

Citation: Msuya F.E. 2006. *The Seaweed Cluster Initiative in Zanzibar, Tanzania. In Mwamila B.L.M. and A.K. Temu, Proceedings of the 3rd Regional Conference on Innovation Systems and Innovative Clusters in Africa, Dar es Salaam, Tanzania, September 3-7, 2006. pp 246-260.*

Introduction

Since the start of seaweed farming in 1989, farmers in Tanzania have been producing the seaweed and selling to the buyers who export it to Denmark, France, USA, and Spain. What has been persisting in the seaweed industry is that seaweed production fluctuates between 4000 and 6000 MT of dry seaweed (Msuya 2005) with the highest ever of 9000 MT in 2002 (Table 1). This is (very) low production and there is potential to increase the production through the management/modification of the farming technique. The market is available for higher production because the buyers/exporters would like a production of up to 20,000 MT (Buyers, personal communication). The increase in production could result in the increase of seaweed prices within the country as the business running costs would be lowered.

Associated with the low production is the problem of the die-off of the higher priced *Kappaphycus alvarezii* (Cottonii). The species is more prone to environmental changes compared with the low priced *Eucheuma denticulatum* (Spinsum). The die-offs are experienced in some parts of the country mostly Zanzibar and Tanga. Possible causes of the die-offs have been studied recently (Mmochi et al. 2005) and thus there is need to try and combat the problem.

The produced seaweed is exported in bulk, with no use in the country. Exporting in bulk leads to low prices paid to the producers (farmers). As a result, complaints from the farmers over the seaweed prices are not uncommon.

There is also a potential to farm other seaweed species such as *Gracilaria* (and *Hypnea*) for production of a different gel **agar** as opposed to **carrageenan** produced from the current farmed species. Agar is used by mushroom growers (and food processors) in Tanzania (and abroad) and laboratory cultures in schools, universities, hospitals and so on. The two seaweed species grow naturally in Tanzania. Some scientific studies on these species have been done in the country (Kivaisi and Buriyo 2005) and the CI would like to use the available information to make trial farming of *Gracilaria* and disseminate the species to farmers.

The aim of the Seaweed Cluster Initiative (Seaweed CI or CI) is to address these problems and tap the scientific information for the benefit of the farmers and the country at large. The basis of the aim of the CI is that there is a possibility to increase seaweed production through modifying the farming technique and adding value to the produced seaweed. 1. Trying to solve the problem of cottonii die-off that would have two effects: producing more seaweed through enabling production of cottonii; and raising the income of the framers by enabling them to farm the high priced cottonii. 2. Standardisation of

farms is one way of increasing the production per unit area. Standardisation enables the use of more space within the same farming areas because not much space would be wasted as it is the case with the current farming technique. 3. Looking for ways of using the produced seaweed within the country through adding value to the seaweed. Semi-processing and full processing to make seaweed products would fetch higher prices than the bulk-unprocessed seaweed and will give the farmers a chance to use the seaweed that they produce. 4. To enable the farming of new seaweed species that would add income to the farmers.

Table 1. Annual seaweed production for years 1995 – 2005 in Zanzibar.

Year	Production (MT)										
	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05
	3626	4774	3667	4171	6607	6607	4991	9091	-	6459	6097

Progress on the activities of the CI

CI activities started in March 2006. Since that time when the activities were launched, progress has been made on the planned short-term activities, i.e. informal meetings with key actors, collection of baseline data on production/markets, conveying a workshop with key actors to create the leadership team, conveying a workshop with farmers, standardisation of farms, setting up a trial raft farm, trial making of seaweed soap and snacks, and collection of information on new seaweed species. Details of the activities conducted are shown below.

Informal meetings with key actors

Informal meetings were held with different actors in the seaweed industry as follows: the five buyers (buying companies) C-Weed, BiRR, Zanzibar Agro-Seaweed Cc. Ltd. (ZASCOL), Zanzibar East Africa Seaweed (ZANEA) Co. and Zanque Aqua Farms; Department of Fisheries and Marine Resources, Ministry of Agriculture-Extension Services, and Department of Trade; Institute of Marine Sciences; Soap making group; Soap maker; Seaweed snacks maker; Seaweed farmers; and someone involved in book

keeping. In each case, the CI was introduced and discussion was held on how the different groups can collaborate in the activities of the CI.

Creation of the leadership team (LT)

The LT was formed through the informal meetings with the main key actors in the triple helix as this was seen as the best way to form the LT. Following the election, the LT started working (preparing to work) on the activities of the CI. On 4th July 2006, a key actors' workshop was held to formalise the LT and to explain the key actors on what the activities of the CI are. The LT was then formalised in a workshop with key actors in July.

Key Actors' Workshop, 4th July 2006

A total of 13 participants were invited to participate and 12 of them attended the workshop (Fig. 1). They were from Department of Fisheries and Marine Resources Zanzibar (1), Ministry of Agriculture –Extension services Zanzibar (1), Department of Trade Zanzibar (1), SUCCESS project (1, lecture on book keeping), Soap maker – (Mushroom CI 1, lecture on soap making), C-weed Co. (1, lecture on making of snacks), BiRR Seaweed Co. (1, Seaweed buyer), Farmer (1, Tanga), Farmer (1, Uroa, Zanzibar), Farmer (1, Bweleo, Zanzibar), Institute of Marine Sciences (3).

In this workshop, the leadership team was formally launched. The leadership team from the triple helix is as follows:

1. Academia:

Dr. Flower E. Msuya (Facilitator) – Institute of Marine Sciences
Dr. Alfonse M. Dubi – Institute of Marine Sciences
Dr. Margareth S. Kyewalyanga – Institute of Marine Sciences

2. Government:

Mr. Makame S. Nassor – Department of Fisheries and Marine Resources
Ms. Asha Ameir – Ministry of Agriculture –Extension services
Mr. Juma Omar Haji – Department of Fisheries and Marine Resources

3. Business:

Mr. Bakari Mkwawa (Farmer)
Mr. Arif Mazrui (Buyer)
Ms. Amina Khamis (Farmer)
Mr. Hashim Rune (Buyer)
Ms. Maryam Hussein (Farmer)

The workshop started by a briefing on the initiation of the CI followed by four major presentations:

1. Planned activities of CI, what has been done, and what remains to be done. Details of the Seaweed CI as part of the Innovation Systems and Innovative Clusters in Africa since its start to the present, and the activities planned and done so far were presented. The lecture also showed what activities remains to be done by the CI.

2. Efforts of Zanzibar Government to help seaweed farmers.

The talk was about the involvement of the Government from the start, during the first experiments in the early 1980's. Government plays a role between farmers and buyers in aspects of prices, revenue, and land lease. Efforts of the Government to make seaweed farming a free trade were explained and stated that the process is still not as successful as thought because farmers fail to buy inputs after selling seaweed. They use the money obtained from selling seaweed for other purposes. Nevertheless, negotiation/efforts are continuing with farmers and buyers. It was reported that Government officials were (in July) visiting Philippines, Indonesia, and China to learn the success of free trade and the markets so the tactic can be applied in the country.

3. Making of seaweed soap.

This lecture was given on how to make seaweed soap using caustic soda, coconut oil, water, and seaweed. It was emphasised that to be able to make the soap, education on the making process should be given.

4. Making seaweed snacks.

The lecture explained how to make seaweed desserts by mixing water, fresh milk, corn flour, coconut milk, sugar, and seaweed. Different mixtures are used depending on what dessert is desired. The seaweed needs to be bleached to lower the smell of the seaweed for those who may not like it.

5. Book keeping

The lecture emphasised the importance of monitoring /recording the growth of the product itself, the environment around it, project economics and community development. The lecture concluded that the success of a project is evaluated depending on how much is invested and how much is gained.



Fig. 1 Key Actors' Workshop Participants, IMS, Zanzibar.

Farmers' Workshop, 2nd August 2006

The workshop was held at Kidoti village, Northern Zanzibar. Participation to the workshop was very good with 42 out of 43 invited participants attending the workshop. Some of the participants of the workshop are shown in figure 2. The participants were as follows:

Kidoti soap manufacturers “Tusife Moyo” Group (15), Village leadership (2), Bweleo farmers (5), Uroa farmers (4), Departments of Fisheries (1), Ministry of Agriculture (1), Department of trade (1), Buyers (5), Institute of Marine Sciences (4) and Others (4). Lectures were given on seaweed products for local (as well as international) use, and book keeping for monitoring seaweed (and other) projects.

Seaweed soap

One lecture was on how to make soap using seaweed as a spice. Trial making of seaweed soap was done during the workshop. The soap was made by mixing 1 kg of caustic soda with 2.5 litres of water, mixing, and then adding 7 litres of coconut oil followed by 500 g of seaweed powder. The mixture was poured in a 1 x 2 feet plastic tray and let to dry before cutting the soap to desired shapes. Colour and other spices can be added to give the colour and odour required.

Seaweed snacks

- The making of “seaweed desserts” was also presented at the workshop. The lecture explained the making of three types of desserts named in Philippine as Maha blanca, Gulaman and a third one that was named “Halua ya mwani” in Kiswahili. Three types of seaweed disserts were explained:
 1. The first dessert, Maha Blanca, is made by mixing 2 cups of corn flour, 2 cups of fresh milk, 2 cups of coconut milk, 2 cups of sugar with 0.25 kg of (bleached) seaweed. 100 g of peanut are added at the end.
 2. Gulaman is made by mixing 2 cups of sugar, 2 cups of fresh milk with 0.25 kg of seaweed. Some vanilla is added for the aroma/flavour.
 3. Halua ya mwani is made by mixing 4 cups of coconut milk and 4 cups of sugar with 0.25 kg seaweed and some rice flour. 100 g of peanut and some corn flour are added for better taste and decoration.

The three types of disserts that were previously made at home were brought to the workshop and the participants were able to taste with much interest.

Book keeping

A lecture was given on the importance of keeping records in a seaweed project. In the lecture, it was stated that the aim is to have accurate records on the progress of a project in order to plan on next steps. Four main areas were mentioned as health – how the product (planted seaweed) is growing, environment – assessing the impact to the environment, economics – whether the project will increase the economy of the target group, and if the project will lead to community development. The success of a project is measured by looking at the gains or profit versus the production costs including funds, time, and materials.



Fig. 2 Some participants of the Farmers’ Workshop at Kidoti, Zanzibar.

Increasing seaweed production and combating cottonii die-off

Deep water floating raft method of farming seaweed

The CI is working on farming seaweed in deep-water floating rafts as a way of reducing the problem of cottonii die-off. The method is also being used to see if more seaweed can be produced per farmer compared with the ordinary off-bottom method that is used in the country. Trial farming of seaweed using the deep-water floating raft method is being done at Bweleo village, Menai Bay, on the West Coast of Zanzibar (Figs. 3, 4).

The type of floating rafts being tried are made of thick nylon ropes and are more durable than those made of bamboo (or other tree poles), and thus more profitable to farmers. These rafts have been tried in Bagamoyo District near Dar es Salaam under the Sustainable Coastal Communities and Ecosystems (SUCCESS) project and proved to be more productive than the off-bottom method (data at hand). Materials needed for a 20 x 12 m raft are as shown in table 2.

Table 2. Materials for construction of a 20 x 12 m deep water floating raft for seaweed farming

Item	Material
Raft side lines	Nylon ropes – 12 mm diameter
Anchor lines	Nylon ropes – 12 mm diameter
Anchors	*Plastic bags filled with sand (50 kg fertiliser bags)
Floaters – at the four sides	4 large buoys (20 litre cooking oil containers can be used)
Floaters at the seaweed lines	Plastic bottles (at least two 1.5 l bottles)
Planting	Rope for tying seaweed seed (4 mm diameter)
“	Tie tie

***In areas where the sediment contains a high percentage of clay, stones may be used instead of the plastic bags to avoid frequent replacement of the anchors**

Two small (5 x 5 m) rafts were constructed and deployed at sea in April 2006. Small rafts were used to test if the rafts can be kept at sea for at least six weeks, the harvesting time of farms in ordinary off-bottom method, before putting bigger rafts. They were also aimed at testing the occurrence of conflicts between farmers and fishermen experienced in Bagamoyo. A diagrammatic representation of such a raft is shown in figure 3.

Following the success of the small 5 x 5 m rafts, two larger rafts (12 x 20 m) were constructed (Fig. 4). In both rafts, the high price *Kappaphycus* is planted; in one raft the variety *cottonii* is planted and in the other *K. striatum* (**kikarafuu**) is planted. The first signs show good growth of the seaweed than the ordinary method with higher growth rates and deeper colour on the seaweed.

Increased interest in seaweed farming

There have been positive effects on the interest in seaweed farming after the introduction of the deep-water floating rafts. One person (man) has asked to be provided with materials to make his own raft saying that he feels that his efforts will pay. Men are coming back to farm seaweed. Before introducing the method 10 men were farming seaweed, now there are 17 of them. (Caution needs to be observed so that men will not take over the activity that has been done by mostly women for years now). Kidoti soap manufacturers who are also seaweed farmers have asked to be helped to use the deep-water floating rafts method to farm *cottonii* as they farm only *spinosum*. Uroa farmers have asked to be helped to use the method to increase production of *cottonii* and to farm it for those whose areas do not favour the farming of the species.

Standardisation of farms

To place farms facing the same direction as opposed to different directions used by farmers. The activity has started with farms in one village in Pemba (Wingwi) being standardised. Standardisation of farms will increase the farming area due to omission of unnecessary spaces that are unused between farms that are not standardised and reducing the breakage of seaweed due to strong winds. It is expected that this activity will increase seaweed production. A representation of the standardised and un-standardised farms is shown in figure 5.

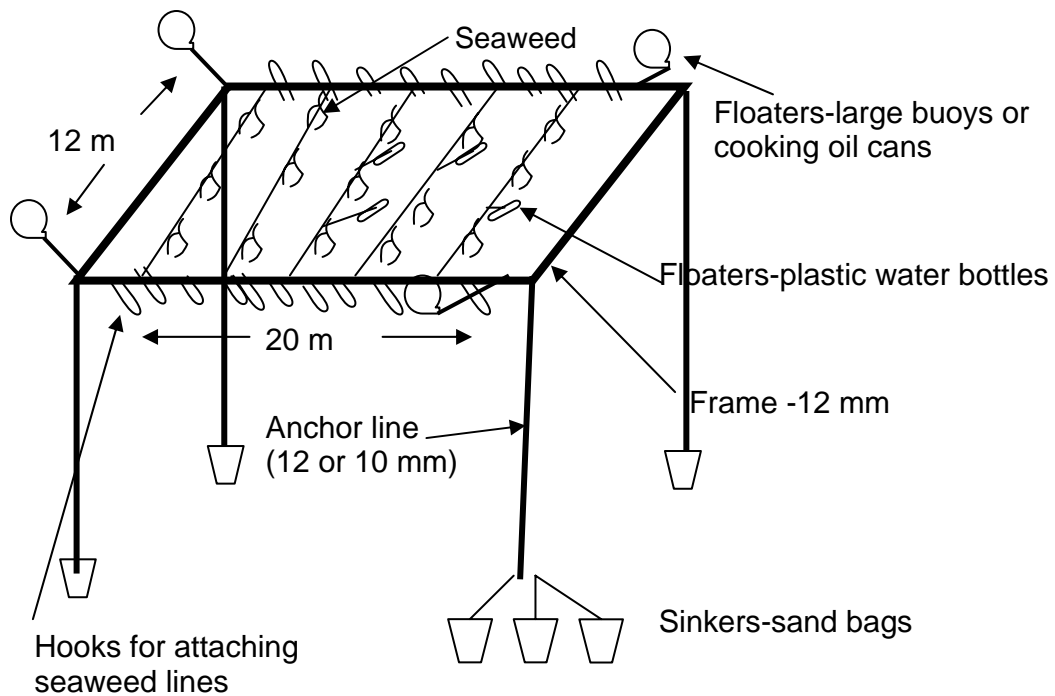


Fig. 3 A diagrammatic representation of the deep water floating raft used for seaweed farming in Zanzibar



Figure 4. Construction of the deep-water rafts and tying of seaweed

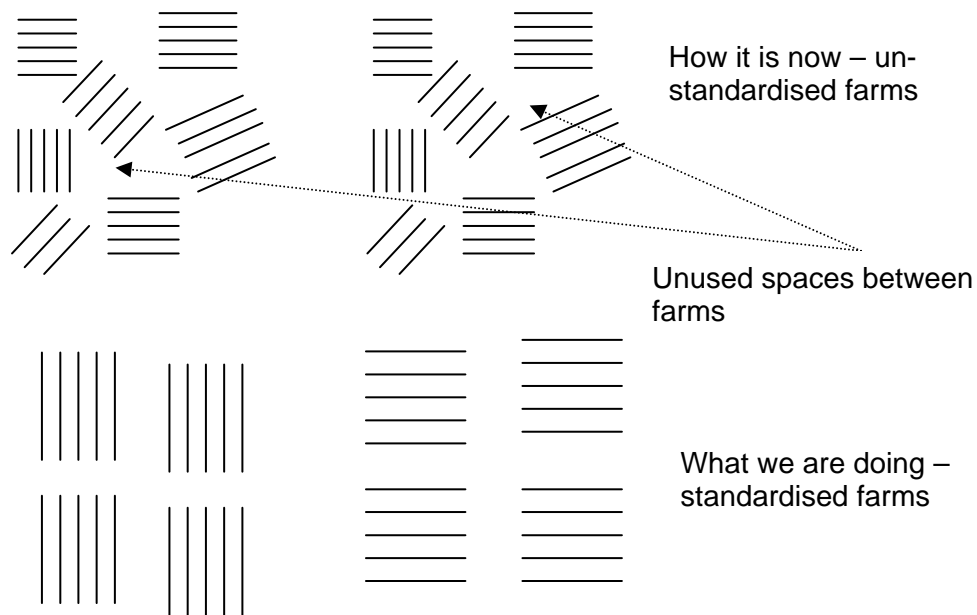


Fig. 5 A representation of the current placement of farms and what the CI is doing to standardise the farms

Baseline data

Seaweed production data was collected for the targeted villages, i.e. villages that the CI will be working with during the planned time frame. The villages are Wingwi in Pemba where trial standardisation of farms is being done, Bweleo in Unguja where the deep-water floating raft is being tried, and Kidoti in Unguja where trial making of soap and snacks has been done. Production data was obtained for Bweleo and Kidoti. The data for Wingwi is being collected. In Bweleo village, cottonii was farmed but the species has failed in recent years and farmers are now farming kikarafuu and spinosum. One aim of the CI is to try to farm cottonii in this village. It is planned that if the method is successful, it will be tried in Kidoti too where only spinosum is farmed. The seaweed production data for two target villages is shown in table 3.

Table 3. Seaweed production in targeted villages in Zanzibar

Village	Production	
	<i>Spinosum</i>	<i>Cottonii</i>
Bweleo	108	-
Kidoti	292.6	-

It was also thought good to obtain annual total seaweed production in Zanzibar as baseline data that may give an indicator of how much the production has increased after e.g. ten years of the CI activities. The production is shown in table 1 above.

Information on the new seaweed species

Apart from interviews with researchers who worked with the new species, *Gracilaria*, and showed that there are two interesting seaweed species of the Gracilariales: *G.*

salicornia which has up to 50% agar and *G. edulis* is known to have high agar content (Kivaisi and Buriyo 2005), additional information was collected which showed that *Gracilaria* that may be farmed through the Seaweed CI will be bought by the mushroom CI. And, on farming method, researchers from South Africa were contacted in order to learn about their farming method. It was found that there were experiments with a species of *Gracilaria* farmed in cages (Prof. Bolton, personal communication). The cluster continues to look for other methods. It is planned that the method to be used by the CI will be the line and peg (off-bottom) method as a starting point since this is cheaper than cages. The method is used in some parts of South Africa. The CI also plans to study agar content of *G. edulis* and use in laboratory cultures, and do market survey on agar users apart from schools.

E. Other activities

1. Possibilities of financing CI activities

A discussion was held with the officials of the Department of Fisheries and Marine Resources on the activities of the CI. It was mentioned that the activities of the CI are within the areas of the Marine and Coastal Environment Management Project (MACEMP), and that the project could assist some of the activities of the CI when requested and presented with what is required.

During the presentation on the efforts of the Zanzibar government to help the farmers in the key actors' workshop, it was explained that if a proposal is written detailing exactly what is required for the CI, MACEMP can help the proposed activities.

2. Collaboration with other institutions/projects

A meeting was held with TIRDO researchers/leadership on 3rd August 2006. After a briefing on CI activities, TIRDO explained that they have been working on possibilities of extracting the gel from the seaweeds for medicinal purposes. They also explained that their aim is to be able to make a processing plant for local use. It was agreed that CI and TIRDO might collaborate in arranging and finally making and using a small-scale processing machine for trial extraction of the gel.

3. The Sustainable Coastal Communities and Ecosystems (SUCCESS) Project has supported some activities of the deep-water floating rafts method.

4. Discussed with a representative of the Japan Social Development Fund (JSDF) on possibilities of joining forces during the long-term activity of improving seaweed quality through the construction of drying racks.

New long-term activities

After the six months of the activities of CI, new long-term activities are proposed as follows:

1. To produce (and disseminate) video programmes detailing the activities of farming in deep waters, making seaweed soap, and making seaweed snacks
2. Produce (and disseminate) workshop reports for the two workshops
3. To produce a booklet on making of seaweed products in Kiswahili and English etc

4. Hold regular meetings of the Leadership Team

Budget

The budget allocated for the activities was surpassed spending more than US \$ 8000 (Table 1).

Table 1. Expenditures for the activities conducted so far by the Seaweed CI

Activity	Who (to be contacted)	No.	Unit (US\$)	Total (US\$)
1. Low hanging fruit activities				
1.1 Appointments with main key actors	Developers	5	90	450
	Microbiology Unit	1	300	300
	Department of Fisheries	1	50	50
1.2. Data collection - seaweed production	Developers/Buyers	3	120	360
	Other business people	1	120	120
1.3. Workshop with key actors-Create LT		1	2000	2000
1.5. Workshop with farmers (1 village)		1	2500	2500
1.6. Expanding farms/standardisation of method		1	150	150
1.7. Setting up of a trial raft in 1 village		1	500	500
1.8. Collect information on the new seaweed species	Microbiology Unit	1	400	400
	Developers	1	90	90
1.9. Monitoring & evaluation		1	500	500
1.10. Travel (Facilitator 2 from Tanga)		2	200	400
1.11. Communication		1	250	250
1.12. Stationery		1	200	200
Total				8270

Immediate need

Funds are needed to continue with the planned activities of the CI.

References

- Kivaisi A. K. and Buriyo A. S. 2005. Assessment of native gar extracted from *Gracilaria cornea* and *Gracilaria salicornia* harvested along the Tanzanian coast for culturing microorganisms. Presented at the Fourth Western Indian Ocean Marine Science Association (WIOMSA) Scientific Symposium: Advances in Marine Science in Eastern Africa: Contribution of Research in Improving Human Welfare and Poverty Alleviation, 29 August - 3 September 2005, Grand Baie, Mauritius.
- Mmochi A.J., Shaghude Y.W., and Msuya F.E. 2005. Comparative Study of Seaweed Farms in Tanga, Tanzania. Report submitted to SEEGAAD Project, August 2005, 37 pp.
- Msuya F.E. 2005. Seaweed Farming in Tanzania: Farming Processes and Interactions between farmers and other stakeholders. In Mwamila B.L.M. and Temu A.K. (Eds). Proceedings of National Stakeholders Workshop on Establishment of an Innovation Systems and Clusters Programme in Tanzania, Bagamoyo, January 24-25, 2005, pp 195-206.