Women in the coastal area and seaweed farming in Madura, East Java, Indonesia

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Abstract. This study aimed to 1) analyze the roles and tasks of female seaweed farmers or wives of male seaweed farmers in Sumenep Regency, 2) analyze the factors affecting the roles of those women to increase family income. The research employed quantitative and qualitative methods, using a questionnaire, in-depth interviews, focus group discussions, and observations as the means to collect the data. Most of them worked as day-based laborers for seaweed farming. The average income earned was IDR 585,100/month. The domestic role of female seaweed farmers as housewives included cooking, taking care of the house, taking children to and picking them up from school, caring for children, and managing family finances. Work-hour, educational background, work experience, and the number of children as variables simultaneously affected the wives’ income share on family income. However, work-hour as a variable did not have a significant effect on it.

1. Introduction
Seaweed is Indonesia's second-biggest fishery commodities after tuna, which has great potential as there is a high demand for it in the market. Indonesia is among the ten largest seaweed exporting countries in the world, with China, Indonesia, Japan, Chile, the United States, South Korea, France, Philippines, Ireland, and Peru. China, Indonesia, Philippines, South Korea, and Japan are the biggest seaweed producing countries on this list [1].

Seaweed in Indonesia is the potential to become one of the sources of the country's foreign exchange and to establish it as the world's largest exporter of dried seaweed. There are approximately 782 types of seaweeds in Indonesian waters [2]. They include 196 green algae, 134 brown algae, and 452 red algae. As an industrial raw material, seaweed has very diverse derivatives including in foods, in beverages, and as fabric, sewing thread, and paper materials. It is also used in photography, pharmacy, and bio-fuel industries [2].

Women are required to carry out productive activities to earn extra income in addition to having to look after the family and children [3]. Fisherwomen productively earning extra income must devote more time...
than their male counterparts, for they must carry on with their reproductive and social roles at the same time. The position and role of fisherwomen or fishermen's wives in coastal communities are crucial as they play a major role in socio-economic aspects, while the men only play a role to earn a living by catching fish. In other words, the land is for women while the sea is for men. The impact of this division of labor forces women in the coastal area to be involved in public activities, including earning extra for the family in case their husbands fail to make ends meet. Their activities in the sea highly depend on the season. Therefore, it is not always promising [4].

The jobs for women involved in the seaweed farming business are still limited to only cultivating, drying, and selling it to the wholesale at low prices. While good quality and diversification of production of seaweed should be able to increase the welfare of the farming community. This idea can only be achieved if there are more women employed in the coastal area, as they have the capability and capacity to be able to optimize the potential of seaweed as an industrial raw material or as a processed commodity for direct consumption [5].

Seaweed is one of the important commercial, renewable fishery commodities and growing well in shallow waters. Seaweed farming creates a wide range of employment opportunities for coastal communities [6]. Seaweed farming can support the survival of the fishermen in a coastal area. Seaweed farming in Sumenep has been carried out since 1997, in which the country experienced a major financial crisis, for its high price and its ability to help the economy of the coastal community, especially in the District of Bluto, Sumenep Regency [7]. In East Java, the promising locations for seaweed farming include Pacitan, Banyuwangi and Sumenep [8]. Seaweed farming in Indonesia has not been implemented optimally. Substantially developed seaweed production centers in Indonesia are only found in Bali, NTB and South Sulawesi. While the waters of East Java and Maluku has the potentials that have not been explored effectively [9].

Seaweed production in East Java increased sharply in 2009. In 2008, seaweed production in the province reached 74,823 tons, before increasing dramatically in 2009 to 340,238 tons. The Ministry of Maritime and Fisheries (KKP) in 2018 targeted the production of wet seaweed to increase compared to the previous year. KKP's seaweed production target in 2018 was 16.17 million tons, which was higher by 21.58% compared to the previous year's production target of 13.3 million tons.

This research focuses on women involved in seaweed farming. Seaweed farming is the main source of livelihood for Sumenep's coastal community. Sumenep Regency has abundant natural marine potentials to become the biggest seaweed producer in East Java province. It is not only marketed nationally, but also internationally, including to China and Hong Kong [10]. Most of Sumenep Regency's exported seaweed commodities are already in dry condition with 38% moisture content and 2% gross. Seaweed production is focused more on food, such as for making gelatin and cosmetics industries.

2. Materials and Methods
2.1 Research period and site
This research was conducted in Sumenep Regency, Madura, East Java from June 2019 to October 2019. This location was purposively selected by considering the high number of seaweed farmers, especially in Bluto and Saronggi Districts. The villages were then selected based on the number of seaweed farmers, including Pager Batu Village and Tanjung Village in Saronggi District and Aengdakeh Village and Lobuk Village in Bluto District.

Sumenep Regency consists of 126 islands, both inhabited and uninhabited ones, comprising 27 districts (19 mainland districts and 8 island districts) [11]. Of the 27 districts in Sumenep, only 10 districts presented a high number of seaweed farmers. However, these 10 districts had helped Sumenep becoming the largest seaweed producer in East Java. Of the 10 districts, 2 (two) of them were decided as the ones with most seaweed productions, including Bluto and Saronggi Districts. From the two districts, 4 (four) villages had
the most seaweed production, including Aengdakeh and Lobuk Villages located in Bluto District, and Pager Batu and Tanjung Villages in Saronggi District. Seaweed production in Sumenep Regency is presented in Table 1 below.

| No | Sub-district | Number of Farmers (Individual) | Facility (Raft) | Longline | Area (Ha) | Production (Ton) |
|----|--------------|-------------------------------|----------------|----------|-----------|----------------|
| 1  | Bluto        | 1.629                         | 23.708         | -        | 8.918     | 142.749,44     |
| 2  | Saronggi     | 1.593                         | 21.739         | -        | 6.730     | 146.319,50     |
| 3  | Giligenting  | 551                           | 5.488          | -        | 12.927    | 86.266,78      |
| 4  | Ambunten     | 40                            | -              | 235      | 520       |                |
| 5  | Dungkek      | 390                           | 5.280          | -        | 11.691    | 2.908,22       |
| 6  | Gapura       | 375                           | 5.453          | -        | 3.588     | 10.846,00      |
| 7  | Talango      | 635                           | 8.353          | -        | 17.168    | 41.155,35      |
| 8  | Ra’as        | 271                           | -              | 821      | 8.495     | 101.579,26     |
| 9  | Arjasa       | 365                           | -              | 1.460    | 32.180    | 1.360,56       |
| 10 | Sapeken      | 1.241                         | -              | 6.662    | 40.803    | 124.745,84     |
|    | Amount       | 7.090                         | 70.021         | 9.178    | 143.020   | 657.890,95     |

Source: [12]

2.2 Data collection method
This research uses the descriptive method. This type of research seeks to provide a clear picture of exploration and clarification, categorization of social phenomena, or realities existing within the problem and unit under study. The population in this study included female seaweed farmers or the wives of male seaweed farmers. The number of respondents in this study was 30 (thirty), including mothers who were seaweed farmers who lived in the four villages. Data collection was conducted in 2 (two) ways: (1) the primary data were obtained from questionnaires and through in-depth interviews with informants, which were the wives of male seaweed farmers, and observations. (2) Secondary data were obtained from library data, including various articles and journals relevant to this research.

2.3 Analysis method
After all, data were collected, they were then processed and analyzed qualitatively and quantitatively. Qualitative research is used for several reasons. First, it is more adjustable to reality. Second, it directly presents the nature of the relationship between researchers and informants. Third, it is more sensitive and more adaptable [13], about the interest of the wives of male seaweed farmers at the research location. Quantitative analysis was used to obtain the distribution of various variables considered affecting the wives' income. This analysis utilized multiple regression.

3. Result and discussion
3.1 Respondent characteristics
Based on age, 60% of respondents were in the range of 41-50 years old. Most families had two children (51%). 24 respondents were elementary school graduates (69%). Most of them have more than 4 dependents.

3.2 The role of women in seaweed farming families
The result of the study of the women in seaweed farming families in Saronggi and Bluto sub-districts showed that they had 3 roles carried out simultaneously. They were Productive Roles, Domestic Roles, and Social Roles.

3.3 Productive role of women in seaweed farming families
The main source of income of the head of the respondents' family (husband) was the seaweed farming business. The average income earned by each family from seaweed farming activities was IDR 1,421,000/month. It was relatively small and lower than the Sumenep Regency's minimum wage of 2019, which was IDR 1,801,406/month. This condition drove the female farmers or the wives of male farmer stories to increase family income because their husbands could not make ends meet.

Female farmers or wives tried to increase family income by working in the productive sector. There were several jobs for women in these families in Sumenep Regency to earn additional income. The jobs chosen by the respondents included: being a day-based worker in the seaweed farming business, opening a food stall, selling processed seaweed products, and becoming traditional midwives. Most respondents chose to become day-based workers for seaweed farming business because there were very few job choices available at the location. Additionally, the lack of skills in businesses other than seaweed farming.

The average income earned by the wives from their side job was IDR 585,100/month. Thus, the total average income earned by each family of seaweed farmers in the Sumenep Regency was IDR 2,006,100/month. The total value of income was greater than Sumenep Regency's minimum wage. With the income from the wives, the families had extra money to make ends meet.

The average time they spent doing side jobs was 5.6 hours per day. In carrying out their productive roles, the female farmers continue to carry out her role as housewives (domestic role) and social actors. The wives carefully divided their time so that all roles could be fulfilled without a hitch. Although the activities were tiring, they claimed that they were all done with pleasure and sincerity, because it aimed to improve the social and economic conditions of their respective family. The description of the productive role of the wives of male seaweed farmers in the Sumenep Regency showed the important role of women or wives in improving family welfare. Women in coastal areas were formidable fighters and were tireless in facing challenges to make ends meet [14]. Women could improve the welfare of seaweed farming families in the Sumenep Regency.

3.4 Domestic role of women in seaweed farming families
Women or wives of seaweed farming families in Sumenep Regency carried out domestic roles daily. The domestic sphere was identical to the activities carried out by women in the family. The domestic realm was considered a woman's nature [15].

The domestic role performed by the respondents was divided into 2 parts, including as a mother and as a wife. Routine activities carried out as a mother in the morning begins with cooking for the children and the husband. They were cooking early in the morning, preparing breakfast for their children before going to school and for the husband before going to farming. All respondents do the activity, emphasizing the importance of breakfast for the health of family members. Cooking was also done because they had limited income; there was no enough money to buy ready-to-eat food. Other domestic roles performed by the wives included washing, taking care of children at home, cleaning the house, and sending children to and picking them up from school. The specific role of a wife was carried out by giving suggestions to the husband about the work and by managing family finances.

One problem faced by the wives of seaweed farmers in caring for their children who were not yet in school. When husbands and wives work at the same time, nobody looked after the children. The solution decided was to leave the child with closest relatives, including their grandparents, wives' or husbands' siblings who lived near the house. If they did not have a family member to help them with children, they
would agree to the allocated work-hour, to make sure that the children were safe. All respondents hoped that their children got a good education so that they would have a brighter future and could get a better job than their parents.

Activities by the women or wives in carrying out their roles as housewives and wives showed how central their role was in the family. Proper childcare and good family health were a reflection of the performance of women or wives in carrying out their domestic roles [16]. Thus, the wives/women need to be more involved in community empowerment programs, particularly in coastal communities. The strategic role of women in the family proved women focal in a family's economic and social development.

3.5 The social role of women in seaweed farming family
The involvement of the wives in a coastal community was not only beneficial for family survival, in increasing self-capacity and social status in society, but also contributed to the social dynamics of the community. Therefore, women (wives) did not only have economic potentials, but also socio-cultural impacts [17]. Forms of social interaction generally took the form of relationships between family members, relationships between friends, involvement in community organizations, and religious and customary events.

A social role was the need of women (wives) to actualize themselves in society. The social interaction as working women strove within a wider scope, while interactions with children and husbands were also maintained. The social role of female seaweed farmers (the wives) in the Sumenep Regency included being a member of the Family Welfare Program (PKK) group. The benefit of joining PKK activities was the interaction among community members. Those who did not know each other would eventually interact and cooperate. Additionally, they could quickly share information through the program. Interactions among the women in seaweed farming families were also encouraged through becoming a member of Posyandu (Integrated Service Post). The benefits of being a member of Posyandu included increasing the women's/wives' knowledge about child development, good nutrition for family members, and being a source of health information.

The religious program was held every Monday and Friday, and it was useful to deepen faith and to increase interactions among wives of male seaweed farmers in Sumenep Regency. Social interactions offered a direct impact on the economy. Arisan (regular revolving savings social gathering) could help their family's economy. They were required to set aside some money every month to pay for arisan, and in the end, the money collected from arisan could be used to pay school fees, celebrations, and other activities that required a large sum of money. Additionally, female tea farmers also participated in activities related to traditional customs or culture such as marriage ceremonies, death ceremonies, bellows, and so forth.

The active social role carried out by the women (wives) in seaweed farming families in Sumenep Regency was a form of community social capital. This was an asset in a community building. It must be maximized through the bonding in coastal communities [18].

3.6 Factors affecting the women's (wives) income
To find out the factors affecting the income of female (wives) seaweed farmers in Sumenep Regency, a single equation model was performed using the OLS (Ordinary Least Square) estimation. The classic assumption test was performed first, consisting of the normality test, the multicollinearity test, and the heteroscedasticity test. The next step was to test hypotheses simultaneously and partially.

Normality test was conducted to determine whether the residual variable in the regression model has a normal distribution or not. A good model is the one with a normal distribution of the residual variable [19]. The normality test conducted in this study used the Kolmogorov-Smirnov test presented in Table 2 below. Based on the calculation in the Kolmogorov-Smirnov test, a significance value of 0.2 was obtained. This value was greater than 0.05, thus the error in the model had a normal distribution.
Table 2. Normality test.

| Significance Value | Description                      |
|--------------------|----------------------------------|
| 0.2                | Error as a variable has a normal distribution |

Multicollinearity test was conducted to determine whether there was a relationship between the independent variables in the model [20]. A good regression model required no relationship between independent variables, which was the indicator of multicollinearity. If the tolerance value was above 0.1 and the VIF value was below 10 then the model did not experience multicollinearity.

Table 3. Multicollinearity Test.

| Variable                  | Tolerance Value | VIF   | Description       |
|---------------------------|-----------------|-------|-------------------|
| Work-hour                 | .831            | 1.203 | No multicollinearity |
| Education background      | .940            | 1.064 | No multicollinearity |
| Work Experience           | .876            | 1.141 | No multicollinearity |
| Number of children        | .862            | 1.161 | No multicollinearity |

The table showed that all variables had tolerance values above 0.1 and VIF values below 10. Thus, the regression model in this study did not experience multicollinearity. A heteroscedasticity test was done to find out if there were similarities invariance in the regression model. A good model was the one with a common residual variant (Homoscedasticity). One way that could be used to determine the heteroscedasticity was by looking at a scatter plot graph. If the spread of points in a scatter plot formed a certain pattern, then the model experiences symptoms of heteroscedasticity [21]. A good regression model was the one that did not experience symptoms of heteroscedasticity.

![Figure 1. Regression model of heteroscedasticity test.](image)

B Based on the scatter plot image, the points spread without a pattern. This showed that the regression model did not experience symptoms of heteroscedasticity.
3.7 Simultaneous test (F test)
This was a method used to determine the effect of variable work-hour, education background, work experience and number of children on the wives' income share. Based on the calculation, the significance value of the data was smaller than 0.05. This shows that all of the independent variables simultaneously affected the wives' income share.

| Variable                                      | Significance | Description               |
|-----------------------------------------------|--------------|---------------------------|
| Work-hour, education background, work experience and number of children | 0.022        | Affecting Simultaneously  |

Table 4. Simultaneous test (F test).

Income showed no relationship with the number of children, as the number of children does not indicate an increased income. It had no significant relationship with work-hour either because the work in seaweed farming is conducted in a piecework system. While the educational background and work experience partially affected the wives' income share. Simultaneously, all variables were significant. According to [8], when the contribution made by a woman (wife) to her family is calculated based on her wage, the result would be incomparable to what she has done so far. It also applies to the work-hour spent by the women in productive, reproductive, and social activities.

3.8 Partial test
A partial test was conducted to determine the effect of each independent variable (work-hour, education background, work experience, and a number of children) individually on the dependent variable (Share of wives' income). If the significance value was < 0.05 then the independent variable had a partial effect on the dependent variable. Meanwhile, if the significance value was > 0.05 then the independent variable had no partial effect on the dependent variable. T-test results for each independent variable can be seen in the following table.

| Independent Variable    | Significance | Coefficient Value | Description           |
|-------------------------|--------------|-------------------|-----------------------|
| Work-hour               | .202         | .023              | No partial effect     |
| Education background    | .047         | .085              | Affecting partially   |
| Work Experience         | .039         | .121              | Affecting partially   |
| Number of children      | .988         | .000              | No partial effect     |

Table 5. Partial test (t-Test).

The t-test result for work-hour as a variable showed a significance value greater than 0.05 (0.201 < 0.05). Then the hypothesis stating that the work-hour did not affect the wives' income share failed to be rejected, because what some women did as a job in seaweed farming business, which was binding seaweed seeds, was a piece work carried out from 6 a.m. to 10.00 a.m., with 10 people on each raft (length is 7 x 9 m) and a wage of IDR 2,000 per drill/rope (10 meters). According to [8], the wives' contribution to the productive activities in seaweed farming once a season or a raft, indicated 39% of the total seaweed farming activities, while the husbands' work is 61%. The job of binding seaweed seeds was predominantly done by women as piecework.

T-test result for education background as the last variable showed a significance value of less than 0.05 (0.047 > 0.05). Thus, the hypothesis stating that the educational background partially affected the wives' income share was rejected. The greater the wives' education background, the greater the effort to increase
her income. The greater the wives' education background, the more work options they could choose, in addition to the wives' ability to think deeper about what need to be done to increase family income. The wives could take part in post-harvest seaweed training.

Housewives had special tips on managing income to make sure the family welfare. It was not uncommon for housewives to look for part-time jobs to increase family income. The responsibility to improve the welfare of the family did not depend solely on the husband's ability to make a living, but also on the wives [22]. The greater the income of housewives, the better the welfare, nutritional quality, and health of the whole family [23]. The educational background of most respondents was an elementary school (24 people).

T-test result for work experience as a variable suggested a significance value of less than 0.05 (0.039 > 0.05), thus the hypothesis stating that work experience did not partially affect the wives' income share was rejected. The positive coefficient value showed that the better work experience, the higher the wives' income share. Women in coastal communities played a crucial role in maintaining the survival of their families. In addition to being responsible for domestic affairs, women (wives) must also help the work of their men (husbands) by actively engaging in earning a living to make ends meet [22].

T-test result for the number of children as a variable suggested a significance value greater than 0.05 (0.988 < 0.05), thus the hypothesis stating that the number of children did not partially affect the wives' income share was accepted. That was because the income received by seaweed farming families was very limited. No matter how many children the seaweed farmers had, it would not affect their income. The farming community tended to be accepting of how has been given to them. Their culture encouraged them to always be thankful to the Almighty.

4. Conclusion
The productive role of women (wives) in seaweed farming families in Sumenep Regency was carried out in to support their family income. Most of them worked as day-based workers for seaweed farming business. The average work-hour was 5.6 hours/day. The average income earned was IDR 585,100/month. The domestic role of female seaweed farmers as housewives included cooking, taking care of the house, taking children to and picking them up from school, caring for children, and managing family finances. Work-hour, educational background, work experience, and the number of children as variables simultaneously affected the wives' income share on family income. Whereas work-hour as a variable did not have a significant effect because it was done in a piecework system. Number of children as a variable did not have a significant effect partially, because the income earned by housewives was relatively small.

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