



JÖNKÖPING UNIVERSITY

*School of Education and  
Communication*

# The livelihoods of female seaweed farmers

A study about women's experiences of old and new techniques of seaweed farming on Zanzibar, Tanzania.

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## ABSTRACT

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Seaweed has been hit hard by climate change around the world. The island of Zanzibar, which is the world's third biggest exporter of seaweed, is one of the places where seaweed is affected. 80 percent of the seaweed farmers on Zanzibar are women who are directly affected by climate change since they are making a living from seaweed farming. New efforts to tackle the impact of climate change on seaweed has been made on Zanzibar through the SEA PoWer project which is a new technique of growing seaweed and enables twenty-four female seaweed farmers to grow in deep and cooler waters instead of the more traditional way which is in shallow waters. The aim of this study is to, from a livelihood perspective, examine women's experiences and perceptions of the old versus the new techniques of farming seaweed on Zanzibar, Tanzania. The research questions for this study focus on finding out the women's experiences and perceptions of the changes in the techniques in relation to opportunities for livelihoods through seaweed farming. Furthermore, this study investigates if women experience conflicts of interest with men regarding the use of ocean space. Semi-structured interviews with eleven women who have used the new technique of growing seaweed were conducted and the results was analyzed in the light of previous research, through the definitions of livelihood and gender, and the theoretical concept of feminist political ecology. The result has shown that all women experienced improvements in their livelihoods through the new technique of seaweed farming. One clear improvement was that there were no negative health effects when using the new technique. The study also found that there are no conflicts of interest between men and women regarding the use of ocean space when using the new technique of seaweed farming. The women had a positive view on the future and had high expectations, they had already noticed positive effects on their livelihoods in form of social, human, physical capital and health.

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Keywords: Seaweed farming, SEA PoWer, women, gender, livelihoods, feminist political ecology, Zanzibar, Tanzania, Africa

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## 1. Introduction

One species of the marine life which has been hit hard by climate change in the world is the seaweed. Seaweed farming is a big industry today and the Island of Zanzibar in Tanzania is the third biggest exporter of seaweed in the world. The seaweed is being farmed by locals on the island and 80 percent of those farmers are women. Those women are especially vulnerable because they are directly affected by climate change when they grow seaweed for a living. The seaweed is affected by climate change because of higher temperatures in the ocean and that makes the farming of seaweed harder since the farmers have to find new, cooler and deeper waters to grow the seaweed in (Akoma, 2016). This is a problem since women on Zanzibar often do not know how to swim or have access to boats, which means they do not have access to deeper waters (Hedberg, von Schreeba, Charisiadoua, Jiddawi, Tedengrena & Nordlund, 2018). Furthermore, climate change affects the women directly since they can no longer grow the more popular and higher valued kind of seaweed called *Kappaphycus cottonii*. They now have to produce the lower valued species *Eucheuma spinosum* which does not generate as much income for their livelihoods. Because of the heat and rising temperatures in the ocean, the farmers also must move their farms (Msuya & Hurtado, 2017). How will women cope with these difficulties of farming seaweed and how will it affect their livelihoods?

A way to cope with the effects of climate change for the women who grow seaweed on Zanzibar is to grow it in a new way. Dr. Narriman Jiddawi is an expert in the field and, researcher on the subject. Her opinion is that the future of seaweed farming is to teach a new technique of growing seaweed to the women harvesting and planting seaweed (Akoma, 2016). According to Dr. Narriman Jiddawi (personal communication, Mars 16, 2018), the new technique has now begun on Zanzibar with twenty-four women and the help of Institute of Marine Sciences (IMS) where she is employed.

Besides having to grow seaweed in a new way or having to move farms, women who work with growing seaweed have also observed a decrease in seaweed growth over the last decade. According to Nordlund, Erlandsson, de la Torre-Castro and Jiddawi (2010), the decrease is because of the increased number of people who are farming seaweed. This affects the women's income and can force them to harvest seaweed for longer periods of time to collect the same amount as before the decrease (Nordlund et al., 2010). If women already experience a limited seaweed growth and limited space for growing it, a big problem for the new technique of growing seaweed can be the use of space for it. Today deeper water is occupied by men while women are banned to shallow waters (Hedberg et al., 2018). At the same time, men are forced to seek themselves to shallower waters because of a decline of valuable species in the ocean (Fröcklin, de la Torre-Castro & Håkansson, 2014). This could cause big problems for the women growing seaweed with the new technique regarding the use of ocean space. How will women find space to grow their seaweed and will it cause conflicts of interest with men who use the same ocean space?

A future problem for the industry of seaweed farming is if this new technique will work or not. Will it contribute to making the women's livelihoods better or worse? What do the women think of the new technique? Are there any changes to their livelihoods because of it? Will the

new technique generate more income or not? Those are questions that need to be answered, which is what this study aims to do.

## 1.1 Purpose of the study and research questions

The aim of this study is to, from a livelihood perspective, examine women's experiences and perceptions of the old versus the new techniques of farming seaweed on Zanzibar, Tanzania.

Research questions:

- How do women perceive and experience positive and negative effects of the old and the new techniques of growing seaweed on Zanzibar?
- How does the old and the new techniques of growing seaweed on Zanzibar affect the women and their livelihoods?
- Does the old and the new techniques cause conflicts of interest between women working with seaweed farming and men working within fisheries when it comes to the use of ocean space? If so, how?

## 1.2 Geographical context

The United Nations implemented the 17 Sustainable Development Goals with 169 targets in January 2016 with the aim to add to and complement the eight Millennium Development Goals with 21 targets. The Sustainable Development Goals or the 2030 Agenda will seek to balance all the dimensions of sustainable development, namely, the social, environmental, and economic dimensions and aim to reach the targets by 2030. The goals aim to achieve the empowerment of women and girls and gender equality as well as to realize human rights for all (Sustainable development knowledge platform, n.d.a).

Goal number 5 in the United Nations Sustainable Development Goals acts to empower women and girls and to achieve gender equality. In developing countries, women are generally a more vulnerable group than others. In Tanzania, inequalities are still a big struggle for the country. Tanzania's gender inequality development index is 0.547 which makes them fall on place 122 of 155 countries. The main struggles for women in Tanzania are violence, discrimination in health services and education, access to employment, the possibility to own land and resources, low participation in decision-making of all kinds and also that women get excluded from the economy (United Nations Development Program, 2017).

Gender inequality, which is central to this study, refers to the inequalities in access to fishing resources. World fisheries have traditionally been associated with men but women have an important role in fisheries that is often unacknowledged or not counted as employment. Women are usually those who do the pre- and post-preparation while men are primarily capturing fish. Fisheries as an occupation is sometimes the last resort both for men and women but traditional beliefs, norms, and laws make it even harder for women in developing countries to make a

living for themselves and their household. This puts the women in the lowest end of fish value chains and could result in poverty, like in nearshore fishing and gleaning for invertebrates (Fröcklin, de la Torre-Castro, Lindström & Jiddawi, 2013).

Africa has made great progress towards the United Nations Millennium Development Goals, especially in the area of education and health (Sustainable development knowledge platform, n.d.b). Developing countries usually prioritize economic growth, provisions for health care and poverty reduction and therefore other factors have a lower priority. One of these factors is to take action for climate change and its impacts. Even though developing countries are highly impacted by climate change there are not many adaptive strategies implemented. Africa has several areas where climate change could affect the livelihoods of people, namely in fisheries, agriculture, and tourism. Despite that, there are efforts to deal with adaptation strategies through the National Adaptation Plans for Action (NAPA) in Tanzania, but the plan does not cover all areas and challenges. Zanzibar, which is an island state union with Tanzania is not mentioned more than briefly and experience impacts of climate change similar to small island states (Mustelin, Klein, Assaid, Sitari, Khamis, Mzee, & Haji, 2010) which have their own particular and unique challenges (Sustainable development knowledge platform, n.d.c). Zanzibar has recorded possible climate change in terms of extreme temperatures, rainfall, and sea-level rise. These factors create vulnerability especially for the rural population on Zanzibar who is highly dependent on natural resources for their livelihoods. Loss of richness in species relates especially to temperature and can cause existing species to disappear and new species to establish (Mustelin et al., 2010).

Seaweed is one species that has been hit hard by climate change, but the production of seaweed is still a growing business on Zanzibar where export of seaweed has grown four times from when it first started in 1989. The growth from 4 000 tonnes exported seaweed to 16 000 tonnes makes the island the third biggest exporter of seaweed in the world. The price for seaweed is around \$0.27 per kilogram so seaweed farmers are being more creative to find different areas of use through value addition like spice, soap, shampoo and body oils (Akoma, 2016).

The seaweed production contributes to revenues for the Zanzibar's Government and is also an important and emerging source of income for smallholder farmers who use their income for basic needs such as food, medical services, and education which improves their livelihoods (Food and Agriculture Organization of the United Nations, 2017).

Tanzania is one of five countries in the Western Indian Ocean (WIO) region that cultivates red seaweed and is also producing most of the red sort of seaweed in the region. The seaweed in the region faces diseases like “ice-ice” and *epiphytes* which causes die-off of the seaweed. Research has been made in the region that shows a correlation between higher temperatures in seawater and the die-off of seaweed (Msuya et al., 2013). Two seaweed species that is cultivated on Zanzibar are *Eucheuma spinosum* (Msuya & Hurtado, 2017) and *Kappaphycus cottonii*. *Kappaphycus cottonii* is growing optimal between 21–31°C worldwide and the WIO region has seen an increase in surface seawater temperatures measuring 37–38 °C. To combat the challenges of seaweed die-off on Zanzibar, efforts are being made to find other ways for the seaweed to grow better (Msuya et al., 2013).

### 1.3 Institute of Marine Sciences and the SEA PoWer project

The Institute of Marine Sciences (IMS), located on Zanzibar, is the leading institution in Tanzania for marine sciences and belongs to the University of Dar es Salaam. IMS, which was established 1978, is providing consultancy and advisory services in marine affairs as well as providing advanced training in marine sciences (Institute of marine sciences, n.d.).

According to IMS, their vision and mission are to become an international center of excellence in research and development, manage and engage in marine and coastal resources, provide provision services and training of scientific services in technology and marine science for exploration. Through training, advisory services and research, IMS aim to advance the social, technological, and economic development for Tanzania in the sustainable exploitation and exploration of marine resources (Institute of marine sciences, n.d.).

IMS is contributing to the economic development in various ways. One of these ways is in seaweed farming which became a success on Zanzibar after it was introduced in 1989 by an independent businessman. IMS has assisted in the introduction of seaweed farming on Zanzibar and also launched a research program to stabilize the seaweed industry in Tanzania. To help the seaweed resist diseases and environmental change, IMS has created research efforts to increase the genetic base of seaweed as well as establishing monitoring programs (Institute of marine sciences, n.d.).

The old or traditional seaweed farming technology that is used on Zanzibar is peg and rope in shallow waters (Institute of marine sciences, 2017). With the old technique, seaweed is tied to strings which are then attached to wooden sticks in the bottom (Fröcklin, de la Torre-Castro, Lindström, Jiddawi & Msuya, 2012). However, because of climate change the women farming seaweed have not been able to grow the higher valued species of seaweed in shallow waters which affects their income. IMS together with other actors have therefore started the SEA PoWer project that is introducing a new way of growing seaweed to women on Zanzibar. This new technique is used in deeper waters with tubular nets to plant the seaweed. This is done by going out with boats in the ocean where women cooperate with men who dive in the water to place the nets. The SEA PoWer project has bought netting materials, ropes for the tubular nets, anchors, life jackets, sun hats and gum boots for the women participating in the project. This allows the women to once again farm the higher valued species of seaweed and cope with the effects of climate change (Institute of marine sciences, 2017). The most important resource for the women, according to Dr. Narriman Jiddawi (personal communication, April 21, 2018), is a boat which is also provided by the SEA PoWer project. The SEA PoWer project aim to create the change that is needed for women to develop their economic and social status in their communities (InnovationXchange, n.d.).

## 2. Previous research and theoretical framework

This chapter outlines previous research regarding livelihoods, seaweed farming and feminist political ecology. Definitions on feminist political ecology, livelihood and gender will be presented. At the end of the chapter, an analytical summary is given where this study's definitions and approaches are described.

### 2.1 Livelihood

Livelihood is an important word to define in this paper since women's livelihoods are the focus of this study. How have previous researchers defined livelihood? For example, Fröcklin et al. (2014), defined it as "the assets (natural, physical, human, financial and social capital), the activities and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household" (Fröcklin et al., 2014, p. 2). Another definition was given by Hanass-Hancock, Misselhorn, Carpenter and Myezwa (2016) who wrote that a sustainable livelihood is the capitals that form the assets, activities, and capabilities that are necessary for living. The livelihood capitals are the same as Fröcklin et al. (2014) has described. However, Hanass-Hancock et al. (2016) and the Department for International Development (1999) offered definitions on each capital. Financial capital can be income, in terms of cash or equivalent. Available stocks and regular inflows of money are two ways to hold financial capital. Available stocks can be life stock or jewelry and regular inflows of money can be remittances, transfers from the state or earned income. Social capital can be relationships with others, membership of groups, networks and can be the basis of informal safety nets. Physical capital can be infrastructure in terms of transport and secure buildings and shelter. Natural capital can be water, air and resource-based activities such as fishing and farming. For the last capital included in livelihood there are different definitions, according to Department for International Development (1999) human capital includes skills, knowledge, the ability to work and good health. However, according to Hanass-Hancock et al. (2016) human capital is level of education and does not include health in that definition. Hanass-Hancock et al. (2016) used the definition of livelihood to investigate how both men and women with HIV could rebuild their livelihoods. The findings of that study were among others, that women had it much worse than men when it came to the capitals included in livelihoods. It was also found that livelihood capitals had correlation with health factors. For example, depression resulted in a higher food insecurity (Hanass-Hancock et al., 2016). Fröcklin et al. (2014) studied men and women working within invertebrate fisheries on Zanzibar to see if there was a decrease in invertebrate abundance, if it affected catch composition, and if this resulted in gendered differences regarding income between men and women. The results were that there were gender inequalities regarding the chance for livelihoods between men and women on Zanzibar. Women were often more valued for their reproductive role in society rather than their productive role. Because of women's reproductive role they had a lack of free time and limited mobility. Furthermore, this reduced the women's chances for gaining financial, social, physical and human capitals.

## 2.2 Seaweed farming: women and gender

Scientists who have previously researched seaweed farming have had different aims and therefore different results. A case study research by Msuya and Hurtado (2017) resulted in five examples of success stories, women who had changed their life for the better through seaweed farming. Msuya and Hurtado (2017) pinpointed the positive effects that seaweed farming had when it comes to women's livelihoods but also highlighted the challenges they faced because of climate change (Msuya & Hurtado, 2017). This is relevant to this study since the aim was to investigate if that success still applied when women were working with a new technique of farming seaweed and to see if there were any differences between farming in the old and the new way. However, there was also an interest in looking at the negative effects of seaweed farming. Other scientists have shown a more sceptic view of seaweed farming or aquaculture. Hedberg et al. (2018) have studied women who grow seaweed in Zanzibar and have concluded that women who grow seaweed do not know how to swim or have access to boats. This caused them to be "banned" to shallow waters. In a gender perspective it was therefore important to note the competition for space to farm seaweed and the habitat preference for it. Nearly all farmers, both male and female, farmed on shallow waters that you can walk out from even at a tide. However, the farmers expressed that they would prefer to farm in deeper waters if possible. In the interviews 93 percent of the farmers, both men and women, thought the most important habitat factor for seaweed farming was the depth of the water since seaweed should not be exposed to sun and dry for too long. Most farmers were happy with their site of farming, but some said that strong winds and currents caused them trouble. Some farmers mentioned having to move their farms because of too shallow water, because hotels had driven them away or that seagrass had reduced because of their farms (Hedberg et al., 2018). This is particularly interesting since this research aimed to look at only women who farm seaweed and to see if women and men experienced conflicts of interest because of the new technique of growing seaweed. As Hedberg et al., (2018) wrote, farmers of both genders have expressed a desire to farm in deeper waters. This is now being implemented because of the new technique. What this study aimed to do was to see how women farming with the new technique felt about working on deeper waters and in a different way from before.

The difference in the use of ocean space depending on your gender was discussed and investigated by Fröcklin et al. (2014), she was also pinpointing the differences between men and women when it came to restrictions of working in the ocean. A decline in valuable species of invertebrates had forced men to be involved with other species and in shallower waters previously only occupied by women. This could exclude female harvesters from any good fishing grounds. Women were more restricted to work only by low tide which could be 3–5 days a week. Men could work on a daily basis. There was a difference since women had little or no access to boat transports and lack of equipment such as snorkels etcetera. Men had a clear advantage as they could access transport and equipment and therefore use several techniques in harvesting. Women had to pay for transport and did not always know how to use the same equipment as men, which made the men less dependent on others than women for harvesting. Something noticed in the in-depth interviews was that men in the households were in charge of income and most of the decision making while women should take care of the home and

experienced very little free time. Men and women found invertebrates very important for income and between 2005 and 2010 women's income increased, while men's decreased (Fröcklin et al., 2014). These authors wrote that the competition between men and women could exclude women from good fishing grounds which was very interesting to further investigate (Fröcklin et al., 2014). That is why this study aimed to find an answer to the research question "Does the old and the new techniques cause conflicts of interest between women working with seaweed farming and men working within fisheries when it comes to the use of ocean space? If so, how?"

In order to answer our first research question "How do women perceive and experience positive and negative effects of the old and the new techniques of growing seaweed on Zanzibar?" it was important to note that a lot of research had already been done on women's perceptions of the old technique. According to Nordlund et al. (2010) decline in seaweed growth has, in turn, had a negative effect for the livelihoods of the harvesters, giving them less catch weights and the effort of harvesting had clearly increased. Previous research has both pinpointed positive effects of seaweed farming with the old technique but also challenges with it. According to previous researchers, female seaweed farmers experienced many health issues during their work. As Fröcklin et al., (2012) wrote, tiredness and different kinds of pain were common among seaweed farmers and the workload was heavy in comparison to what income they got for it. However, even though much research exists on the old technique this study aimed to collect data about it as well. Furthermore, it was desired to get an overview of the old technique in order to compare it with the new technique regarding women's perceptions of positive and negative effects on their livelihoods.

As Msuya and Hurtado (2017) wrote, women were directly affected by climate change since they could no longer grow the more popular kind of seaweed. Instead, they had to produce another species which did not generate as much income for them. Since this was a problem, it was important to ask the women what kind of seaweed they grow with the old technique and with the new one in order to compare their income from selling seaweed.

### 2.3 Feminist political ecology

Feminist political ecology is a theory that has previously been used when looking at women and their livelihoods. Feminist political ecology, hereby called FPE, started as a growing western feminist engagement and approach of women, gender, and development. In the 1990's studies about women, environment and development became important for development institutions. In Africa studies about environmentally-related subsistence crises for rural women were conducted. Later on, FPE was developed and this theory also focused on the importance of social institutions, gender relations and global processes (Goebel, 2004).

The theory of FPE has previously been used by, among others, Hanson (2016) who used the theory to explain how gender division and the knowledge of women were an important part of understanding environmental change and degradation. The focus of the theory is to analyze connections that are historical, material, and cross-cultural. These connections can be between

gender, power relations, labor and everyday practices. Gender, according to Harcourt (2016), is defined as a socially constructed phenomenon rather than determined by biology. Through policies, actions, and practices that shift over time, gender is reproduced (Harcourt, 2016). According to Hanson (2016), gender is also important to other factors such as ethnicity, race, and class. All of these factors relate to how socio-environmental change, material and symbolic connections to resources and spaces have consequences for ecology and social difference (Hanson, 2016). Harcourt (2016) describes FPE as analyzing gender as a social category that shapes relationships with nature. FPE looks at gender, power, and knowledge in environmental and livelihood processes. Furthermore, Harcourt (2016) wrote that the key to FPE is “the search for good living, secured livelihoods and the ‘sustainability of life’ with a focus on interdependencies between people and ecosystems” (Harcourt, 2016, p. 1009). To have a sustainable livelihood, according to FPE, requires satisfaction of fundamental needs such as clean water, housing, gender equality, meaningful and diverse labor, nutrition and ecological balance. For FPE, livelihood is, therefore, more than meeting your economic needs. FPE also looks at everyday practices, everyday needs, labor, and connections with the environment (Harcourt, 2016).

This theory is relevant for the study because of the focus on women and the coping strategies they need to adapt because of climate change. The new technique of growing seaweed is necessary to cope with climate change, but an important question to ask is if it will be better or worse for the women’s livelihoods. This study aimed to answer three research questions which are how the women perceive and experience the old and the new techniques, how they affect their livelihoods, and if there are any conflicts of interest with men regarding access to ocean space. According to feminist political ecology you should analyze connections that are historical, material and cross-cultural. The research questions for this paper was analyzed through similarities and differences between the old and the new techniques of farming seaweed and the changes that had occurred for the livelihoods of women farming seaweed during the years. The connections are related to labor, everyday practices and gender. As FPE also describes, livelihood is more than just meeting your needs of income, it is suitable for this study since the aim was to look at how changes in how the women created their livelihoods and how that affected the livelihood itself. Livelihood is more than money, it is also about everyday practices, work, and connections with nature which are all dimensions that this study aimed to look at.

## 2.4 Summarizing analytical framework

In previous research there was often a research question with a focus on natural science at first and the question of livelihoods came second. There has been research done with a pure focus on women, but not in the area of seaweed farming. Previous research has not been made on the new technique of farming seaweed on Zanzibar which is the main reason for that being a focus of this study. In comparison with previous research this study makes the women and their livelihoods the main focus.

This study is based on a feminist political ecological approach and definitions of livelihoods and gender. Livelihood is defined as the activities, assets, and capabilities that are necessary

for the women's life. The capitals that are included in livelihood for this study derives from Hanass-Hancock et al. (2016) and are financial capital (income) human capital (education), social capital (relationships), physical capital (infrastructure) and natural capital (water and air). In difference from previous definitions of livelihoods, this study adds another factor, which is health. This factor is added because of the important effect it has on livelihoods. The reason for including health in this study is that if women have health issues it affects their ability to work. Department for International Development (1999) included health in the definition on human capital, but in this study, health is a separate factor because of the impact it can have on the women's life.

FPE is applied to understand women's livelihoods through relations between labor, everyday practices and gender. When looking into the livelihoods of women, FPE as a theory is useful as it explains the meaning of a sustainable livelihood. It is about more than income, it is also about everyday practices, work, and connections with nature which are all essential parts of the female seaweed farmers life's. The definition on gender from Harcourt (2016) is used in this study and defined as a socially constructed phenomenon rather than determined by biology that is reproduced through policies, actions and practices that shift over time (Harcourt, 2016). For this study factors as ethnicity, race and class is ruled out. FPE is also used to analyze connections between resources and space in relation to socio-environmental change. However, the first and most important use of FPE in this study is to analyze women's livelihoods through their labor and everyday practices. Environmental factors are analyzed as well, through questions about changes in seaweed quality but is not the main focus of this study. In turn, the research questions are answered through the lens of livelihood, FPE and gender.

### 3. Method and data material

This chapter is structured around five headlines, choice of method, selections and limitations, ethical guidelines, interview guide and data collection and processing.

#### 3.1 Choice of method

Semi-structured interviews were conducted as the method for this qualitative study. Structured interviews or a quantitative study were not selected as methods since those methods aim to have specific questions to gain specific answers. Such questions reflect the scientists interest and not the respondents. Qualitative interviews are better suited since the aim was to find the respondents views and perceptions. It also allows the scientist to get deep and detailed answers. Furthermore, since semi-structured interviews were chosen an interview guide was followed (see appendix: Interview guide). Themes and main questions were formulated but there was space for new questions and follow-up questions as the interview was carried out. It is a flexible method and gives the respondent time and space to explain events in the respondent's life and give explanations to it (Bryman, 2011). An open interview would not have been suitable since

it would not involve any prepared interview questions. For this study it was crucial to get answers to certain questions in order to be able to answer the research questions. By using an interview guide it could be ensured that the answers necessary for the study was collected. In depth-interviews as a method was not selected partly because it would have been harder for a translator to cope with. Furthermore, important information could have been lost in the process. Another argument for not choosing in-depth interviews is because the method is time-consuming and in this study the aim was to interview as many women as possible.

### 3.2 Selections and limitations

For this study, women were chosen as the target group because they are the main actors in seaweed farming on Zanzibar and because the majority of actors in the SEA PoWer project are women. Eleven women were selected with the help of this study's contact person at IMS. Twenty-four women are participating in the SEA PoWer project and the selection of the women was a targeted selection. A random sampling was not possible since there was limited access to women who had tried the new technique of seaweed farming. There were two villages, Nyamanzi and Muungoni, where women used the new technique which also limited the locations for the interviews. There was no age limitation when choosing which women to interview as long as they were above 18 years old. However, an important criteria was that they had experience with the old and the new techniques of farming seaweed. In total eleven women were interviewed, four in the village Nyamanzi and seven in the village Muungoni.

### 3.3 Ethical guidelines

This study has followed the ethical guidelines for Swedish research when conducting the interviews and the women have been informed of their right to immediately cancel the interview or skip questions. The women were anonymous, and their names was encoded in the study and replaced with fictive names. That the study followed the ethical guidelines for Swedish research means that the Information demand, Consent demand, Confidentiality demand and Using demand was followed. That meant that as researcher, you are responsible to inform the participants about the purpose of the study, that you get their agreement on participation, that you treat the information you get with highest confidentiality and that you will not use the facts collected for anything else than the purpose of the research (Bryman, 2011). The interviews were recorded with a dictaphone if consent was given from the respondents and the collected data material was after that transcribed. The women were informed before starting the interviews that they would be anonymous. The aim of the study was described, and the researchers of the study introduced themselves as students from Sweden. After that the women were asked to give their consent to participate in the study, at last they were asked if it was okay to record the interview. The women were informed that the recordings would only be heard by the researching scientists and that the recordings would be deleted after transcribing.

There are challenges with recording the interviews, partly because you need consent from the interviewee to do so. Furthermore, a recording can make the respondents worried, self-conscious and throw them off track because their words will be saved and possibly shown to the world (Bryman, 2011). Therefore, risks were reduced as much as possible, firstly, by telling the respondents that the interviews would only be heard by the researching scientists and that only parts of their words in the written text would be shown in the final draft of this study. The researching scientists were prepared for if the respondents did not want to be recorded. If that happened one of the two researching scientists took notes during the interview and one asked the questions and observed the respondent's reactions.

Another important thing to note with recording interviews is that even if the interviewee agrees to be recorded, they can still be uncomfortable. This can affect the respondent's answers to the questions. In the field, the researching scientists of this study experienced that most women were hesitant to be recorded but gave their permission. This can have affected the results of this study if the women felt that they could not tell the truth because of the recording. However, the researching scientists experienced that the women were relaxed during the interviews and shared their stories without leaving things out. It felt like they were truthful even though recordings occurred. The women had a similar background to each other and this could have resulted in similar answers when doing the interviews. Another factor that could have given similar answers and something that is worth considering was that the women were living in the same villages. Therefore, they could have talked to each other in advance before the interviews since they all sat and waited together before the interviews.

### 3.4 Interview guide

A challenge with semi-structured interviews is to always ask neutral questions and for the scientist to keep her/his professional role. In an interview, it is important that the scientist does not express any of her/his own opinions on the subject or try to steer the conversation in a certain direction. At the same time, the interviewer and interviewee need to have some level of trust between them so that the interviewee feels free to speak the truth (Hjerm, Lindgren & Nilsson, 2014). Therefore, the interview guide used in this study started with some background questions, in order to make the respondent more comfortable. The interview questions were carefully formulated by the researching scientists and were reviewed several times. Furthermore, the interview guide was read by both the researching scientists contact person at IMS and their supervisor at Jönköping University. This ensured that the interview questions were neutral without any individual values or opinions being expressed through them. An interpreter provided by IMS was used in order to conduct the interviews in Kiswahili. A female interpreter was requested since questions about conflicts with men were asked in the interviews. Therefore, it was believed that a female interpreter would fit the situation best and increase the trust during the interviews.

In the interview guide, three themes were included, those were growing seaweed with the old technique; growing seaweed with the new technique; and value addition to seaweed. From the beginning, only the first two themes mentioned were a part of the interview guide. However,

two test interviews were made in order to see if the questions were relevant and answered the research questions for this study. The findings of the test interviews were overall good, but some questions were reformulated, and some were added. The main issue seen was that an important factor was missed regarding the women's livelihoods from seaweed farming. Many women who work with seaweed farming for a living also do value addition to seaweed. This means that they make soap, shampoo, cleaning products and so on from the seaweed they collect and then sell these products. Since it affects their income from seaweed farming, this was added as a theme in the interview guide.

Furthermore, the interview guide was formulated with reference to previous research and the questions were thoroughly overviewed. There was a mix of deeper questions and short answer questions. During the interviews it was not of high significance that the interview guide was strictly followed, on the opposite, follow-up questions were used and the interviewee was free to speak about the things that came to mind. The interview had three background questions and then nine questions followed regarding the old technique of growing seaweed. There were then twelve questions regarding growing seaweed with the new technique. If the women had done value addition to seaweed, there were six questions regarding that.

An important thing to ask in the interviews was how seaweed farming had affected the women's life and livelihoods since previous research has discovered that women experience a better livelihood because of seaweed farming. To be able to compare the old and the new techniques it was important to ask what kind of workload the women experienced with both techniques since previous research suggests that women need to harvest in longer periods of time due to climate change. Since this study included health in the definition of livelihood, the interview guide was designed to compare health effects with the old and the new technique of seaweed farming. Another important factor was if harvesting techniques affected the time women needed to spend on harvesting. Since this study was investigating the livelihoods of women an important question to ask was if they had other sources of income besides seaweed farming since this would affect their livelihoods. Another factor was that different species of seaweed generates more or less income, that was why the interview guide had a question about that. Previous research has also shed light on the problem with ocean space. The ocean space is used by both men and women which can cause conflicts, which was why it was included in the interview guide. Women on Zanzibar has in previous research expressed that there are more women harvesting now than before which affects the seaweed growth which caused the researching scientists to ask if there were conflicts between farmers as well.

### 3.5 Data collection and processing

Each interview took 15–45 minutes. The aim was to record all the interviews to not miss out on any important information. Only two out of the eleven interviews were not recorded and were only written down during the interviews. The recordings and notes from the interviews were transcribed immediately after they were conducted the same day. There are many chal-

lenges with transcribing, such as the time it takes to do it. The recordings and notes were transcribed simultaneously to eliminate possibilities, such as hearing wrong from the recordings, getting tired of listening and being sloppy (Bryman, 2011).

The interpreter that was used to translate the interviews was a woman from Zanzibar who had good knowledge in both English and Kiswahili and no previous relationship to the respondents. The importance of having a woman to translate the interviews was to ensure that the women that were interviewed would feel as comfortable as possible, especially when some of the interview questions were regarding if there had been any conflicts with fishermen in the term of using the ocean space. Worth noticing was that the interpreter did not hold any official license to translate so it was of great importance for the researching scientists to inform the interpreter to translate as correct as possible and not change or add anything to the answers given by the respondents. Due to the use of an interpreter, consideration was taken that important information might have been changed or lost in the translation process. To prevent misunderstandings and errors a meeting was held before starting with the interviews together with the researching scientists and the interpreter to ensure that the interpreter understood the meaning of the interview questions.

The gathered data material from the semi-structured interviews were analyzed through qualitative coding. Themes were carefully identified when going through the large amount of information. The analyzing of the gathered data material was made on the written text after transcribing the recorded interviews and notes. After this, the data material was analyzed several times by both of the authors individually to ensure a higher accuracy. In this study, the analysis was carried out through using codes that originated from the data material. This was done in order to find variations and unexpected patterns (Hjerm et.al., 2015). Firstly, the data material was analyzed carefully and with an open mind to let categories and ideas evolve in relation to the research questions of the study, creating preliminary codes. Secondly, codes that seemed to relate to each other created themes also analyzed in relation to the research questions of the study. The researching scientists individually selected codes that were compared to ensure that the themes selected were not affected by their opinions. The data material was later presented in this study's result chapter under the chosen themes. Relevant themes to this study which came through the analysis of the gathered data material were: Reasons for starting with the new technique; Perceptions of the old technique and its impacts on livelihoods; Perceptions of the new technique and its impacts on livelihoods; Self-development, hopes, and expectations; and Conflicts of interest. Due to the use of an interpreter, some rewriting has been made and some quotations from the respondents have been altered to make them more understandable. The rewriting of quotations meant in this case to sometimes shorten or eliminate too much of colloquial language. The quotations from the women in the result of this study are sometimes representative for several women and some quotations are used to exemplify.

This study did not aim to generalize but rather to illustrate and retell the women's stories with the help of the data material and quotations from the interviews. The results were analyzed in relation to this study's previous research chapter which concludes the theory of FPE; definitions of livelihoods and gender; and previous research. Semi-structured interviews were chosen

to give the respondents the opportunity to explain their feelings and perceptions around the study's research questions, which enabled a deep knowledge through the data material.

## 4. Results

The results were processed from our data material that were collected between 18th of April to 2nd of May. When processing and coding the interviews, it resulted in five main themes which are presented here. First, background of the women who were interviewed will be presented.

### 4.1 Background information on women

Here follows background information on the eleven interviewed women, showed in the table below, to help get an overview on their individual backgrounds.

Table 1.

*Background information on women*

Name	Age	Years cultivating seaweed	Marital status	Children in household	Other sources of income
Julia	45	10	Husband	9	Cook food to workers and sell vegetables.
Lauren	45	15	Husband	7	Buy vegetables and later sell it in her village. She also makes bread and sells it.
Isabella	43	15	Husband	6	Sell bananas and cassava.
Grace	47	18–19	Husband	6	Cut firewood and sell it.
Sarah	48	25	Husband	2	Sell cassava and other vegetables.
Natalie	22	5	Husband	0	No other sources of income.
Jasmine	43	18	Husband	4	Cut firewood and sell it.
Rachel	44	12	Husband	4	Farm cassava mostly for household use.
Megan	24	10	Husband	3	Farm cassava mostly for household use.
Angela	48	20+	Husband	6	Cut firewood and sell it as well as selling coconuts.
Brenda	60	20+	Divorced	0	Farm cassava and beans for household use.

*Comment.* The table is showing an overview of the background information on the eleven interviewed women. The table is showing their fictive name, age, years cultivating seaweed, marital status, children living in the household and if they have any other sources of income besides farming seaweed

The eleven interviews with the women were conducted in two villages on Zanzibar. Four interviews in the first village, Nyamanzi, and seven interviews in the second village, Muungoni. The women had been using the new technique between two to twelve months depending on which village they came from. All of the women were only planting and harvesting the more valuable species of seaweed *Kappaphycus cottonii* when using the new technique. Five out of

the eleven women, Sarah, Natalie, Rachel, Angela, and Brenda were growing both *Kappaphycus cottonii* and *Eucheuma spinosum* when using the old technique. The rest of the women were only planting and harvesting *Eucheuma spinosum* when using the old technique. The women were spending two to eight hours per day when farming with the old technique and one to five hours per day when farming the new technique. The women usually farmed the new technique fewer days in the week compared to the old technique or they spent approximately equally many days for the old and new techniques per week. Meaning that the women were farming the old and the new techniques at the same time. Most of the women had a one to two hours long walk to the seaweed farms from their home.

Nearly all the women had some sort of additional income which could mean cooking and selling food to workers, firewood collection, farming vegetables and selling bread. Some women did only farm vegetables for their own household use. Julia said: “If seaweed would be a higher market I am ready to remain in seaweed farming only. But due to the low market, I have decided to deal with other activities like selling food to workers”.

#### 4.2 Reasons for starting with the new technique

The main reason for choosing to start with the new technique was because the interviewees heard about the technique from someone else or that they were visited by someone who suggested it to them. Julia said that there was a Chinese person who came and visited them together with two doctors from IMS. Julia said that she got information about the new technique, education about the value of it and how they were going to benefit from it. After this, she decided to use the new technique. Another argument to start with the new technique was that the women heard about it and that Cottonii was used which has a high market, compared to Spinosum. Grace said this was her reason:

That it came people like you (talking about the interviewers), come and tell us you have to use this kind of technique. Please do this technique it is good for you and you can benefit. So, we started to use. We are feared because we do not know how to swim.

There were other reasons for starting with the new technique such as that the challenges of the old technique which made them want to try something else, together with education about the new technique they decided to give it a try. Jasmine said that the seaweed got destroyed when she was using the old technique in shallow water and that was why she wanted to try growing seaweed in deeper water. According to Natalie, the new technique was done with a distance from other fishers or farmers which made it easier to farm. Many women said that they heard good things about the new technique and that the seaweed grows well with it. They wanted a new technique and wanted to see the results of it.

#### 4.3 Perceptions of the old technique and its impacts on livelihoods

All the women expressed that their income had increased thanks to seaweed farming and that the income from seaweed farming had helped them in their home activities. The majority of

the women expressed that they felt happy to contribute to the family's economy. When asking Julia how she felt when she was starting to grow seaweed she expressed herself: "I was happy because I knew that I was going to get money that could improve the livelihood of my family." The money that the women got through seaweed farming enabled them to buy things for their family. Julia, Lauren, Grace, Megan, and Angela mentioned that the income from seaweed farming enabled them to pay for their children's school fees and school uniforms. Brenda, Angela, Rachel, Jasmine, Grace, Lauren, and Julia mentioned that they bought things for their homes like soap, food, clothes, and other things for household needs. When asking Jasmine how she was affected when she started to grow seaweed she answered: "I thank God. I did not have many things before I started with seaweed farming. It has helped me to get an income and I have bought a lot of things so far."

Isabella, Sarah, and Jasmine said that their income had been a bit reduced since they started to farm due to changes in the seaweed. Jasmine said: "Before, when I was planting the seaweed, it was growing very fast, but now it takes time. [...] before I got quick money but now it is a little slow. It is a problem and producing less money than before". Sarah, Jasmine, and Angela expressed dissatisfaction with the market for seaweed. Jasmine said: "It is a lot of work but very little payment" and Sarah said that she would like an increased price from the government on seaweed.

Nearly all the women had experienced some sort of negative impact on their health when farming seaweed with the old technique. Julia, Natalie, Rachel, and Brenda said that they got "stings" when walking without gumboots and Julia said that there are some fish she has been bitten by. Sarah, Natalie, Megan, and Brenda mentioned that they felt that their health was affected due to the hot temperature in the water during sunny days. The women had a far distance to walk back and forth to the seaweed farms, sometimes one to two hours walking. Most of them had no other transport opportunity than to walk by foot. Julia, Natalie, Rachel, and Angela mentioned the distance to the seaweed farms being difficult for them during hot days. Julia mentioned that the seaweed was heavy to carry for such a long distance as well. Jasmine mentioned that her health depended on which season it was: "During the Northeast monsoon, the sea brings something that makes my body itch. At one time I even had to go to the hospital, but I got medicine and got okay".

Julia mentioned that her health got negatively affected when she was drying the seaweed. "Seaweed is not only seaweed, it contains other rubbish, so when I am cleaning and drying the seaweed I am getting a flu". Other negative health effects that the women mentioned were that their eyes hurt from the sun, back and chest pain from carrying seaweed long distances, cuts in the hands from shells in the water and that it was not good to sit too many hours in saltwater. Despite these health effects, Julia and Natalie expressed that there was no health effect that would make them stop farming seaweed. Natalie said: "I will continue to farm seaweed because it gives me some income".

Lauren, Isabella, and Grace had not experienced any negative effects on their health when farming seaweed with the old technique. Grace and Lauren even explained positive outcomes to their health thanks to seaweed farming. Grace said that the money that she got through seaweed farming had helped her with her health. Lauren was able to quit with firewood collection

that she had as an additional income source before she started with seaweed farming. She said: “Before I started with seaweed farming I was collecting firewood to get an income. It made me tired and I used a lot of energy when cutting the firewood. It was difficult for me”.

All the women had experienced some sort of change in the seaweed throughout the years. Julia, Lauren, Sarah, Natalie, Megan, Angela, and Brenda mentioned temperature having a major impact on the seaweed’s quality and growth. Julia, Lauren, Natalie, Rachel, and Angela said it was due to the different seasons and that warmer temperature in the seawater made the seaweed rot and catch diseases like “*ice-ice*”. Isabella, Grace, and Jasmine had experienced algae on their seaweed which reduced the seaweed growth. Grace said: “So first when I plant seaweed I have to remove all that and then I can plant the seaweed [...] It is something that grows above the seaweed”. Jasmine said that she had noticed the seaweed being gone due to strong winds and Brenda said that the fish sometimes eat the seaweed.

#### 4.4 Perceptions of the new technique and its impacts on livelihoods

All women who participated in this study felt that the new technique of seaweed farming was good. They were happy because they could produce the higher valued species of seaweed which they call Cottonii. According to the women, they would benefit more from this than from the old technique where most women grew seaweed called Spinosum. Another positive side of seaweed farming according to some women was that they now did not have to carry seaweed from the ocean anymore because they had a boat. The women were happy about the new technique and they said that their families were happy as well. Julia said:

Also my family is happy because there is change about home activities. Before after going to the seaweed I call my children to come carry the seaweed. So in this new technique, they will remain at home because a boat will come out. So it will be simple to them and I’m happy.

For some of the interviewees, the family’s approval seemed important, as they mentioned that their husbands were fine with the seaweed farming, that their families were encouraging and that the families had accepted it. Reoccurring among the interviewees was that they said that their family was happy about the new technique of seaweed farming.

Some of the respondents thought that the new technique was easier than the old one and they felt very happy about that. According to Natalie it was easier because she only needed a net and then she could plant which relieved other complications as the need to cut trees for sticks in the old technique. Megan felt that the seaweed grew faster with the new technique than with the old one. Lauren was quite confident that the new technique would be better than the old one. She said: “We are happy, because we know our income will increase and everyone knows money is everything”.

The women have mentioned some negative aspects of the new technique of seaweed farming even though all women were overall happy with the new technique. One thing that was mentioned is that even though Cottonii provided a higher income, it was also more expensive to purchase. Sarah said that when they started with the new technique they had thin nets which did not work well, but when they got bigger nets the seaweed grew very well. Another difficulty

for them was the rain season, because of the rain they did not have anywhere to dry the seaweed after harvest. Another problem noted was that fish sometimes eat the seaweed. Jasmine felt that the new technique took more time than the old since they have to stitch the nets, use the tube and then go out with the boat. However, Brenda, Angela, Megan, Rachel, and Lauren said that the two techniques took the same amount of time. A negative aspect that many of the women agreed on was that the income they got from seaweed farming was low compared to the workload they had. The new technique was also more expensive when it came to equipment according to Angela, this since they needed a boat, net, tube, and rope to the anchor. Brenda said making the net was the only difficulty with the new technique. Angela was worried about the cost of the equipment and said that it was only possible to continue in a group, on your own it would be too expensive. Jasmine said this when asked about what she thinks of the new technique:

For me, it feels like it takes more time with the new technique than the old one. Because you have to stitch the nets, you have to use the tube, and then you have to go with the boat up there and then put it there. I'm so used to the old one that I just put it there with the rope and tie. But when it grows, it is a lot.

Some women expressed that they were doubtful, feared, worried or scared when first hearing about the new technique. Mostly, they were worried about being out on deep water and not knowing how to swim. Another worry was that they did not know how the technique would work. However, all women felt that the technique was going well and that they got used to working with it. Natalie said "Initially I felt it was going to be very difficult and wondered if it was manageable. But now I think it will be possible to do it" when asked what she thought about the new technique.

When it comes to health all women stated that there was no effect on their health when using the new technique. The women said that since they did not deal with the new technique for so long they did not have much experience with health issues yet. However, some women said that the equipment, like rain boots and the boat, helped them with their health. With boots, they did not get sticks/stings and with the boat, they did not have to carry seaweed or walk as far. They could also do preparation of the seaweed in the shade before they did this in the water where the sun could affect them. All women have stated they were in "normal health" or "not affected".

Regarding income, all women agreed on that they did not yet collect any income from the new technique of seaweed farming. They were in the early stages of the new technique, some women had only grown it for two months and some women for six months or more. The women from the village Nyamanzi had only tried the new technique for two months and therefore they had not done any harvesting yet. The women from the village Muungoni had tried the new technique for six months or more and had harvested seaweed. However, the women stated that all harvest went to planting and cultivating new seaweed. They kept the money as a group and bought more seeds to replant. They also had basket traps below where the seaweed grew which gave them some fish that they divided between each other. Therefore, the women said that they could not see what their income would be in the future. However, many women hoped and felt

that the income would be higher since they thought the seaweed was growing well with this new technique. Natalie described it as:

We have grown and sold a little bit, but it is not for me because it is still in a group format. So we are selling as a group and cannot see how much income because we are in a group and using it in a group. We are also using it to buy seeds.

Furthermore, Brenda said: “When I used the old technique, the income increased with the new one we haven’t divided the income between the group yet we have just bought more seeds. We divide for ourselves only to eat. We also get fish in the basket that we divide”.

#### 4.5 Self-development, hopes, and expectations

During the interviews all women but two expressed feelings of independence, self-development, or education. Julia, Isabella, Sarah, Natalie, Rachel, Megan and Angela expressed an eager to be taught how to swim as it would help them to cope with the new technique of farming seaweed since they used a boat to go out on the ocean. The women felt that they were ready and happy to learn how to swim, they looked forward to it. It would also help them in other activities that were done in the sea, such as collecting shells. However, the women also expressed that they were feeling safe despite not being able to swim as they used life-jackets in the boat. Brenda stated “I know a little bit how to swim so I’m not scared. We also wear life-jackets”. Furthermore, Rachel said “I would be really happy to learn how to swim. And I’m ready to do it”.

Megan, Angela, Julia, and Sarah talked about independence from men regarding both the old and the new techniques. Megan stated that when she started doing seaweed farming she was no longer depended on her husband, she said: “I got money, I could buy anything I wanted, I was not depending on my husband” when asked about how it was to start seaweed farming. Angela said that she got empowered economically from starting with seaweed farming. Julia and Sarah said that they want to be able to go out on the boat with the new technique alone and without men. Julia said when asked how it was working with men when using the new technique:

When we are going there in high tide we take three men because we don’t know how to swim. But now we are happy to be taught to swim because the group is only for women and we want to remain only women. So when we know how to swim we will go alone without the men. Women empowerment. We don’t want to depend on men.

Besides from learning how to swim, the women also expressed that they had received education about seaweed farming and that they were prepared to learn more. The education was mainly about the new technique which the women thought was good and helped them deal with the seaweed farming activity. The women were happy about a chance for development in seaweed farming and had gotten education from neighboring villages or people from the outside. Rachel said “I’m happy. Because it is development, because it is a new technique and I’m learning something new”. Furthermore, Julia said “I’m happy and happy happy [...] I’m ready to learn more and more about seaweed farming”.

The women's hopes and expectations with the new technique were many. Julia, Lauren, Rachel, and Jasmine mentioned that they were hoping to get more money out of the new technique compared to the old one. All the women were waiting for the results of the new technique and was at the moment a group-based project. Jasmine said when answering to the question about how she would feel to be able to do the new technique individually later on: "We are still in a group but maybe it could be nice to start individually later on but I do not know yet."

The women were doing both the old and the new techniques and Julia said: "I am torn between the old and the new techniques and I want to get a result. Which seaweed will be the best, have the best quality? Which harvesting technique will be the better way?". Lauren said that she was happy for the education that was brought with the new technique. The education gave her hopes and expectations:

I am happy, because, I have already got education compared to the old technique. We have gotten education about the new technique, that we can get benefit, that it has a higher price. We are prepared to get that "fruit" that has been told to our village. To get benefit!

All the women mentioned that they were not doing value addition but if they would get the chance to learn they would be happy to do it. Julia said this when asked about the value addition of seaweed: "We need a trip to visit the place where they use the values of seaweed. [...] But we do not have the knowledge and no tools, but we are ready to do it. It is difficult when there are no tools or any support for that".

#### 4.6 Conflicts of interest

To answer this study's third research question "Does the old and the new techniques cause conflicts of interest between women working with seaweed farming and men working within fisheries when it comes to the use of ocean space? If so, how?" data material on conflicts have been collected. Six out of the eleven women who participated in the study said that there were conflicts with fishermen when using the old technique of seaweed farming. All women who claimed this said the problem was the same, that the boats with fishermen passed their seaweed farms and knocked their sticks down which were holding the seaweed. This made the women feel very bad and they got more work to perform since they needed to put up new sticks again. Some women expressed helplessness since the ocean was for everyone and they could not tell the fishermen where to go. Angela said: "The fishermen's boats sometimes knock my farm, but what can I do, the ocean is for everyone. I can't say anything, I just have to accept it" when asked about conflicts of interest regarding ocean space. However, Julia and Sarah stated that they had resolved the conflict either by speaking directly to the fishermen or by going to the leaders of the village.

Lauren, Isabella, Jasmine, Megan, and Brenda did not experience any conflicts with fishermen when using the old technique of seaweed farming. All of the interviewees expressed that there was no conflict at all when using the new technique so far. Natalie stated that it was because their farms were distant, where boats did not pass. Another argument was that there was only

one farm using the new technique at the moment. Lauren expressed fear that it would be conflicts in the future between fishermen who could come from other places. This could be a future problem since they may not know the area and try to put their nets where the seaweed farms will be. The nets from the fishermen could take away the women's seaweed according to Lauren's statement.

## 5. Analysis and discussion

In this section, the results will be analyzed and discussed through previous research and the analytical summary of this study. Furthermore, suggestions for further research will be presented.

### 5.1 Changes in the livelihoods for female seaweed farmers

The perceptions and experiences of the old technique according to the women are both positive and negative. Negative in that way that the women experienced a decline in seaweed growth and negative health effects with harvesting with the old technique. Positive in that way that it generates an income for them and their family. The overall experience which all women had were that they had experienced a higher financial capital through the labor opportunity which seaweed farming gave. Since the seaweed farming created a labor opportunity for the women which made the women more independent. According to the women's experiences, the generated income from seaweed farming has had a clear positive impact on their livelihoods which enabled the women to buy things for their household and family. However, according to Hanass-Hancock et al. (2016), a sustainable livelihood requires more than a good financial capital. This study defined livelihood as financial capital, human capital, social capital, physical capital, natural capital, and health (meaning how the women define their health). A clear negative impact from harvesting seaweed with the old technique was the negative health effects many of the women experienced. Previous research had also found negative impacts on female seaweed farmers on Zanzibar who were using the old technique. According to Fröcklin et al. (2012) tiredness and different kinds of pain are common among female seaweed farmers and something that was also found when doing this study. Despite an increase in financial capital of seaweed farming the women's health were negatively affected. However, this study found that some women had been positively affected in terms of their health, such as being able to quit other jobs that involved more heavy work. Another positive effect was getting money from seaweed that had good effect on their health, possibly money that could be used for buying medicines or seeing a doctor. These women did not mention any other negative health effects when they were asked how their health was affected by seaweed farming when using the old technique. Therefore, there could have been similar negative health effects as the other women mentioned and maybe those women rather focused on the positive aspects.

As mentioned before a study by Nordlund et al. (2010) have already looked upon how women perceive and experience the old technique of farming seaweed on Zanzibar. The findings in

Nordlund et al. (2010) was a decline in seaweed growth that in turn created a negative effect on the livelihoods of the women harvesting seaweed which correlates with the findings of this study. Since most of the women had harvested seaweed with the old technique a long time they had noticed changes in seaweed and seaweed growth during the last decade. It was clear that the changes in seaweed, a decline in volume and diseases, had resulted in more work for the women and in some cases less income. This can be assumed to affect their livelihood negatively when seaweed farming in the beginning, enabled them to buy things for their household and family. The women's experiences of this decline were mostly because of rising sea temperatures due to different seasons but none of the women mentioned anything about climate change. The answers they gave could be related to climate change, as for example the rising sea temperatures which Mustelin et al. (2010) mentioned having a major impact on different species and sometimes causing different species to disappear and other species to establish (Mustelin et al., 2010). This seems to be the case for the algae that has started to grow on the seaweed which many of the women mentioned. Where the algae being the new species and the seaweed being the species that seem to disappear or decline. Other experiences that the women had regarding the change in seaweed do not necessarily seem to arise from climate change as due to strong winds and that some fish are eating the seaweed. What was clear was that these factors relating to changes in seaweed growth affects their livelihoods negatively. The change in seaweed growth has resulted in a change for their livelihoods in terms of financial capital. The theory of FPE according to Harcourt (2016), is therefore relevant in this matter since the women's connections to resources are changing due to environmental factors and force them to find other alternatives.

## 5.2 A decision for sustainable livelihoods

In order to understand the women better, a question in the interview guide was why they chose to start using the new technique of seaweed farming. By looking at this it was clear that the women had challenges with the old technique and therefore was eager to try a new one. The women chose to start mostly because someone else came and told them about the possibilities of the new technique which made them want to start using it. You could, therefore, say that they first got a bigger human capital to their livelihoods since they got education about the new technique. According to Hanass-Hancock et al. (2016), human capital is your level of education, in this case, the women increased their level of knowledge about seaweed. After this, you could say that they saw an opportunity to increase their financial capital through a new technique of seaweed farming since they were informed of the benefits from outside actors. In the view of FPE, this can be seen as a journey for a sustainable livelihood including clean water, housing, gender equality, meaningful and diverse labor, nutrition and ecological balance. The women chose the new technique believing they could improve their livelihoods. As Harcourt (2016) wrote, a sustainable livelihood is more than meeting your economical needs. Through the new technique of seaweed farming women have not yet seen any effects on their financial capital, but through the view of FPE, this is not all that matters. To increase your other capitals

can be equally important. The women are happy with the new technique and see it as an opportunity, so even though they had not gotten any money from the new technique of seaweed farming they were still satisfied.

### 5.3 A new technique, effects on livelihoods, and self-development

For this study's first two research questions "How do women perceive and experience positive and negative effects of the old and the new techniques of growing seaweed on Zanzibar?" and "How does the old and the new technique of growing seaweed on Zanzibar affect the women and their livelihoods?" several answers have been found. However, the results from the perceptions and experiences of the new technique, as well as its effects on livelihoods, are good but scarce. This is since the women have used the new technique for a limited period of time and they have not yet seen the full effects that the new technique could bring.

However, the perceptions and experiences of the new technique are mainly positive. The new technique provides a better chance for an increased financial capital since they can grow the higher valued species of seaweed namely *Kappaphycus cottonii*. Human capital was also increased since they were learning new things and tried new ways of growing seaweed. According to all women, there were positive effects on their health from the new technique since they were traveling in a boat (no walking distance) and that there was no need to carry the seaweed for longer distances. This was positive since many women had health issues using the old technique of seaweed farming. They had also increased their physical capital, partly with a boat provided by the SEA PoWer project but also with gumboots which prevented sticks and stings. As some women stated their social capital was also improved, mainly because their family was happy but also because the workload was reduced for the whole family. According to Hanass-Hancock et al. (2016), livelihood capitals are natural, physical, human, financial and social capital. Through the new technique, improvements are seen in human capital, physical capital, social capital and the women expected financial capital to increase. Through this view, one could say that the new technique had given the women better livelihoods than before. Fröcklin et al. (2014) wrote that women suffer consequences on their livelihoods because of their reproductive role in society and their lack of free time. This study has however, in contrary to Fröcklin et al. (2014), found that women gained human capital, social capital and physical capital through the new technique of seaweed farming. Even though no financial improvement has been noted yet. Apart from Fröcklin et al. (2014), the respondents of this study had not experienced lack of free time or mobility. However, the women are restricted from diving, where they still need the help of men.

There were some negative aspects that affected the livelihoods of women such that the seaweed they were growing with the new technique was more expensive to purchase. Another factor was the rain season which hindered the women from being able to dry the seaweed, this was however not a problem with the new technique itself. A direct problem with the new technique was that women have experienced that fish eat the seaweed in the water. The main perception was that the two techniques took the same amount of time, but one woman thought the new

technique took more time. A worry was that the equipment for the new technique was expensive. At the time for this study, the equipment was provided by IMS and the SEA PoWer project but if the women themselves would start this it would be hard. So even if their financial capital improved through the new technique, their physical capital needed for farming could cause them extra costs.

For the financial capital, the women had not noted any difference yet, except that the seaweed grew well which led them to believe that the income would be higher. At the time for this study, they were only reinvesting their money in the project. So even though the women had not yet experienced any financial improvements from the new technique they felt that health was improved, family life and home activities. According to Msuya and Hurtado (2017), women experienced a decrease in income because they were growing a lower valued species of seaweed. With the new technique women were able to grow the higher valued species of seaweed which should increase their income. Therefore, women should have an increased income from the new technique even if they had not noticed it at the time for this study.

As Harcourt (2016) wrote, FPE was applied to understand women's livelihoods through connections between labor, everyday practices, and gender. In this study, it was found that the new technique of seaweed farming gave the women hope that their labor would be better and more financially sustainable. Their everyday practices seem to be easier thanks to the new technique since the distance of walking and carrying seaweed was reduced. At the same time, their families were happy as well. Furthermore, women had expressed feelings of wanting to be independent in the new technique of farming seaweed. They wanted to learn how to swim and be able to dive themselves instead of having men doing it for them. To be able to swim, would according to the respondents, help them with the new technique, but also with other activities in the ocean such as collecting shells. Through a gender perspective, this could be a big step for the women to achieve independence and equality but for now the dependence of men has increased. Since the new technique required being able to swim in order to place the nets in the water, men were needed since the women did not know how to swim. As Harcourt (2016) wrote, policies, actions, and practices that shift over time can reproduce the view of gender. The women who had tried the new technique of seaweed farming are involved in such practices, through challenging old stereotypes and going out on deep waters. They can therefore, also challenge the view on gender as they do other activities than should be done by women according to norms and traditional beliefs in the society.

#### 5.4 Challenging old stereotypes

When it comes to this study's third research question "Does the old and the new techniques cause conflicts of interest between women working with seaweed farming and men working within fisheries when it comes to the use of ocean space? If so, how?" it has been found that conflicts do not occur at the moment. The women participating in the study felt that with the old technique men with boats came and knocked down their sticks that held up their seaweed farms. This could be a result of what Fröcklin et al. (2014) wrote, that men are forced to occupy shallower waters because of a decline in valuable species in the ocean. Fröcklin et al. (2014)

furthermore wrote that this competition could exclude women from any good fishing grounds. The findings of this study have a different view. Women working with the new technique of harvesting seaweed did not experience any competition with men regarding the ocean space. Hedberg et al. (2018) wrote that women are banned to shallower waters because they can not swim or have access to boats. This also changes with the new technique of seaweed farming, twenty-four women who were participating in the SeaPoWer project had access to a boat for seaweed farming. This allowed them to farm in deeper waters and in the future, maybe the ability to swim. One could therefore say that the new technique of seaweed farming challenges old stereotypes created regarding the ocean space. Women do not have to stay on shallow waters, they can go out on the deep waters as well. Through the lens of FPE this could mean that the women are coming one step closer to gender equality through their labor and everyday practices.

## 5.5 Suggestions for further research

In accordance with this study's findings a similar study could be done in the future, but where the focus lies on the new technique of seaweed farming. Research questions for this study have focused on both techniques but results on the new technique are limited because of the short period of time it has been used. Therefore, a new study is necessary to fully understand the impacts the new technique of seaweed farming will have on women's livelihoods.

Furthermore, a study could be done on the seaweed itself. Does it grow well with the new technique? Does it catch diseases or rot as well as with the old technique? Studies like this have been done regarding the old technique of seaweed farming but not on the new one. It is of high significance for the future of seaweed farming to see if the new technique can, in fact, conquer climate change and allow the industry to survive. The effects on the seaweed will also determine whether seaweed farmers will be able to continue their work. If not, it would mean that a lot of people would lose their opportunity for livelihoods. This could also be a future study, what would happen to people farming seaweed if the industry does not survive?

Another option for future studies is to go even deeper into the women's experiences and perceptions of the new and old techniques. Perhaps, by doing in-depth interviews or oral histories future researchers could look into one or two women's lives in order to get a full understanding of all they have experienced through their years of seaweed farming. For a future study in this area, researchers could focus on all factors of seaweed farming or separate factors, such as mainly health effects.

A different angle for future research could be to study men instead of women. Due to traditional beliefs and norms where men are seen as the providers in society it would be interesting to interview or do surveys with men. The interviews or surveys could investigate what their opinions are regarding that women are now going out on deep waters and possibly learning how to swim.

## 5.6 Conclusions

The results can be summarized by saying that all women have experienced improvements in their livelihoods through the old technique of seaweed farming. However, they had not noticed many improvements regarding income from the new technique since they had not done it for a longer period of time. One clear improvement was that there were positive health effects from planting and harvesting seaweed with the new technique. Furthermore, women did not experience any conflicts with men regarding the ocean space when using the new technique. Through this study, it has been found that women are challenging old stereotypes regarding the use of ocean space as they go out on deep waters. They have a chance to improve their livelihoods if the new technique works well and it has been found that the women view the future in a positive way. They have high hopes and expectations for the new technique and have noticed positive effects on their livelihoods in form of social, human, physical capital and health.

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## Appendix: Interview guide

### Statement

Jambo!

- Our names are Viktoria and Veronika, what's your name? **MAJINA YETU NI .... WEWE JE UNAITWA NANI**
- We are two students from Sweden doing research about female seaweed farmers and their livelihood. **SISI NI WANAFUNZI 2 KUTOKA SWEDEN TUNAFANYA UTAFITI WA WANAWAKE KATIKA KAI ZA UKULIMA WA MWANI NA MAISHA YAO**
- We are interested to see what your experiences are growing seaweed in shallow waters versus deep waters and how the new technique has affected your livelihood. **TUNAPENDA KUJUA UELEWA WAKO KUHSU UKULIMA WA MWANI KATIKA MAJI MAFUPI NA KATIKA KINA KIREFU**
- You will be anonymous and you can choose to skip questions or cancel the interview whenever you like. **HATUTAKUTAJA MAELEZO YAKO NA KAMA HUTAKI KUJIBU SUALA LOLOTE UNaweza KUACHA**
- Do you want to participate in our study? **VIPI UTASHIRIKI?**
- Is it OK if we record the interview? It is just for our own memory, it will not be shared with anyone else. **TUANATAKA KUWEKA KUMBUKUMBU KWA KURIKODI HATUTOMPA MTU YOYOTE TULE SAWA**
- The interview consists of three parts, one about the old technique of growing seaweed, one about the new technique and one about value addition to seaweed. **MAHOJIANO YAMO KATIKA SEHEMU 3 NJIA YA ZAMANI, NJIA MPYA YA KULIMA MWANI NA KUONGEZA THAMANI BIDHAA ZA MWANI**

### Interview guide **MWONGOZO WA MAHOJIANO**

#### Background questions:

- How old are you? **UNA MIAKA MINGAPI**
- Tell us a little bit about you and your family? (Who shares your household?). **UNAISHI NA NANI KATIKA NYUMBA**
- How long have you been growing seaweed? **UNALIMA MWAN SASA MIKA MINGAPI**

#### Theme 1: Growing seaweed with the old technique. **KUOTESHA MWANI KWA NJIA YA ZAMANI**

- What sort of seaweed do you grow in shallow water? **UNAOTESHA MWANI WA AINA GANI KATIKA MAJI YA KINA KIFUPI**
- How were you affected when you started to grow seaweed? **ILKUWAJE ULIPOANZA KULIMA MWANI**
- How was your family affected when you started to grow seaweed? **Familia yako walionaje jambo hili**
- How did seaweed farming affect your income? **VIPI UKULIMA ULIBADILI KIPATO CHAKO**
- Did you have other sources of income during this time when you were only growing seaweed on shallow waters? **ULIKUWA NA NJIA NYENGINE ZA KUJIPATIA KIPATO?**
- How does seaweed farming on shallow waters affect your health? **UKULIMA WA CHINI UNAATHIRI VIPI AFYA YAKO?**
- Did you notice any changes regarding the seaweed throughout the years? **UMEONA MABADILIKO YOYOTE YA KULIMA MWANI TKEA UANZE KUOTESHA**
- How much time do you spend each day on planting/harvesting seaweed with the old technique? **ULIKUWA UNATUMIA MUDA GANI KATIKA KUPANDA MWANI WA CHINI**
- Have there been any conflicts with other farmers or fishers (fishermen) when it comes to using the ocean space for planting seaweed? **JE KULIKUWA NA MIGONGANO YOYOTE ILE NA WATU WENGINE HASA MAENO Y KULIMA MWANI**

**Theme 2: Growing seaweed with the new technique. KUOTESHA MWANI KWA NJIA MPYA YA MAJI YA KINA KIREFU**

- Why did you decide to start growing seaweed with the new technique? **KWA NINI ULIJARIBU NJIA HII MPYA YA KULIMA MWANI**
- What do you think about the new way of growing seaweed in deep waters? **UNAIONAJE NJIA HII MPYA YA KUOTESHA MWANI**
- What kind of seaweed do you grow in deep waters? **UNAOTESHA MWANI WA AINA GANI KATIKA MAJI YA KINA KIREFU**
- How did it feel to start working with the new technique? **ULIJIHISI IPI ULIPOANZA NJIA HII MPYA**
- How were you affected when you started to grow seaweed with the new technique? **ULIJISIAKIAJE ULIPOANZA KULIMA KWA NJIA HII MPYA?**
- How was your family affected when you started to grow seaweed with the new technique? **familia yako walinaonaje ULIANZA KULIMA MWANI WA MAJI YA KINA KIREFU**
- How did the new technique of seaweed farming affect your income? **VIPI NJIA HII MPYA IMAEBADILI KIPATO CHAKO**
- Do you have other sources of income besides growing seaweed today? **JE UNA NJIE NYENGINE ZA KIPATO ZAIDI YA KULIMA MWANI**

- How does the new technique of seaweed farming affect your health? **NAMNA GANI NJIA HII MPYA INAATHIRI AFYA YAKO**
- How much time do you spend each day on planting/harvesting seaweed with the new technique? **UNATUMIA MUDA GANI KWA SIKU KUUPANDA MWANI/ KUVUNA KWA NJIA HII MPYA**
- Have you experienced any difficulty with using the new technique? If yes, how? **JE ULIPATA SHIDA KUPATA ENO LA KUOTESHA? KAMA NDIO KIVIPI**
- Have there been any conflicts with other farmers or fishers (fishermen) when it comes to using the ocean space for planting seaweed? **JE KULIKUWA NA MIGONGANO YOYOTE ILE NA WATU WENGINE HASA MAENO YA KULIMA MWANI**

### **Theme 3: Value addition to seaweed.**

- Are you also doing value addition to seaweed for a living? **Je na wewe unatumia njia ya KUONGEZA THAMANI YA MWANI KWA KUTENGENEZA BIADHAA**

If yes: **KAMA NDIO**

- How does value addition affect your income? **VIPI KUONGEZA THAMANI KUNA-CHANGIA KATIKA KIPATO CHAKO**
- How much time do you spend on making products each day? **UNATUMIA MUDA GANI KATIKA KAZI HII KWA SIKU CHANGAMOTO GANI UNAKABILIANA NAZO KATIKA SHUGHULI HII?**
- What challenges do you face in this business: **UNAKABILINA NA CHANGAMOTO GANI KATIKA BIASHARA HII**
- Which products do you make: **UNATENGENEZA BIDHAA GANI?**
- What do you think of this new initiative? **UNAONANJE JAMBO HLI JIPYA?**

### **Conclusion:**

- Is there anything you would like to add that you would like us to know? **JE KUNA JAMBO ZAIDI UNATAKA KUCHANGIA AMABLO HATUKUULIZA NA UNATAKA SISI TUJUE**

Asante sana. Thank you so much for your participation. **AHSANTE KWA USHIRIKI WAKO**