Women in Informal Employment
Globalizing and Organizing

A Study of Working Conditions in the Zanzibar Seaweed Farming Industry

Flower E. Msuya

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WIEGO's OHS for Informal Workers research reports seek to expand the knowledge base on occupational health and safety in informal places of work. Main thematic areas include institutional issues in extending OHS services to informal workers, regulation of OHS, as well as data collection on work related health and disease amongst the informal workforce.

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WIEGO Secretariat
Harvard Kennedy School
79 John F. Kennedy Street
Cambridge, MA 02138, USA

WIEGO Limited
521 Royal Exchange
Manchester, M2 7EN
United Kingdom

www.wiego.org

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List of Acronyms

DFMR	Department of Fisheries and Marine Resources
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
MACEMP	Marine and Coastal Environment Management Project
NGO	Non-governmental Organization
OHS	Occupational Health and Safety
SACCOS	Savings and Credit Cooperative Society
SMZ	Serikali ya Mapinduzi Zanzibar (Revolutionary Government of Zanzibar)
STI	Sexual Transmitted Infections
TASAF	Tanzania Social Action Fund
TZS	Tanzanian Shilling
WIEGO	Women in Informal Employment: Globalizing and Organizing
ZANEA	Zanzibar East Africa Seaweed Company Limited
ZaSCI	Zanzibar Seaweed Cluster Initiative
ZASCOL	Zanzibar Agro-Seaweed Company Limited
ZERI	Zero Emission Research Initiative

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Introduction

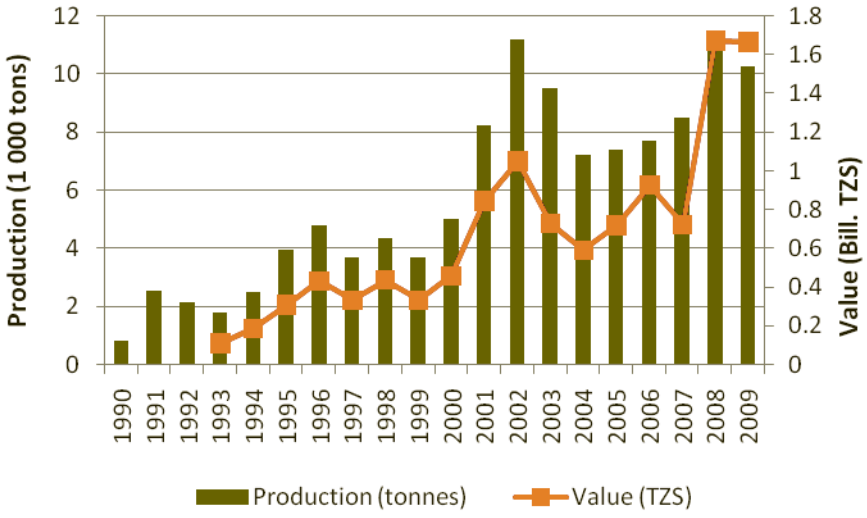
Seaweed farming in Tanzania's Zanzibar Island (*Unguja*) is a well-established industry that brings in foreign money and gives coastal people, especially women, an opportunity to earn an income for themselves and their families. Food, pharmaceutical, cosmetic, and textile industries, among others, use seaweed extracts such as carrageenan, agar, and alginates as gelling substances, stabilizers and emulsifiers in industrial products like perfumes, shampoos, toothpaste, medicines, ice cream, milk shakes, and yoghurt (Msuya 2006a). Seaweed is mostly valued on the quality of the carrageenan.

Zanzibar began exporting seaweed as early as the 1930s when red seaweed, under the genus *Eucheuma*, was harvested from naturally occurring wild stocks and exported to Europe. By the 1950s, some 4,000 tons of dry seaweed had been exported to France, the USA and Denmark (Mshigeni 1973, 1976). Commercial farming began in Zanzibar in 1989, and by the early 1990s, farmed seaweed was commercially exported. Between 1992 and 1996, seaweed farming expanded to the mainland's Tanga (Zuberi et al. 2007), Bagamoyo and Mafia Island (Msuya 2010a), and in 1995–6 continued expanding to Mtwara, Lindi and Kilwa (Msuya 1995, 1996). Currently, two species – *Eucheuma denticulatum*, known commercially as Spinosum, and *Kappaphycus alvarezii*, known as Cottonii – are farmed.

The industry has become increasingly important by bringing foreign revenue into Zanzibar's economy and raising farmers' and communities' living standards, although its contribution to

the mainland economy is still minimal. In Zanzibar, however, seaweed farming is second only to the tourism industry in terms of foreign exchange earnings. Seaweed is its largest marine export product, contributing over 90 per cent of Zanzibar's marine exports in recent years (Department of Fisheries and Marine Resources [DFMR] database). According to the DFMR, in the three years between 1990 and 1993, seaweed production increased from 808 to 1,768 metric tons, valued at 106 million Tanzanian shillings (TZS) (US$67,840.00[1]). By 2009, seaweed production had increased to 11,000 metric tons, valued at 1.6 billion TZS (US$10.24 million). (See Figure 1.)

Figure 1
Seaweed Production and Value in Zanzibar
1990–2009



Source: DFMR

The income generated by seaweed farming has enabled farmers to improve their standards of living by giving them income to pay school fees, buy uniforms and books for their children, improve the houses in which they live, and purchase clothes and food to meet their daily needs (Eklund and Pettersson 1992; Mshigeni 1992; Pettersson-Lofquist 1995; Shechambo et al. 1996; Msuya 2000; Semesi 2002; Msuya 2006a). Shechambo et al. (1996) reported that ownership of items such as radios, clothes (mostly *khanga*, which are the traditional cloths worn by women), kitchenware, bicycles, motorcycles, furniture and so on was significantly different before and after seaweed farming began. For example, women who owned less than five pairs of *khanga* before gaining income through seaweed farming could now own up to 30 pairs (Msuya et al. 1994).

1 A conversion rate of 1 TZS to US$0.00064 is used throughout this paper. The rate is based on the June 30, 2012 mid-market rate reported by XE (http://www.xe.com).

Murphy (2002) reported similar increases in the ownership of items in Indonesia, where farmers gained means to purchase houses and boat engines, among other items.

However, recent changes in the world market and in the farming environment are threatening this industry. For example, Cottonii – the most profitable seaweed species – is now failing to grow in areas where it used to, due to changes in environmental conditions. These changes include the rise in seawater temperatures, epiphytism,[2] and fouling (Mmochi et al. 2005; Msuya 2007). Some farmers, especially men, are leaving seaweed farming while others, mostly women, are carrying on with lower expectations.

A number of studies have looked at the industry's status including its socioeconomic impact (Eklund and Pettersson 1992; Pettersson-Lofquist 1995; Shechambo et al. 1996; Semesi 2002; Msuya 2006a), its environmental impact (Johnstone and Olafsson 1995; Olafsson et al. 1995; Msuya et al. 1996; Eklöf et al. 2006; Msuya and Porter 2009), interactions with the other industries (Msuya et al. 2007) and comparison of farming methods (Msuya et al. 2007). However, no studies have focused on the workers within the industry, now mainly women, or on the working conditions.

For this reason, the global research and advocacy network Women in Informal Employment: Globalizing and Organizing (WIEGO) initiated a study of working conditions within Zanzibar's seaweed farming industry. The study forms part of the Occupational Health and Safety (OHS) Project, which falls under WIEGO's Social Protection Programme. The study aimed to produce a clear portrait of the industry from a worker perspective, and had three main objectives:

- to provide current information on the seaweed farming industry in Zanzibar from a worker´s perspective, with a particular emphasis on gender dynamics;
- to gather information about the health and safety risks and hazards seaweed workers face; and
- to gather information about both formal and informal authorities and institutions that impact farmers' working lives in general and their health and safety in particular.

2 The growth of these epiphytes may damage the seaweed plants.

Research Methods

The research was conducted from September to November 2010 on Tanzania's Zanzibar Island. Researchers conducted interviews with farmers in different communities using an interview guide, which included pre-prepared questions. In answering these questions, respondents described details about their individual and group health, particularly in relation to the occupational health problems they faced.

The basis for selecting the communities for the study was three-fold:

- Geographical location: communities studied represent the north, south, east, and west of the island. These were Paje (south-east); Bweleo (south-west); Kidoti (north-west); and an Islet (Uzi) on the south-west coast. Other sites included Uroa (east coast) and Jambiani (south-east coast).
- Experience with seaweed farming: communities have practised farming for varying lengths of time. Some sites were the first villages to implement farming while others implemented farming two to three years later.
- Gender distribution in farming groups: the study took care to include women and men who farm as each may experience different health problems.

The research used mixed strategic data collection methods as appropriate to the topic of the study. The data sought was descriptive and explanatory in nature, and the study used a qualitative approach covering knowledge and attitudes concerning OHS. Data was obtained through individual explanations and focus group discussions, and captured seaweed farming processes and experiences in the lives of respondents (farmers and non-farmers). Researchers also recorded data retrieved through in-depth interviews, community meetings, and situational observations regarding social interactions within respondents' lives. In addition, the study collected information concerning their perceptions and attitudes towards seaweed farming, and their strategies to avoid health and social hazards related to the work. Finally, researchers used quantitative methods to collect baseline statistical information such as respondents' gender and other quantifiable information such as economic status, and the impacts or benefits seaweed farming induces at the household and community levels.

Literature surveys of and consultations with seaweed buyers and traders and relevant departments like the DFMR, Agriculture, and Environment provided secondary information. Researchers also obtained information on changes in the number of seaweed farmers and in seaweed production

in each village, as well as seaweed farming's historical beginnings and evolution within that village. Site visits of the beach and farming areas were also conducted.

A total of 137 farmers of diverse age groups participated in the study. Sixty were men and 77 were women. Forty nine focus group discussions, each consisting of four to six members, took place. Four village meetings were held. Two to three key informants in each study site were interviewed. These informants included leaders/chairpersons of groups, village leaders, community leaders such as local councillors, seaweed buyers, traditional and religious leaders, and institutional representatives such as school teachers and health officers.

Research Findings

1. Structure of the Industry

Past studies have estimated the number of seaweed farmers in Zanzibar to be between 15,000 and 20,000 (Mshigeni 1992, 1998; Msuya 2006a). It has proved difficult to verify these figures due to the fact that reliable data on workers within the seaweed industry is scarce. Neither the DFMR nor the village offices record such data.

In Zanzibar, farmers use the peg and line, or off-bottom, farming method in the shallow intertidal areas (Msuya et al. 1996). 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 six 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 floating lines (Msuya 2007; Msuya et al. 2007) 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. In some villages like Uroa, a grandmother, a mother, and a daughter all farm seaweed. Sisters-in-law may also farm together. However, because education levels have risen since the 1980s, this family chain is starting to break. For example, Shechambo et al. (1996) reported that farmers were generally aged 40 years and above, with the majority over 50

years. If children find work in towns, they tend to leave the villages. However, the current study observed that many young people still farm seaweed.

Moreover, studies conducted in 1996 and 2006 also reported that most farmers either had no formal education or left schooling after standard seven (seven years of primary school). However, the current study observed more and more farmers are now educated. Whether these results are an indication of increasing unemployment in Zanzibar remains to be examined.

When Zanzibar entered commercial seaweed farming, buying companies on the island started nursery farms for seed production and employed a few men and women as workers and paid them monthly wages. When there was enough seed, the buyers urged people to form farming groups. The group farming system did not work well, and most seaweed farmers now work on an individual basis.

That being said, some farmers employ others on a part-time basis for planting, harvesting, cutting pegs from trees, carrying seaweed and so on. This is common with farmers who have a large amount of seaweed and with older farmers who do not have much strength. The part-time employees are paid when they finish the work assigned. This study observed that farmers employ fellow villagers or villagers contract themselves out to farmers to perform one or more of the following tasks:

- cut and sell pegs for farming seaweed (price: 50 TZS/peg or US$0.03/peg)
- carry seaweed either from farms to the drying places or from the drying places to homes (price: 200 TZS/sack or US$0.13/sack)
- tie seaweed seed from the time the tide goes out to the time when it comes in (price: 2,000 TZS/day or US$1.30/day)
- help harvest the seaweed (price: 150-200 TZS/sack or US$0.10-0.13/sack)
- carry dry seaweed from homes to the selling points (price: 200 TZS/sack or US$0.13/sack); sometimes a cart owner is hired (2,500 TZS/trip or US$1.60/trip)

Once the seaweed has been harvested and dried, it is sold to companies for export. Currently (2010), eight companies export seaweed from Tanzania: C-Weed Company; Zanzibar Agro-Seaweed Company Limited (ZASCOL); Zanzibar East Africa Seaweed Company (ZANEA); Birr Sea Weed Company; ZanQue; Zanzibar Shell; Kai Trading; and SM Rashid. These companies sell mostly to the USA, France, Denmark and Spain, but also to Chile and China.

Each company has buying offices in the villages, and employs a local villager as a buying officer. These officers are paid monthly wages. Buying companies also hire other villagers temporarily to buy seaweed during peak harvesting seasons. In Bweleo village, farmers explained that companies hire young village people to fill these seasonal positions. Farmers harvest their seaweed, and when they have collected enough they will sell to the companies, who will store it in the village until sufficient quantities accumulate to make a truck trip to Zanzibar Town. After being transported to Zanzibar Town, local companies export the seaweed to multinational sister companies abroad.

The Zanzibari authorities have made a declaration of free trade within the seaweed industry on the island. This means that, theoretically, seaweed farmers are free to sell to the buyer of their choice, so that they may get better prices for their crop. However, in reality farmers are unable to sell their harvest in this manner. The materials and tools necessary for seaweed farming, such as ropes, pegs, boats (needed if the tide is high), and transportation, can be expensive for a farmer who earns as little as 20,000 TZS (US$12.80) per month from seaweed sales (to compare: the minimum wage in Zanzibar is 100,000 TZS, or US$64.00 per month). Often ropes need to be replaced – they are easy to steal, and can also be dislodged in bad weather. In Uzi Village, the prohibitive cost of the materials for farming was one of the main reasons why villagers who were not seaweed farmers said they would not enter into the occupation.

Many of the seaweed buying companies offer to supply the farmers with materials, and even sometimes extension services, in return for exclusive rights to the farmer's harvest. As a result, seaweed in Zanzibar is purchased and exported under a system which can be characterized more as a monopsony than a free market (MNRT 2005). This system gives the buying companies a great deal of power in determining seaweed prices, and may also lead to abuses of power. For example, farmers in Kidoti and Uzi villages reported that companies often do not give farmers enough rope, which means that farmers have to buy extra rope with their own money, while still having to sell their seaweed at the same price to the buyers.

However, local people do also sometimes participate in seaweed's purchase and sale. Msuya (2010a) mentions the case of a woman in Bweleo who had been in the seaweed trade business for a number of years. During an interview, she explained that her aim was not only to gain a profit but also to help her fellow farmers increase their income. She also explained that she buys seaweed from needy farmers when the export companies fail to do so. She then re-sells the seaweed to exporters in Zanzibar Town. She has signed a contract with a company to whom she sells the seaweed.

The Zanzibar Seaweed Cluster Initiative (ZaSCI) aims to bring innovation into the seaweed farming industry in Tanzania. Working in more than five villages in Zanzibar, ZaSCI has approximately 3,000 members. One ZaSCI group in Chwaka village, named *Tuwe Pamoja* ("let us be together"), is taking steps to obtain an export licence from the government. While the group awaits the licence, members are actively looking for markets abroad. For the time being, the group arranges exports through the export company Calmax Exporters in Dar es Salaam, which is also affiliated to ZaSCI.

2. Industry Trends

2.1 Production

As mentioned in the introduction, two main varieties of seaweed are grown in Zanzibar – Cottonii and Spinosum. Cottonii is currently favoured by the world market because its gel is stronger than that extracted from Spinosum. Consequently, the price of Cottonii in Tanzania is 300-500 TZS (approximately US$ 0.19-0.32) per kg of dry seaweed, while that of Spinosum is 200 TZS (approximately US$ 0.13) per kg of dry seaweed. Cottonii is also valued more highly because of its relative scarcity. Zanzibar is not the only place where the species is now failing to grow – other countries, like the Philippines and Brazil, have reported similar problems (Largo et al. 1995; Hurtado et al. 2006).

Still, although Cottonii production has significantly decreased over the years, from 1,048 tons in 2001 to 16.5 tons in 2008, overall seaweed production has increased after a period of stagnation. The increase is the result of efforts by the buying companies to increase Spinosum production following a decrease in the world supply of this variety caused by the 2004 tsunami in Asia. These efforts have included providing rewards and other incentives to best producers. If the trend is sustained, the production of Spinosum will continue to rise. However, since the price of Spinosum has not changed, most farmers' incomes have not increased much. This is especially the case for women farmers, who have less chance to increase the size of their farms due to limitations in strength, control over labour, as well as the demands of their household responsibilities. The Cottonii die-off has, therefore, had an important impact on the seaweed industry in Zanzibar.

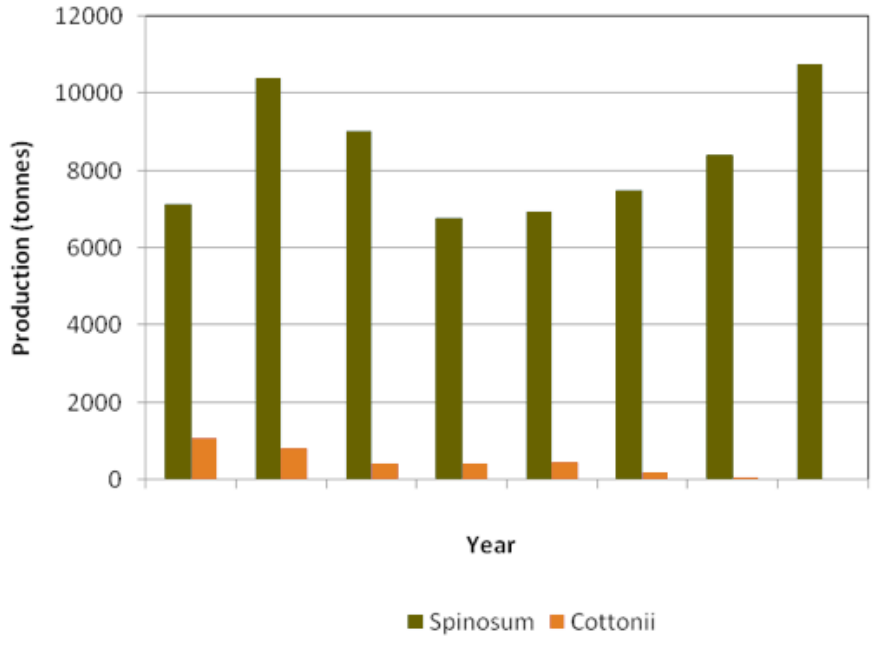
Production value estimates were obtained in some of the villages in this study. In Paje, a villager formally employed by a buying company stated that the company used to purchase up to 60 tons of seaweed per month from Paje, but now the amount is less than 5 tons. Statistics from the village database show that between 1989 and 1995, production was 45–50 tons per month, but currently production is 7–10 tons per month. A manager employed by a seaweed company

in the Uroa-Matemwe area mentioned the amount of seaweed purchased, especially in Uroa, has decreased. He said that in the year 2000, he bought 70–80 tons per month from Uroa. This amount decreased to 55–60 tons per month in 2003, to 35 tons per month in 2006, and to 7–13 tons per month in 2010.

Reasons given by the villagers for this decline included the fact that the farmers believe that seaweed's properties have changed over time and that seaweed has appeared to lose its weight. For example, farmers stated during the decade between 1990 and 2000, one four-metre long seaweed line could fill one 25 kg sack. Currently, it takes four four-metre long lines to fill one such sack. A farmer in Uroa village made a similar observation. She estimated that while formerly two to three lines filled a sack, currently five to seven lines fill a sack of the same size.

Environmental factors were also thought to be involved. In Paje, 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 in Paje 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 (Msuya et al. 1996).

Figure 2
Variation in Seaweed Production per Species in Zanzibar
2001-2008



Source: DFMR

2.2 Earnings

Despite the needed income seaweed farming brings to households, many of the seaweed farmers interviewed felt that the amount of money they earn from farming does not reflect the amount of work that they have to put in (the price of Cottonii is approximately US$ 0.19-0.32 per kg dry weight and Spinosum is approximately US$ 0.13 per kg). They stated that the money they received in the past was more satisfactory than what they receive now. In Uzi, farmers said that price gains in rice and seaweed were becoming increasingly unequal. For example, whereas in 1990 rice and seaweed were on par with each other, rice is now valued five times more highly than seaweed. Nineteen villagers (9 men, 10 women) who had never taken up seaweed farming in this village were asked why they had not done so. Twelve of them indicated that they could not afford the necessary implements and materials, while seven thought the low prices were not worth the effort.

The amount of money farmers obtain from selling seaweed depends on how long a farmer collects seaweed before selling, the growing season, and the farmer's effort. When seaweed is collected for two to four weeks, a farmer gets 100,000–300,000 TZS (US$64.00-192.00). These are considered good earnings and usually occur after the rainy seasons (March to May and November to December) which provide good growth conditions. In these times, farmers are able to collect higher volumes of seaweed, which is also the case in the June to August cold season when low temperatures are favourable to seaweed growth. Other seasons average 50,000–60,000 TZS (US$32.00-38.40) although this figure can vary. In Paje village, for example, farmers explained they used to earn 20,000–30,000 TZS (US$12.80-19.20) per month, but they now earn much less. If a woman farmer gets a large volume of seaweed, she will earn 45,000 TZS (US$28.80). Farmers in this village stated that the seaweed has appeared to become thinner with time, so the same farmed area produces less than it did in the early 2000s.

The farmers in Uzi said they sell seaweed at each low tide because of economic hardships – they need money all the time. In other villages, farmers collect seaweed for two to three low tides before selling, which means they get more money from a single sell than those who sell at every low tide. In this study, participants did not complain about delays in selling seaweed; in other words, farmers did not have to wait for long periods before they sold their seaweed. Buyers seemed to buy seaweed on time.

In Uzi, interviewees mentioned that hardworking farmers get between 50,000–100,000 TZS (US$32.00-64.00) in one low tide season, whereas the less hard-working farmers get 10,000–20,000 TZS (US$6.40-12.80) per low tide season. Bweleo farmers stated that hard-working farmers get 50,000 TZS (US$32.00) per low tide and less hard-working farmers get 20,000 TZS

(US$12.80), though they also stated that during better days, hard workers used to get 80,000 TZS (US$51.20) per low tide.

Only one farmer reported considerable profit gained from seaweed sales. In Bweleo village, the woman farmer mentioned earlier in this report began buying seaweed from her fellow farmers and selling this seaweed directly to a buyer in Zanzibar Town. Since 2009, she has made a profit of 40 TZS (US$0.26) for each kilo of dry seaweed that she sells. She earns between 150,000 and 250,000 TZS (US$96.00-160.00) per month and about 2.5 million TZS (US$1,600.00) per year, with no transportation costs as the buyers come to her rather than the other way around. This is in addition to the income she earns from her own farmed seaweed.

When asked to suggest how they would value seaweed, farmers generally proposed that the seaweed price be raised to encourage farmers. Farmers in Paje suggested a kilo of seaweed be sold at 400 TZS (US$2.60), but added that even this price did not really account for the work done in growing and harvesting the seaweed. In Bweleo, the *Sheha* (village chairperson) and farmers proposed a price of 1,000 TZS (US$6.40) per kilo.

2.3 Number of Farmers

Decreases in production and earnings correlate with a decrease in the number of seaweed farmers in some villages. This is readily apparent in Paje village on the east coast. In 1993, when Cottonii was also farmed in the village, Paje had 500 seaweed farmers (440 women and 60 men). In 1998, this number grew to 1,400 farmers (men and women). However, by 2010, this number had dropped to 150 farmers, all of whom were women. In Bweleo village on the south-west coast, the number of farmers had decreased slightly from an initial 152 to 140 by 2010. In Kidoti, respondents said that the number of farmers had decreased because some men had stopped farming. In Uzi village, however, the farmers explained that the number of farmers has not decreased over the years. One farmer stated "the number of farmers has not decreased in this village; the only problem that we are facing is lack of farming materials." One thousand people (700 women and 300 men) farmed seaweed in this village.

The decrease in the number of farmers is related to the presence or absence of alternative economic activities. In villages like Uzi and Bweleo, there are few alternative economic activities, and so the number of farmers has remained relatively stable. On the other hand, villages like Paje and Jambiani have developed flourishing tourism industries. When asked about why they had stopped farming, men and women in Paje village argued that tourism and related activities such as craftwork provided a better, more regular income for less work. Seaweed farming was often described as "tough work" – physically hard, time consuming, and with the added disadvantage

of the long wait for the seaweed to dry and irregular selling times, which means incomes are also irregular. As a woman farmer in Kidoti said, "Imagine that you spend the whole day at the farm site and come home empty handed and yet you have to eat and feed your family. You have to be very patient." In some cases, the period between selling times can be so long that stored seaweed rots – this happens in hot weather especially. Low prices for Spinosum seaweed are also to blame for the exit from seaweed farming. According to some farmers in Paje, this makes the tough work and uncertainty not worthwhile. "Seaweed price is everyday cry and no solution," one said. Participants mentioned that previously farmers were able to purchase items such as tailoring machines or could even build new houses, but this spending power is not available now.

Additionally, the growth of the tourism industry in Paje has also impacted on farmers access to the beaches and thus farms. Several of the villagers mentioned that hotels had built seawalls, which required farmers to walk long distances in order to access the beaches. Hotel walls had also been built in areas which had previously been used for the drying of seaweed.

2.4 Gender Dynamics

One of the more remarkable social changes brought about by the introduction of seaweed farming in Zanzibar has been the cash earning power acquired by women farmers who, as in other Muslim societies, were previously dependent on their husbands to provide for the families' needs. Although men were sceptical when women began to farm seaweed, they became more supportive when they saw the monetary results.

Farmers expressed mixed views about seaweed farming and alternative economic activities in the villages depending on whether they were men or women. Most women believed seaweed farming remains beneficial, while men argued that prices were too low for it to be considered a beneficial activity for them. Men can go fishing or work in the booming tourism-related construction industry, from which women are mostly excluded. Male respondents also claimed that it was necessary for men to earn cash on a regular and timely basis in order to provide for their families, which is often difficult with seaweed farming. However, the men believed that seaweed farming was still a beneficial activity for women, whose income is considered supplementary and is used for luxury "extras." This implies that women's reduced or irregular income does not have a catastrophic impact on the household income, although the extra income they do bring in is welcomed.

Across all villages, generally once a woman begins farming, she will farm all her life. As mentioned, men are more likely to quit farming to look for quick paying, higher income jobs. Occasionally, a woman will quit farming altogether if she finds a higher paying job that allows her to be close to her children, but the majority of women will still keep farming seaweed as a part-

time activity because of the reliable, if low, income. The women explained that seaweed farming provides them with a means to tackle a range of day-to-day problems that could not be solved without seaweed money. In Kidoti, women farmers stated that seaweed farming yields returns greater than the wages normally paid to those people employed to work in land-based crop farms. They explained that in preparations for religious celebrations such as Eid, seaweed farming provides sufficient income to buy new clothing for their children. Eklund and Pettersson (1992) and Shechambo et al. (1996) reported similar results.

Although most men do not farm seaweed now, they do still help their wives during activities such as harvesting large volumes of crops, carrying wet seaweed from farms to drying places, and carrying dry seaweed to selling points. Children help in activities like tying seed at home or harvesting during weekends and school holidays. Thus, seaweed farming is a more family-centred than individually-based work, which helps women continue in the business. Studies have shown that women, who previously depended on men to provide for household necessities, now make 80 to 90 per cent of the total number of seaweed farmers in Zanzibar (Msuya 2006a).

3. Working Conditions in the Zanzibar Seaweed Industry

3.1 The Working Day

The work process of a seaweed farmer differs according to gender, and to the tides. When working according to the morning tides, a woman seaweed farmer wakes up at 04:00, prepares hot water for bathing, brushes her teeth, and then prepares herself for prayers. At 05:30, she cleans the house, prepares breakfast and pours tea into a vacuum flask. She then puts the breakfast in a safe place for her husband and children to eat when they wake up. At 07:00, she leaves the house for the seaweed farms, after preparing her farming implements. Once at the farm, she harvests seaweed, plants new seed, carries seaweed to the drying place, and spreads seaweed to dry. She then turns seaweed that was harvested and spread to dry the previous day, so it dries better and more quickly. At around midday, she carries home seaweed dry enough for storage. When she reaches home, she bathes, eats her first meal of the day, and fetches water. Then she washes the dishes the whole family used for breakfast and prepares lunch. At around 16:00, she prays and rests with her family until around 18:00, when she prepares dinner. Later during the evening, she puts dry seaweed in sacks ready for carrying to selling points and prepares farming tools such as ropes and pegs for the next day.

During afternoon tides, a woman farmer still wakes up at 04:00 and prepares for prayers, but she cleans the house, takes breakfast with her family and washes the dishes before leaving at about 10:00 to go to the farms. She works on the farm until 18:00 when she goes back home and bathes.

With other household tasks to attend to, it may be as late as 22:00 before the evening meal is ready. She then bathes the children and puts them to bed. At 23:00, typically, the woman seaweed farmer goes to bed, although some farmers do get to bed by 21:00.

The men farmers in all the villages created a similar narration of their duties, using words like "I make sure." This could indicate that the man is more of a "supervisor" than a "doer" in regard to household chores. A typical day was described like this: A man makes sure he and his children get breakfast. He makes sure that everyone in the family is healthy. He makes sure that the children go to school and to religious teaching classes (*madrassa*). When he leaves home to go to the farm, he makes sure the house is left in safety. He carries with him the farming implements including ropes, pegs, sacks, iron bars, etc. When the tide comes in, he leaves the farming site, carries seaweed to a drying place, spreads it to dry, and goes home. He finishes up activities related to the farming and makes sure that the children have come back home from school and religious teaching classes.

Very few husbands help make breakfast for the children when the wife goes to the farms during morning tides, and they will never wash the dishes or bathe the children. Some of the women respondents argue that sometimes husbands leave the house earlier than women just to avoid being told to look after the children. When this occurs, the women cannot have breakfast before going out to farm. In Kidoti, women farmers explained that only a few husbands – maybe only 10 in the whole village – make lunch for the children when their wives are at the farms.

3.2 Workplace-Related Health and Safety Issues

In seaweed farming, farmers perform a wide range of tasks under varying conditions in the course of a typical working day and across the seasons. Men and women seaweed farmers may be exposed to changing risks during the run of the day and the course of the year. Farming activities involve tough physical work often performed alone. During activities such as harvesting and drying, farmers use communal and family labour at their home premises, which can also put family members and other workers at risk.

Participants in this study listed the following as the most important health and safety risks they face at work:

- weather-related problems: Farmers find spending long hours in the strong sun harmful, especially as salt water increases the intensity of light and sun. Unlike on land-based farms, seaweed farmers do not have shade to protect them. As a result, farmers experience a number of undesirable skin conditions including itching, scarring and marking, darkening of colour, skin that shrinks and changes in its firmness or condition. Farmers

stated "even if you are young, you will look like an old person." Conversely, rain can cause problems. Farmers are affected by the cold, especially during the rainy and cold seasons. The March to May rainy season is a very good growth season, but it is very cold. The rain sometimes makes it impossible to work, and there is no sun to help. Also, if it starts raining, regardless of the time of day, farmers have to rush to the drying points to take in the seaweed before it gets saturated. If seaweed comes into contact with fresh water, it bleaches, which may lead to an un-sellable product that is not adequately dried. If this happens at night, some farmers fear meeting "madmen" or "trouble makers."

- stings: Farmers may be stung by stonefish, sea urchins, stingrays, and marine catfish (the collective *Kiswahili* word for stonefish and stingrays is *nyenga*). The cold season is most dangerous because more stonefish are present. Farmers in Paje village stated that during the last fasting, or cold season, which lasted only one month, three to four people received stonefish and stingray stings. When farmers get stings from stonefish, they must inject against tetanus. It is expensive to take care of someone who gets a stonefish or stingray sting. Some said it takes up to a month to recover and can cost about 7,000 TZS (US$4.48) for three weeks depending on whether treatment is in a government or private hospital. Some farmers have to go to neighbouring villages for tetanus injections. Farmers' feet can also get cuts from shells, like the bivalve *Pinna*, and from stones.

- sexual exploitation and STIs: Sometimes tasks like cutting pegs and carrying seaweed require greater strength. If a woman farmer asks a man to cut the pegs for her, she may be forced to pay in-kind. This may lead to women paying with sex. Multiple partners can increase the woman's risk of contracting HIV/AIDS and other STIs.

- eye damage: Farmers' eyes are subject to negative effects including pain, blindness from prolonged exposure to strong sunlight, redness from salt water and intensified reflections, and itching from salt and sand particles.

- falls: Farmers can fall in holes and depressions at the sites, which can injure ankles, knees, and so on. When this happens, farmers are forced to take time off, resulting in loss of income.

- skin irritations: Farmers experience body itching.

- musculo-skeletal problems: Seaweed farming can be heavy work, especially if farmers cannot afford to employ extra help with lifting and carrying seaweed to and from the farms, and to the selling points. Harvesting the seaweed is also hard work, as well as carrying heavy farming implements for long distances. Farmers may also have to move large stones long distances. These stones are used to hold down the seaweed ropes. Near

seaweed farms, the stones are often depleted, so farmers may have to walk long distances to find them and transport them back to their farms. Many farmers said that their "whole body hurt" after work. Farmers experience a number of bodily aches and pains including headaches, backaches, and leg and joint pain.

- cuts: Farmers can cut themselves with machetes when preparing pegs. As well, when farmers put dry seaweed into sacks, seaweed pieces get under their fingernails, where the brittle nature of the dry seaweed causes pain that can last as long as a month.

3.3 Issues at Home

When looking at work-related health hazards, it is not always easy to clearly separate work from home. Some of the hazards faced by seaweed farmers, particularly women, are not confined to their workplaces but spill over into their homes. Many of the participants in this study stated that seaweed farming had created disruptions in their family lives, which has contributed significantly to the levels of stress they experienced. These problems included:

- **Strained relationships between husbands and wives:**

  If a wife gets back late because there was a lot of farming work, there are quarrels with the husbands who wait for the wives to come back and cook for them. Women farmers explained that after working in the sea they are "too tired to enjoy with their husbands." According to both men and women, seaweed farming causes "automatic family planning" because the farmers are usually too tired for sex.

  Some women do not get permission from their husbands to go out and farm seaweed so they cannot participate in the farming although they would like to do so. If they get permission it will be through difficulties and sometimes quarrels. Women in Kidoti said that "some husbands would reach as far as telling their wives that if they went out to sea, they should get a sting from the stingray!" Those who do not get permission are employed as daily labourers in, for example, carrying stones, iron bars, ropes, pegs and empty sacks for the farmers.

  There are also quarrels between husbands and wives farming seaweed because of storing seaweed in the house. The seaweed can cause an unpleasant smell, especially during the rainy season, and some husbands have threatened to divorce their wives if the wives insist on storing dry seaweed in the house. Some husbands even remove the stored seaweed. The women argue that they have no other facilities for storage, and if one leaves dry seaweed outside it can get stolen.

- **Impact on women's household duties:**

  Women seaweed farmers are expected to carry out the same household duties as those women who do not farm. This can be very difficult for the farmers – many of the women complained that when they get back from the farms, "too much work" awaits them. This is a particular problem for pregnant women, who may already be lacking energy. As section 3.1 showed, women are often up late into the night cooking meals. Sometimes meals are made as late as 22:00, when other members of the family are already asleep. After cooking, the woman farmer has to wake up the rest of the family to eat dinner (she could be too tired to eat herself), and the men complain because their meals are late. Sometimes women farmers fail to cook because of tiredness. Husbands say that the wives "should bring what they got from the sea to cater for a family meal" when the women have not even sold the seaweed. This is an expression of anger. Some women complained that their husbands do not help them with the farming activities.

- **Impact on childcare:**

  Childcare becomes a problem for women who have to work long hours. Sometimes women farmers are unable to work their farms because they are unable to find someone to take care of their children. Conversely, sometimes children are left on their own, or not prepared enough by the parents to go to school, and when the mothers are back from the farm they do not have time to check if the children did indeed go to school. In some cases older children are given a responsibility of looking after the homes and the young ones though they are not much older than the other children. Men say that children cry because there is no one to take care of them. Women feel guilty that they are not caring for their children properly. One woman noted, "You feel bad because your children are waiting to eat."

- **Impact on community activities:**

  Some farmers complain that they are unable to attend community activities such as weddings, burials, and community meetings because of long hours in the sea. This is more serious during harvesting times, when the hours are even longer. Sometimes they are forced "to leave by the backdoor" so that other members of the community will not see them. This causes problems with other members of the family as well (extended families are very common in Zanzibar). They may also have problems attending trainings for skills development, etc., that would help them do better in the business. This is more of a problem for families who depend on the farmer's earnings.

4. Worker Organizations

Once, when seaweed farming paid well, there were many farmers' cooperatives. Farmers formed smaller groups and cooperatives, and a Seaweed Farmers' Association was active in each village. These cooperatives are now found in only a few villages. Cooperatives like those mentioned by Shechambo et al. (1996) and Msuya et al. (1994) in Bwejuu, Paje, and Jambiani are no longer active. In 2006, however, the Marine and Coastal Environment Management Project (MACEMP) mobilized farmers in different villages to form groups of 20-30 people so as to access support through the project. In the same year, ZaSCI also helped organize farmers into groups to get help from the initiative.

In Paje village, currently one committee, formed when MACEMP began assisting Zanzibar's seaweed farmers, remains. The committee was a link between members of 13 groups of about 20 people each and the village leadership/government. The different groups led by the committee were supposed to acquire funds from the project as a group, but the promised funds never materialized, and the groups no longer exist. Today, even groups of three or four people no longer come together to form small cooperatives.

One non-governmental organization (NGO) formed under ZaSCI also still exists. The NGO consists of a group of 36 women who work with the Seaweed Centre in Paje and ZaSCI. The Seaweed Centre is a joint initiative started by the Adventure School of Zanzibar in Paje, Chalmers School of Entrepreneurship in Sweden, and ZaSCI to help seaweed farmers in Paje (and later elsewhere). A Savings and Credit Cooperative Society (SACCOS) also operates in Paje, a system common in many areas of Zanzibar. The SACCOS credit system in Paje is not meant for seaweed farming although the members can choose to use the credit from SACCOS for farming seaweed.

Cooperatives also used to function in Uzi. When business was good, six to seven famers would work together, but nowadays no cooperatives or groups exist. In 2006, in Bweleo village, a cooperative whose name meant "patience is a key to heaven" was formed so that Bweleo farmers could join ZaSCI. Bweleo is also home to two more groups formed under the Seaweed Cluster Initiative and SACCOS. In Kidoti, a village farmers' association dissolved when seaweed farming decreased. Currently Kidoti is home to three groups, including a cooperative of 20 women farmers formed in 1992 called *Tusife Moyo*, which translates as "we should not lose hope." Apart from farming seaweed, the group makes soaps mixed with different spices, and seaweed soaps.

Overall, the groups formed under MACEMP aimed to provide farmers with farming materials and to start other economic projects such as poultry production. Groups formed under the ZaSCI aimed to train farmers to make value-added seaweed products and to use innovative techniques

for farming seaweed. The committee in Paje looks after the affairs of the group formed under ZaSCI through activities like recording the problems that the group faces. ZaSCI also aims to link farmers from different villages together, so they can work together to add value to the seaweed and use innovate new farming methods such as the deep-water floating lines system. Thus, in addition to farming seaweed, groups have learned to make products such as seaweed soaps, body creams, massage oils, and foods like cookies, cakes, juice, salads, and so on.

Groups and cooperatives formed during the industry's peak no longer exist. The MACEMP groups formed to provide farmers with farming materials and other economic projects are still operating in the few villages that did receive the help they were promised. In areas where help was not provided, the groups dissolved, which indicates that they must receive help to survive. Currently, the only promising groups are those formed under the ZaSCI because they are not based on provision of funds but rather on collaborating while becoming innovative and competitive. These groups, in other words, cooperate while competing ("co-opetition").

5. Institutional Support to Farmers

Seaweed farmers collaborate with a number of institutions and individuals in different aspects of the seaweed farming industry. Farmers collaborate with people who provide farming materials, buy seaweed, and provide extension services; government offices, research institutions, and those that help with medical issues. The following is a list of some of these institutions:

- ZaSCI: offers training in value addition and production of value-added products such as seaweed soap; innovation training; research on farming the higher priced seaweed varieties
- Village Chairperson: supervises village meetings, especially those related to seaweed farming; works with buyers to distribute farming materials; receives complaints from farmers and sends the complaints to the people responsible; acts as a link between farmers and other stakeholders; talks to buyers about seaweed prices
- MACEMP: provides funding; trains in environmental protection; provides farming materials
- Department of Agriculture, Forestry and Environment: controls visitor access to villages like Paje
- DFMR: acts as a link between farmers and buyers; provides farming material through different projects

- Donor organizations: occasionally provide funding for seaweed farming projects
- University of Dar es Salaam, Marine Sciences Institute: provides research and training
- Seaweed buying companies: provide farming implements; set up seaweed buying stations in villages; buy seaweed from farmers; offer extension services on a limited scale

During the focus group discussions, farmers complained about the lack of institutional support to seaweed farmers in Zanzibar. In particular, the farmers complained about the lack of platforms available for negotiating the seaweed price with the buying companies, or for communicating with government institutions like the DFMR. So despite the fact that a number of government and village institutions have an official mandate to act as a link between the seaweed farmers and the buyers, these do not seem to operate as real bargaining platforms or communication channels for the farmers. There were also complaints about the extension services offered by the buying companies. In Uzi, a male farmer complained about the fact that farmers were not farming with the proper technique because they had not been trained to do so. As this may be one of the factors affecting farmers' productivity, the issue requires more research.

Despite all the problems farmers face, government officials believe that seaweed farming still offers benefits to farmers. DFMR's Assistant Director explained that seaweed farming yields farmers positive returns and helps them meet their daily needs when otherwise they would not be able to do so. He added that since seaweed farming is a part-time activity, it is advantageous because it gives farmers time to do other activities when it is not low tide. A Regional Agricultural Officer expressed the same views.

Different stakeholders are trying to help the farmers by providing possible alternatives and strategies to the seaweed farming industry. One such alternative is through innovation that adds value to seaweed through the production of value-added products (Msuya 2010b, 2006b; Msuya 2008; Msuya and Kyewalyanga 2008). Since 1983, Tanzanian scientists have been developing trials that pave the way for further research into seaweed's alternative properties and uses. For example, initial trials using extracts from the seaweed species *Gracilaria* as a fertilizer for bean plants have built the foundation for other projects, such as the Zero Emission Research Initiative (ZERI[3]) project and the ZaSCI, mentioned earlier. Tanzania's universities and research institutions are also developing new methods of extracting carrageenan (see Buriyo et al. 2001).

The government of Zanzibar (*Serikali ya Mapinduzi Zanzibar [SMZ]*) is also providing farmers with farming materials in the hope that they will be able to expand farms, produce more

3 ZERI was a project in the late 1990s which aimed at using agricultural by-products, including seaweed, to make biofuel.

seaweed, and eventually become independent from buyers. SMZ is also trying new methods of farming such as the "cast method," where seaweed is tied to rocks and allowed to grow. Buyers continue to combat Cottonii die-off by importing alternative species and varieties. One company specializing in Spinosum gives gifts to the best farmers to encourage more production. Scientists are researching the possibility of farming *Gracilaria* to produce a gel called Agar (Msuya 2010b, Msuya 2006b). Research has also suggested that to boost production, seaweed farming could integrate with other farmed marine organisms such as shellfish, cucumbers, and so on (Msuya 2010a; Msuya 2010b).

There are also several institutions with which farmers interact in terms of their health-related issues.

- Traditional healers provide medicine when farmers get stings from stonefish, flatfish, sea urchins or stingrays. These healers are not paid for their services – they are fellow villagers and mostly fishermen.
- Medical officers provide medical services/medicine such as pain killers and injections.
- Tanzania Social Action Fund (TASAF) works with MACEMP and funds the construction of storage facilities in some villages. TASAF also provides protective shoes to some farmers, and provides farming implements such as ropes and tie-ties.
- AIDS Control Committee (Uzi) offers HIV/AIDS counselling and preventive education.

However, none of the above institutions has a mandate to protect the health and safety of seaweed farmers in Zanzibar. A buyer like Birr Sea Weed Company in Pemba may provide protective gear such as gloves and boots simply to encourage farmers to produce more seaweed or sell the seaweed to that company. In other instances, OHS services are provided because the organization or person has a stake in the output. For example, the USA-based international fair trade organization Ten Thousand Villages provided seaweed farmers in Kidoti village with gum boots and sunglasses so they could make seaweed soap to sell back to the organization. However, few of these organizations have ever acted on after-effect treatment of injuries such as stings.

Unlike other countries, Zanzibar does not have a safety and compensation council. As a result, many work-related injuries remain unreported, even at hospitals. When they are reported, most injuries (including back injury, cuts and skin problems) cannot be traced directly to workers' environments and occupational hazards. Most are treated as general ailments. Consequently, there are no clinical records and statistics that can help create a picture of OHS in any sector, including seaweed farming. Official guidelines on preventive, protective, and curative procedures are not readily available.

The farmers themselves have a clear sense of what could help reduce their risk. During interviews and focus groups, farmers mentioned that they need protective gear such as gumboots or thick canvas shoes, gloves to protect them against stings and abrasions of the hands, and hats to protect them against sunlight. In Uzi, farmers explained that they need a dispensary that will help them to get timely treatment for injuries and stings rather than having to travel to health centres in nearby villages. Uzi farmers also requested boats to use for farming. Uzi's Sheha requested that concrete steps be built at the beach to help the farmers when they go to and from the farms because the beaches and shoreline are rocky.

Conclusion

This study has shown that seaweed farmers in Zanzibar currently face a number of challenges. Changes in environmental conditions, and the world market preference for one seaweed species, mean that farmers are working for decreasing returns. The precarious position many of the farmers now find themselves in is exacerbated by the fact that in Zanzibar, it is difficult for farmers to negotiate better prices for their crops. Although officially the selling of seaweed by farmers to buying companies is supposed to operate under a free trade system, in reality it operates under a system of monopsony, which gives the buying companies greater power to set seaweed prices. Furthermore, although there are a number of institutions which are meant to sustain links between the farmers and the buying companies, there are clearly few institutionalized platforms for farmers to negotiate better prices for themselves.

This study has also made clear the lack of institutional structures which regulate the conditions of work of farmers, including their occupational health and safety. Some institutions and individuals such as hospitals and traditional healers may help treat farmers' health problems, and some buying companies may occasionally provide protective equipment, but this is on a very limited scale and is not backed up by any legal provisions.

The changing conditions of work in the seaweed industry has also led to an important shift in the gender composition of the farmers – more and more men are leaving to take up higher paying jobs in the tourism and construction industries. Women, many of whom have never earned a significant income before, are moving in to fill the places left by men. This has allowed the women a level of empowerment rarely seen before in Zanzibar. However, it has also led to increasing levels of stress for these women, emanating particularly from the change in family dynamics. As with many societies in which women earn an income, these women now bear the "double burden" of work and household responsibilities, including childcare. This is most problematic

when women work with the afternoon tides, meaning that they return home from work late. They are often unable to perform their domestic duties in the same way as they did before they started farming, leaving them feeling guilty while often also dealing with disgruntled husbands.

The seaweed industry is a global industry – buying companies in Zanzibar ultimately sell the seaweed farmers' products to larger companies operating at the international level. One of the most practical ways to extend worker protections to seaweed farmers – including the protection of prices for their crops – may be to create awareness that puts pressure on the end sellers and consumers to create and enforce standards through ethical trade initiatives. This may be particularly effective in terms of ensuring that buying companies provide farmers with proper extension services, including training, the provision of materials needed for farming, and basic protective equipment.

The specific problems encountered by women seaweed farmers are perhaps less easily addressed. Women all over the world, even in developed countries where women are considered empowered, suffer the double burden of their responsibilities at work and at home. Women seaweed farmers have to work with the tides when farming, so their working times are not flexible. By necessity, then, this has an impact on their ability to perform their household duties in the mornings and evenings. However, assistance with childcare and other supportive policies to empower women could be built into ethical trade agreements. This would not, of course, solve all the difficulties these women face in balancing their responsibilities at work and home – which can perhaps only really be addressed by a complete change in societal norms – but it may help to lighten the load, and even perhaps engender a wider scale acceptance of women as workers on Zanzibar.

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