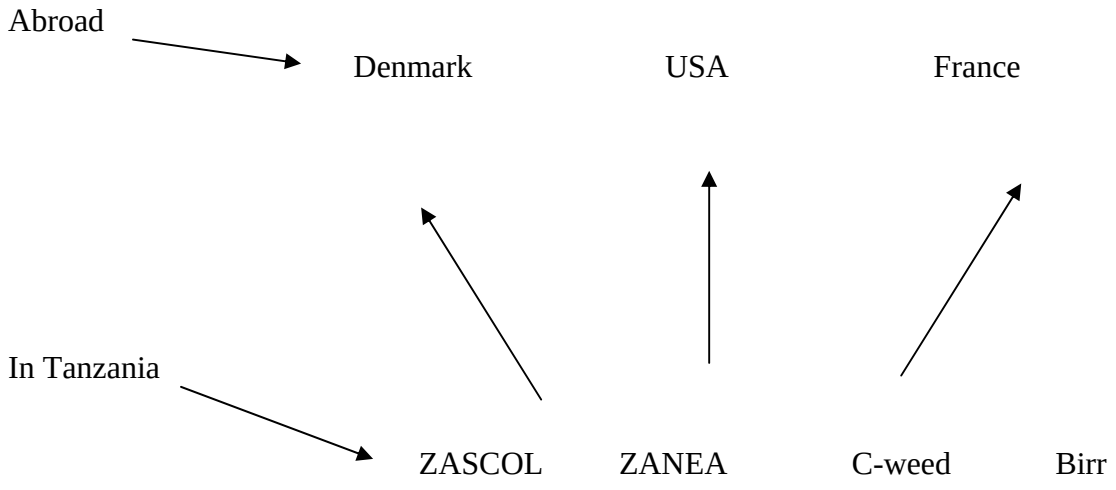


Fig. 4. Main buyers of the seaweed farmed in Tanzania.

Local Market Prices, World Trend in Seaweed Purchases, and Farmers' Reaction

The price of 1 kg of dry seaweed used to be 120 Tanzanian shillings (Tshs. – about 0.012 of a US dollar) for both *Eucheuma denticulatum* and *Kappaphycus alvarezii*. However, there is a recent world market preference of *K. alvarezii* that produces "kappa" carrageenan as its end product than *E. denticulatum* that produces "iota" carrageenan. This has changed the prices of the two species to 200 Tshs. for *K. alvarezii* and 80-100 for *E. denticulatum*. Unfortunately, *K. alvarezii* is less resistant to environmental changes i.e. is attacked by diseases & epiphytes, and grows in fewer areas than *E. denticulatum*. The difference in prices has discouraged those farmers whose intertidal areas do not favour the cultivation of *K. alvarezii*.

Possible Innovation to Improve Production – Farmers Level

1. Addition of lines within lines – As mentioned above, in a typical seaweed farm the seaweed lines are placed at intervals of about 30 to 45 cm. To increase production, farmers may add a line in between two lines to increase the density and hence harvest more seaweed (this density is not too high to affect growth).

2. Addition of cuttings between cuttings: Like the ropes, the seaweed cuttings are tied at about 20 cm intervals. Farmers may add cuttings so that the distance between two cuttings in 10 cm.

3. Formation of farmers' cooperatives: Working in groups may increase farmers' efforts by applying combined forces. It is also easier to get financial support when working in groups. Money can help in e.g. expanding the farms, using hired labour etc.

4. Improvement of the cultivation method of *K. alvarezii*: *K. alvarezii* is affected more by exposure than *E. denticulatum*. Farmers may work with other stakeholders to improve the cultivation methods for *K. alvarezii*, including moving to deeper waters, i.e. from the intertidal to subtidal and tidal areas, and using floating longline method as opposed to the off-bottom method commonly used worldwide.

Possible Innovation to Improve Production – Institutional Level

1. To reduce or get rid of the monopoly: This can be negotiated between the farmers, the buyers, and other stakeholders for possibility of the farmers buying the farming materials themselves instead of getting them free of charge from the buyers. The farmers can then sell to buyers of their choice. This, however is a sensitive issue considering that it will be hard for the farmers to sell the seaweed as they do not know the export market channels, and thus the issue needs to be carefully discussed and agreed among all stakeholders, and may need government intervention.

2. Research in market prices of processed seaweed: Since the seaweed is exported in bulky, the prices are lower than what would be expected from a processed product. To add value to the seaweed, research may be conducted to establish the market prices of processed seaweed and cost of processing versus raw seaweed market and transport costs to develop local processing industry. The current production is about 6,000 tonnes dw per year. With the current technology in machine making and the studies that have been conducted on semi-processing of seaweeds e.g. extraction of carrageenan by the University of Dar es Salaam (UDSM) and The Tanzania Industrial

Research Development Organisation (TIRDO), it is possible to establish a way to process the seaweed before exporting. To make this innovation more profitable, the possible production innovation strategies mentioned above can be applied.

3. Research to improve resistance of *K. alvarezii*: As mentioned above, the seaweed that is farmed here is imported from The Philippines. Buyers who are facing a decrease in seaweed production have so far imported five verities of *K. alvarezii* that are more resistant but that have proved to have lower growth rates than the initially imported variety. One way in which the resistance of *K. alvarezii* can be improved is to go into plant breeding/genetic engineering to produce a variety that is both more resistant and has a high growth rate.

Seaweed Die-Offs

Seaweed die-off of *K. alvarezii* is experienced in some areas mainly in Zanzibar and Tanga. Although this is a recent event, it may result in some decreases in seaweed production and the number of farmers. Farmers and other stakeholders are requesting help from relevant institutions to find out causes and possible solutions to seaweed die-offs. The Institute of Marine Sciences of the University of Dar es Salaam is working on one such request.

Concluding remarks

Seaweed farming is an activity that has, and continues to improve the living standards of the people. About 90% of the farmers are women. The coastal women have little other economic activity. There is a world market preference of one species to the other - whose duration is not known, and that is already having some effects on the farmers. Innovation strategies that include genetic engineering to select more tolerant and fast growing species, better farming methods and processing to add value will improve the actitivy for the benefit of the participating stakeholders.

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