

ASSESSMENT OF SEAWEED FARMING IN SUSTAINING HOUSEHOLD LIVELIHOOD IN EAST COAST DISTRICT, IN ZANZIBAR, TANZANIA

Christina Shimba
Tengeru Institute of Community
Development (TICD)
TANZANIA
tinashimba@yahoo.com

Douglas A. Magombola
Tengeru Institute of Community
Development (TICD)
TANZANIA
magombolad@gmail.com

Suleiman Ibrahim
Tengeru Institute of Community
Development (TICD)
TANZANIA

ABSTRACT

The paper title is the assessment of seaweed farming in sustaining household livelihood in East coast district. The main objective of the study was to examine seaweed farming sustaining in supporting household livelihood, and the study was guided by three specific objectives which were to identify the nature of seaweed farming, to analyse the profit occurred from the seaweed farming, and to assess the contribution of seaweed farming on farmer livelihood. The researcher employed case study type of design and three methods of data collection were used which are observation, interview, and questionnaire. Whereby data were analyzed both qualitatively and quantitatively where by qualitative method based on explanations and quantitative method involve the use of calculations percentage and tables. A sample of 70 respondents were selected by employing probability and non-probability sampling from the population which are seaweed farmer, government officers, seaweed companies' staff. Findings revealed that the changes in water levels are directly linked to changes in production of seaweed. The study revealed that of respondents most farmer grow spinoseum type compare to cotton. This is because due to its tolerance of environmental changes compared with cotton type which is very sensitive to environmental changes and many sites do not have appropriate condition to support this type of seaweed and mostly died off during hot season. The seaweed farmers have secure shelter and clothes to their children due to the availability of seaweed majority of the farmer buying their children school uniform due to the contribution of seaweed farming, clean and affordable energy, and availability of productive tools of livelihood. The study recommended that, there should be national Development plans for the seaweed industry and shares this plan with other producing Countries as a means to communicate their future intentions and targets in terms of Production levels.

Keywords: Seaweed, Zanzibar; household livelihood; farmers.

INTRODUCTION

Seaweed farming has been produced into many communities based coastal areas. Seaweed has been cultured traditionally for decades and probably for centuries in several Asian nations such as China, Korea and Japan (Crawford, 2002). In Africa countries seaweed farming has played an important role in improving the life style of their people. In Tanzania seaweed was first harvested in the early 1950s, when native seaweed species were collected from intertidal zone of coral reefs (Mshingeni, 1973; Jaasund, 1976). The farming of seaweed started in Zanzibar Island at Jambiani and Paje villages (East Coast of Unguja) when private

entrepreneurs established commercial farms in Zanzibar using an imported strain of eucheuma from the Phillipines (Msuya 1996).

Seaweed has high content of carrageenan, a polysaccharide material which can be used as shampoo, medicine, ice cream, a gelling, thickening and foods, cosmetic, paints, and manufacture of soap and pharmaceutical products. Tanzania seaweed was collected for export to France and Denmark, where the carrageenan was extracted for commercial purposes.

Seaweed farming contributes significantly to the economy of Zanzibar, as it ranks the second after tourism in Zanzibar's exports (Msuya, 1996). Apart from being the second most important foreign money earnings, seaweed farming contributes above 90 percent of Zanzibar marine export product. Material found in seaweed are used as a gelling, emulsifying agent in foods, cosmetic, paints, manufacture of soap and pharmaceutical products.

Statement of the Problem

Despite the varieties of uses of seaweeds, the life of the farmers has not changed at the expected rate in terms of household livelihood outcomes in terms of income, reduced vulnerability, food insecurity. It is not well established as to what are the reasons for this. Is it due to poor agronomic practices, diseconomies of scale as a result they don't enjoy the economies of scale, unreliable market, low prices of the products. Thus this motivated the setting of this paper so as to examine the contribution of seaweed in enhancing the farmers' livelihoods.

Research methodology

The study used the case study design in order to collect information in depth through intensive investigation of the particular unit. It is the best method because of time management the research explored the assessment of seaweed farming in sustainability supporting household livelihood in East Coast Region of Zanzibar, hence a case study design will be used to represent the whole population. The study covered in East coast region of Zanzibar. This consist total of three wards, Paje, Bwejuu and Jambiani reached. The East Coast Region of Zanzibar is located between latitudes 5°40 and 6°30 South and longitude 39° east. The main economic activities in this area are small-scale fishing and subsistence agriculture. There is also a small tourist industry. This region selected because of the following reasons; it is the first place where seaweed farming was established in Zanzibar. Also, is the region which has a numbers of small seaweed farmers group (Msuya 2006).

Study Population and Sample Size

The study targeted population was seaweed farmers who live in East Coast Region of Zanzibar. The study covered people of three villages Jambiani, Paje and Bwejuu. This Region has the population of seaweed farmers about 1009; Jambiani 552, Paje 257 and Bwejuu 200. The study involved a total of 70 respondents composed by 60 seaweed farmers who acted as a main sample size of the study; 5 staffs from seaweed buying companies and the remaining 5 respondents consists government officers from Department of Marine Resources as they participate in day to day decision making.

The study applied both probability and non-probability sampling. In case of non-probability techniques, the study employed purposeful sampling for officials, NGOs and Seaweed Company members. This technique was preferable since the researcher identified only respondents who were relevant and link to the problem under investigation. The probability techniques involve the sum total of all seaweed farmers.

Method of data collection

Interviews

This is the major technique for obtaining specific in -depth qualitative and quantitative information on specific questions related to the seaweed farming, interview with seaweed farmer groups in East Coast Region, staff member from two company concerning with buying and transporting seaweed, ZANEA Seaweed Ltd and C-Seaweed Corporation Ltd and officers from Department of Marine Resource Zanzibar.

Observation

This technique of data collection also applied in collection of information as researcher shall participate fully in the day-to-day activities with the aim of studying daily operations and therefore make an appropriate analysis of each particular observation. This can create fraternity and friendship toward the researcher and seaweed farmers.

Questionnaire

The researcher was used both open and closed ended questionnaires to collect the data from respondents who were performed the seaweed farming survey, this instrument provides the respondents freedom to give their experience regarding on seaweed sustainability in supporting livelihood.

Methods of data Analysis

In fulfilling the objective of the study, the data were analyzed using explanatory method such as descriptive method using tables, charts and graph.

Results and Discussion

Respondents by sex

Seaweed farming has been practiced by many people both men and women in Zanzibar coastal areas as a way of sustaining their wellbeing. The study revealed that the total number of respondents was 70 of whom 80% were females and 20% males (Table 1). The large number of female respondents was due to the fact that females in the study areas are more engaged in seaweed activities as they have no other reliable source of income.

Table 1 shows that seaweed farmer's respondents were mostly female who 56 were (80%) match up to numbers of male who were (20%), this is because most of them were housewives so they engaged themselves in seaweed farming to increase their income.

Age profile

Age is a fundamental measure of population growth. Age is an important variable in the studies since it determines understanding of the person, the division of labor and the entry in school. The researcher saw age as an important variable in the study because it helps to predict Groups dealing with seaweed farming in the east coast region. Age also shows women Categories that are most active in seaweed farming activities. Basing on this fact, ages of the respondents were categorized into 4 groups ranging between 18 years to 50 years.

Table 1 shows that majority of respondents were found at age of 31- 40 (34%) reasons behind is they were more active and high capabilities of doing work. The results showed that, those between 31-40 years of age were the majority who dealt with seaweed activities in east coast region which involved 24 people (34%). This was followed by that aged 41- 50 which involved 18 (36%) while 41-50 and 18-20 years of Age both have 14 people (20%).

Education profile

Respondents were also asked to state their level of education. This is due to reason that level of education tends to define one's ability of solving problems and handling things including business, farming and other economic activities. The study found that 26 (37%) respondents had primary education, 32 (46%) had Secondary education while 12 (17%) had diploma. Generally, it found that most of seaweed farmers had secondary education. Table 1 shows that 46% of respondents had secondary education and there were no respondents with education above diploma. This is because those who above diploma Level of education tend to pay no attention on farming activities.

Marital status

Marital status was used in this study in order to understand which category of people Involved in seaweed farming activities. Researcher perceived this as an important variable because marital status is associated with the responsibilities as Coulter (2005) argued that many married people are faced with responsibilities of taking care of family expenses. With this regard, respondents were also asked to identify themselves as whether they were single, married or divorced. The study discovered that 37% respondents were married; 34% were divorced and only 29% respondents were single. This was supported by Komba (2010) who argued that married women can get initial capital and ideas from their husbands. This could probably suggest that married women were engaged in seaweed activities in order to get socio-economic necessities to support their families.

Table 1 Distribution of Respondents (n=70)

Variable	Category	Frequency	Percent
Sex	Male	14	20.0
	Female	56	80.0
Age group	18-20	14	20.0
	21-30	18	26.0
	31-40	24	34.0
	41-50	14	20.0
Education level	Secondary	32	46.0
	Primary	26	37.0
	Diploma	12	17.0
Marital Status	Divorced	24	34.0
	Married	26	37.0
	Single	20	29.0
Occupation	Employed	7	10.0
	Fisherman	15	21.4
	Farmer	48	68.6

Sources field findings 2019

Table shows that 37% of the respondents were married and 34% were divorced while only 29% of them were single. Therefore, it concludes that unmarried individuals were little involved in seaweed farming activities because they have little responsibilities compared to married and divorced women. Table 1 indicates that most of the respondents were married; and they were involving in seaweed farming because they got support from their husbands in terms of financial support and ideas while divorced women engaged in seaweed activities because they lack support so they struggle to make their income.

Structure of seaweed planting

Farmers use the peg and line, or off-bottom, farming method in the shallow intertidal areas. In this method, farmers tie seaweed to nylon ropes that are then stretched between two wooden pegs, which are cut from mangroves and other land-based plants. Farmers usually tie 100-gram branches to these lines using thin nylon ropes called “tie-tie.” Then they allow the seed to grow for four weeks before harvesting. When harvesting, farmers remove the lines and the seaweed before tying in new seaweed branches. Recently, other methods such as a technique using deep-water have been developed. Here, farmers tie seaweed on nylon ropes the usual way and deploy the floating device in deeper water – usually at a depth of two to five meters depending on the tidal level. The cast method is another new method which is still being experimented with, in which farmers use rubber bands to attach seaweed to rocks, where they hope the seaweed will further vine and attach (author’s personal observation). Seaweed farming is conducted as a family business, which means that daughters or sons are likely to follow their parents into the industry.



Figure 1 structure of seaweed planting

Seaweed farming procedure

There are various techniques for seaweed farming in east coast region; but the respondents used two ways in growing seaweed these include off bottom technique and Deep-water technique (floating method). The off-bottom method is used in the shallow Sub-tidal water of one foot depth at the lowest tide, while the floating line method is used In deeper water of at least two meters depth at mean sea level. The off-bottom technique is the easiest technique which involves ropes, tie-tie, sticks or stones and thus most women use this technique for seaweed farming. Among 56 (80%) of respondents said that they used off-bottom method as compared to only 14 (20%) who used deep water Technique.

Table 2 Procedure in Seaweed Farming

Procedure in seaweed production	Frequency	Percent
Deep Water	14	20.0
Off Bottom	56	80.0
Total	70	100.0

Source: research findings, (2019)

Table 2 shows that the off-bottom technique is the most common technique used by seaweed farmers in the east coast region compared to deep water technique. The reason behind of this preference was that, women were more comfortable with this technique as it's easy to practice for them compared to deep water technique which was mostly practiced by men.

Effect of global warming in seaweed

Environmental factors were also thought to be involved. Farmers mentioned that farms' water levels have been declining and water levels that were once knee height are now much lower. Here, farmers also mentioned that some water channels have dried up. Changes in water levels are directly linked to changes in production. Farmers also pointed out that the beach has changed so significantly that a new beach appears to have formed. This new formation reflects sediment shifting and transport, which is known to affect seaweed growth, the study findings indicated that 78.6% there is effect of global warming in seaweed which lead destruction of seaweed.

Price of dried seaweed

Seaweed farmers have depended exclusively on the price paid by the exporting companies for a kilo of dry seaweed. The farming process was based on agreements that involve the farmers being given some farming inputs (mainly ropes) by the seaweed exporting companies once a year and farmers are required to sell the seaweed to the provider of inputs. In this way, farmers have no negotiating power over seaweed prices.

When respondents were asked to mention the price of one kilo of dry seaweed, they unanimously responded that it was 80% said Tzs 1000 per kilo and 20% said 900 per kg. But altogether, they were not satisfied with the current price (Table 3).

Table 3 show the price of drying seaweed per 1 kg

Price of drying seaweed per 1 kg	Frequency	Percent
900Tsh	13	18.6
1000 Tsh	57	81.4
Total	70	100

Source: research findings, (2019)

Table 3 shows that 81.4 % of respondents sell the seaweed with 1000tsh and 18.6 % sell the seaweed with the price of 900 TSH per kg, this is due to the agreement with company



Figure 2, drying seaweed

Types of seaweeds cultivated by respondents

During the conduct of the study, the researcher interested to know the types of Seaweed that were mostly been cultivated by the respondents. Many farmers responded That they cultivate spinosum type of seaweed due to its tolerance of environmental changes compared with cotton type which is very sensitive to environmental changes and many sites do not have appropriate condition to support this type of seaweed and mostly died off during hot and humid season which occur from December to march. Although spinosum grows well due to its tolerance of Environmental changes but has no price value as cotton in the world market.

Table 4 Types of seaweed growing

Types of seaweed growing	Frequency	Percent
Cotton	11	15.6
Spinoseum	59	84.4
Total	70	100.0

Source: research findings, (2019)

The table 4.9 shows that 84.4 % of respondents grow spinoseum type and 15.6 % grow cotton. This is because due to its tolerance of environmental changes compared with cotton type which is very sensitive to environmental changes and many sites do not have appropriate condition to support this type of seaweed and mostly died off during hot season

Number of plots

The study revealed that 12.9% of the seaweed farmers have 1-2 plots of seaweed, 87.1% have more than 2 plots, this is due to the economic condition most farmer own more than one plot so as to sustaining their life.

Contribution of the seaweed in supporting livelihood of the smallholder farmers

The contribution of seaweed was traced from the livelihood assets maintained by the respondents; namely human, physical, social, financial and personal assets.

a) Human assets

The seaweed farmers have skills on business 29%, knowledge on business 36%, ability to do business 14% good health 21% various tools during seaweed farming and harvesting. Most seaweed farmer has knowledge of business concerning seaweed and they have low ability to do business due its lower income.

Table 5 Human assets

Indicators	Frequency	Percent
Skills on business	20	29
Knowledge business	25	36
Ability to do business	10	14
Good health	15	21
Total	70	100

Research finding 2019

b) Personal assets

The seaweed farmers have emotional wellbeing 29%, self-perception 36%, self-confidence 14% motivation 21% various tools during seaweed farming and harvesting. Most seaweed farmer has knowledge of business in seaweed.

Table 6 Personal assets

Personal	Frequency	Percent
Motivation	15	21
Self-confidence	10	14
Self-perception	25	36
Emotional well-being	20	29
Total	70	100

Research finding 2019

Social assets

The seaweed farmers have cooperation 29%, networking 7%, family support 14% and partnership and collaboration 50% of livelihood. Most seaweed farmer has knowledge of business concerning seaweed.

Table 7 Social assets

Indicators	Frequency	Percent
Cooperation	20	29
Networking, interconnectedness	5	7
Family support	10	14
Partnerships and collaboration	35	50
Total	70	100

Sources field funding 2019

Physical assets

The seaweed farmers have secure shelter and clothes to their children due to the availability of seaweed 57%, majority of the farmer buying their children school uniform due to the contribution of seaweed farming, clean and affordable energy 14%, and availability of productive tools 29% of livelihood. Most seaweed farmers secure their shelter due to the contribution of seaweed farming in east coast region.

Table 8 physical assets

Indicators	Frequency	Percent
Secure shelter	40	57
Clean and affordable energy	10	14
Availability or access of productive tools and equipment.	20	29
Total	70	100

Research finding 2019

Financial assets

The seaweed farmers have income from productive activity 36%, this due to the selling of seaweed, availability of financing 29%, access to credit 21% inflow of money from relative, gifts, government transfer 14% of livelihood. Most seaweed farmer has knowledge of business concerning seaweed.

Table 9 Financial assets

Indicators	Frequency	Percent
Income from productive activity	25	36
Availability of finance or savings	20	29
Access to credit	15	21
Regular inflow of money from relatives, gift, government transfer	10	14
Total	70	100

Research finding 2019

Challenges that Face Seaweed Cultivators in Zanzibar

In spite of many advantages that the nation and society get from seaweed cultivation but also local cultivators face a lot of problems or challenges that hinder or discourage them, the following are some challenges that the respondents were faced:

- (i) Low price of seaweed to compare with the cost that the cultivators incur in processing and cultivating seaweed, this challenge discourages them in continuing with their daily activities.
- (iii) Presence of seaweed diseases such as fungal disease and epiphytes and other marine harmful organism such as fishes that attack seaweed and destroy the growth of seaweed.
- (vi) Lack of basic farming inputs to enhance the production of seaweed.
- (vii) Lack of knowledge for the competitive price of seaweed in the world market Global climatic change The Intervention between Buying Companies and Seaweed farmers.

Five representative staff from the seaweed buying companies were interviewed to gain information on how their involvement in supporting seaweed farmers to get competitive price and their challenges face from seaweed seller. The interviewee said they had a good relation with seaweed farmers but they were not able to buy seaweed with high price compared with current price because of the low price of seaweed in the world market but they understand the difficulties of seaweed farming activities.

Also, the interviewee explained the challenges faces from the seaweed farmers and their opinion to the government. The following were some challenges:

- (i) Due to changes of the government policies and open market system for seaweed industry do not fit to private seaweed investor's environment since it creates much trouble to the seaweed investor's business operation which results of declining the production.
- (ii) Also investors experience miscellaneous problems in the port and it especially affect the entire transportation process from one point to another, where there is only one suitable ship per week.
- (iii) Lack of reasonable facilities to store at the port of Zanzibar while waiting for allocation of containers which is usually not given in case any big cargo ships are already alongside, in such cases high damages charges are requested by the port authority.
- (iv) Government treats the seaweed business in political way rather than business.

Lastly the interviewee recommended that government should help seaweed farmers by giving them seaweed inputs such as ropes and tie-tie, either to treat seaweed farming as business rather than politics.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the above conclusion and discussion of the study, the researcher comes up with the following conclusion. The study revealed that most of the people who engaged on seaweed farming activities were females rather than males and most of them were either married or divorced. This shows that males and single persons were not attracted in seaweed farming. Apart from that most of the farmers had secondary level of education which implies that this Farming does not require much skill and expertise.

The study shows that from the selected cases of seaweed farmers from east coast Region, there is “direct influence of price to the seaweed farming growth and indirect effects to the economics of Zanzibar”. Directly, the low price of seaweed provides low Income to the farmers compared with hard work they do so they become disappointed and the production also decrease. A part from that, disappointment of farmers in engaging in seaweed activities causes the growth of seaweed farming to decrease, as a result the government missing foreign currency and revenues. Indirectly, employment generated by seaweed sector would also decreases as well as the standard of living of the People of east coast region. Although the speed in provision of employment becomes too slow it is promising to people of this region. To the government side, the study revealed that, government had taken many efforts in order to promote seaweed farming. Such efforts were bargaining with seaweed buying Companies to raise price of a kilo of dry seaweed, provision of education on sustainable Seaweed cultivation and formulation of seaweed farming policies.

Recommendations

Based on the findings of the study, some recommendations are hereby put forward. These recommendations if implemented are expected to improve the seaweed farming in Zanzibar.

Encourage males in seaweed farming

Since it was observed that most of seaweed farmers were women compared to men Because of low price of seaweed, it's advised that government should put strategies that will attract men in seaweed farming activities especially cottony type of seaweed which is highly priced in the world market and grow in deep water which is difficult to practice for women.

Persuade singles

The study revealed that married and widowed women were participated in seaweed Farming activities as compared to single. Effort should be made to persuade singles to Engage in seaweed farming in order to reduce the unemployment rate so that they can improve their standard of living.

Encouraging investment

Zanzibar needs to intensify her effort in encouraging investment on marine sub-sector Especially in seaweed investment by engaging in aggressive promotion strategy, this is Critical to influence potential investors in order to increase bargaining power of the Farmers so as to sell their products at a competitive price to enable farmers sustain their Agricultural activities. Zanzibar should encourage local and foreign investment that has internal linkages which will create more job opportunities for Zanzibar is, this could be done by targeting Incentives in seaweed industry. Moreover efforts are needed to simplify the procedures to start and run business and improve necessary infrastructures for seaweed farming Growth in the country.

Government support

Although it was observed that the government of Zanzibar has contributed in the Seaweed farming growth but still there is a room of increasing these efforts especially in the following areas

Training

Since it was observed that education to local seaweed cultivators is another area that needs more attentions, by educating them in terms of skills and knowledge can help the country's unemployment problem and income distribution of its citizen. The Government of Zanzibar should combine their efforts in delivering technical assistance (e.g. training materials, training workshops), encourage the type of agency collaboration already in place as well as to maintain a program of 'training-the-trainer' type courses. Regional efforts could be coordinated through a regional posting (organize training, Share country experiences, technology).

Develop market strategies

Since the study uncovered that there is inadequate market for dried seaweed, it is very important for the government of Zanzibar to use Tanzanian diplomatic missions abroad to find reliable market for the seaweed products as well as to lobby donors.

Developing and improving technology

The study findings indicated that quality control in harvesting, cleaning, sorting, Washing, drying and semi-processing have not been given greater attention. Priorities should be given to selection of species with higher growth rates, higher yield and better Quality through encouraging cutting or pruning when harvesting from natural seaweed beds so as to preserve the natural resources. Government should conduct research to develop fast growing, high yielding varieties through biotechnology.

Processing

The study finding revealed that processing of dried seaweed is practiced at a minor level. The government of Zanzibar has to explore the benefits of in-country processing at a large scale versus exporting raw products. In this regard the government should find the Way on how to establish small-scale processing project for the sake of the Zanzibar Economy.

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