Contribution of agrosilvopastoral pattern to sustainable communities economic improvement (study in Namaa Hamlet, Pelauw Village, Haruku Island Sub-District, Central Maluku Regency)

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Abstract. The agrosilvopastoral management pattern can provide multiple benefits to integrating the agriculture sector with the interrelated forestry and livestock sectors. This research in Namaa sub-village, Pelauw Village. The research aimed at: 1) Knowing the respondent's characteristics in agrosilvopastoral management, and 2) The contribution of the agrosilvopastoral pattern to improve community's economy. This research was conducted by using the purposive sampling method, with a representation of the 20 households of farmers. Primary and secondary data were taken by observation and interviews related to respondents' income and the agrosilvopastoral pattern. The data obtained were analyzed with a quantitative approach and qualitative descriptions. The results showed that the respondents' characteristics were the factors that influenced the management of agrosilvopastoral, namely the level of education, age level, number of family members, land area, and land ownership status, while the contribution of an agrosilvopastoral for respondents was 274,882,000 / year.

1. Introduction
Agrosilvopastoral is a combination of components or agricultural activities with forestry and livestock/animal. This system's purpose is an integrated process between sectors in the farming industry that mutually utilizes the residue of an industry's management process, reused in other sectors to produce other useful benefits. Many things must be considered in the agrosilvopastoral application to support its sustainability, namely market conditions, climate, soil types, and types selection. The selection of varieties is intended for high value, including fast-growing species, deep roots, capable of providing products, and providers of environmental services [1].

The agrosilvopastoral management practice in Maluku is carried out at dusung locations, a form of traditional agroforestry in Maluku [2]. The dusung management activities usually begin with the preparation stage. This stage consists of determining the location, burning the land, clearing the land, planting, maintaining, and harvesting. It requires a long time, extra effort, patience to wait for the harvest, and harvest management skills. The agrosilvopastoral pattern can be used to continue farmer activity because farmers' activities in dusung will be more numerous and varied. Apart from farming activities such as hoeing, planting, cleaning lianas, and harvesting, farmers can also raise livestock by feeding, foraging for livestock, or cleaning pens.

Agrosilvopastoral or hybrid systems, namely agroforestry systems, combine tree crops (forest), agricultural crops, and forage crops and/or livestock [3]. The application of the agrosilvopastoral management pattern in this dusung is very beneficial for improving the community's economy because the results can guarantee short-term, medium-term, and long-term needs. Besides, the system produces various foodstuffs for consumption, namely vegetable food needs and animal food needs to ensure the community's food needs. In general, the dusung farming pattern's contribution to the community has 3 benefits for the community's food security: 1) providing for family food, 2) providing cash, and 3)
increasing family income. The community widely practices the *dusung* farming pattern because of several main reasons a) the *dusung* has various types of plants with different harvest seasons, b) the *dusung* provides cash to its owner like a bank, c) the location of the *dusung* is usually not far from the residential area so that it is easier to maintain [4]. It means that the agrosilvopastoral pattern as a component of traditional agroforestry provides a positive contribution from an economic perspective to improve farmers’ welfare [5].

Namaa Hamlet is a part of Pelauw village. It is located in the Central Maluku Regency, where most of the people are farmers. Farmers in the Namaa hamlet still apply a forest and land management pattern based on the agrosilvopastoral design. This management pattern is a legacy and tradition passed down from one generation to the next. [4] [6] [7]. The *dusung* owned by farmers is an inheritance and is located not too far from the settlement [4] to allow farmers to have plenty of time to manage the *dusung* [6]. If this management pattern is made seriously and on a large scale, it will significantly impact the family economy and sustainable family food availability.

Based on the description above, what needs to be done to improve the community's economy is the maximum application of agrosilvopastoral in terms of resources and management to ensure food security, safety, and quality. It is to strengthen food availability and provide an increase in farmers' income and welfare. Therefore, it was necessary to research the title: Contribution of Agrosilvopastoral Pattern to Sustainable Communities Economic Improvement (Study in Namaa Hamlet, Pelauw village, Haruku Island Sub-District, Central Maluku Regency). The research objectives were to know: 1) the characteristics of farmers in Agrosilvopastoral management, and 2) the contribution of the agrosilvopastoral pattern to the increasing of the community's economy.

2. Methods

This research was conducted in the Namaa hamlet Pelauw village, which took place from May to June 2018. The sample selection of the research location was carried out using the purposive sampling method, namely the representation of farmer elements, namely as many as 20 families. Also, several community leaders who could provide information on the application of the agrosilvopastoral pattern were taken. Data collected includes primary data obtained from respondents through interviews and observations and secondary data obtained from related parties.

The data obtained were analyzed using a qualitative approach, namely an analytical technique to describe a phenomenon, explain relationships, test hypotheses, and determine the implications of a problem under study. To get the amount of contribution of the agrosilvopastoral pattern to income, the researchers used the following formula [8]:
Formulas used

\[ P = \frac{X}{Y} \times 100\% \]

Where:
- \( P \) = income percentage
- \( X \) = Income derived from the Agrosilvopastoral pattern
- \( Y \) = Total of respondents’ income

3. Results and discussion

3.1. Characteristics of Respondents in the Management of Agrosilvopastoral

3.1.1. Respondent Education

The social characteristics of the community greatly influence activities in the management of agrosilvopastoral. These characteristics include education level, income, age, number of dependents of family members, and distance between settlement (house) to the location of the dusung. The characteristics of the respondents based on their education level are as follows:

| Level of education     | Number of Respondents | Percentage (%) |
|------------------------|-----------------------|----------------|
| Elementary School      | 2                     | 10             |
| Junior High School     | 4                     | 20             |
| Senior High School     | 14                    | 70             |
| Bachelor degree        | -                     | -              |
| **Total**              | **20**                | **100**        |

Based on the table above, it can be seen that the education level of the respondents is the highest school in general with 14 respondents, and the lowest is an elementary school with one respondent. The high and low level of a person's education significantly affects their agrosilvopastoral management mindset and behavior. The attitude and behavior are about what must be planted and maintained, as well as the application of new technology/innovation in the fields of agriculture, forestry, and animal husbandry.

3.1.2. Respondents’ Income

Family income dramatically affects the level of fulfillment of basic family needs. Family income is the total income that the family receives from various sources of income, both agricultural and non-agricultural. The respondents’ income based on the following income level:

| Income level/month       | Number of Respondents | Percentage (%) |
|--------------------------|-----------------------|----------------|
| \( \leq 500.000 \)        | 1                     | 5              |
| 500.000- 1,000.000       | 9                     | 45             |
| 1,000.000 – 2,000.000    | 8                     | 40             |
| 2,000.000 – 3,000.000    | 2                     | 10             |

The table above shows the highest income of the respondents, namely Rp. 2,000,000 to Rp. 3,000,000 / month for two respondents. Meanwhile, the income range of Rp. 1,000,000 to Rp. 2,000,000 / month is eight respondents, followed by nine respondents with income in the range of Rp. 500,000 to Rp. IDR 1,000,000 / month and only one respondent with the lowest income, namely \( \leq 500,000 \). The respondents’ income depends on the type and number of plants, livestock being raised, and side jobs.
3.1.3. Respondent's Age Level
The age level of a person also affects the activities and productivity in managing the dusung. Age level also influences the decision/policy-making process, and the absorption of technology/innovation developed. The respondents' age level also affects the division of tasks in agrosilvopastoral management, and their involvement can be measured in each process. Age levels of respondents in agrosilvopastoral management in dusung Namma generally range from 26 years to 70 years. The characteristics of the respondents are as follows:

| Age Level (Years) | Number of Respondents | Percentage (%) |
|-------------------|-----------------------|----------------|
| 19 - 25           | -                     | 80             |
| 26 – 50           | 16                    | 80             |
| 51 – 70           | 4                     | 20             |
| Total             | 20                    | 100            |

Table 3 shows that respondents aged 26-50 years are the most dominant in terms of quantity and strength of work because 26-50 years is a productive age where a person is very busy with routine daily work to meet their daily needs. Generally, a person is married at this age and has the responsibility to support his family in farming and caring for livestock in the dusung.

3.1.4. Number of Family Members
Family members are internal workers in the family who can help complete daily tasks. Likewise, the involvement of family members in agrosilvopastoral management activities in the Namma hamlet, Pelauw village, is very beneficial. In addition to fulfilling the needs of family members, working-age family members can also help work in dusung, both men and women. The following is a table regarding the characteristics of the respondents based on the number of family members

| The number of dependents | Number of Respondents | Percentage (%) |
|-------------------------|-----------------------|----------------|
| ≤ 4 people              | 2                     | 10             |
| 5-6 people              | 12                    | 60             |
| ≥ 7 people              | 6                     | 30             |
| Total                   | 20                    | 100            |

Based on Table 4, it can be seen that the respondents with the most number of family members were seven people, i.e., six respondents and the least number were four people with the number of 2 respondents. Most of the respondents, namely 60% or 12 respondents, had 12 family members as dependents. The number of family members can help work in sharing tasks and roles. Usually, women do light work such as pulling weeds, planting, and looking for firewood, while men usually hoe, make fences, harvest, and feed livestock. Thus the number of family members and gender in a family also dramatically affects the capacity and type of work done by a person in managing dusung with an agrosilvopastoral pattern.

3.1.5. The Distance from the House to the Respondent's Dusung
The distance between settlement and the dusung significantly affects the activities and types of plants planted in the dusung, as shown in Table 9 below:
Table 5. Characteristics of Respondents Based on the Distance from Home to Hamlet

| Distance from Home | Number of Respondents | Percentage (%) |
|-------------------|-----------------------|----------------|
| ≤ 1 km            | 7                     | 35             |
| 1 – 2 km          | 13                    | 65             |
| ≥ 2 km            | -                     | -              |
| Total             | 20                    | 100            |

Table 5 shows that most of the respondents have a dusung that is not far from the settlement. About 35% of the respondents or seven respondents distance from the house to the agrosilvopastoral dusung as far as ≤ 1 km. It can be seen that most of the respondents also use the yard to carry out farming and raising livestock. Meanwhile, 65% of respondents, or 13 respondents, had a distance of 1-2 km from the house to the dusung. The road to the dusung location is still a path with flat conditions so that farmers were comfortable to go to the dusung with a travel time of about 30-60 minutes. It can be concluded that the distance and travel time will also affect supervision and activities in agrosilvopastoral management.

3.2. Application of Agrosilvopastoral Pattern in Namaa Hamlet

Agrosilvopastoral is a land management system that combines agriculture components with forestry and livestock/animals to solve land availability problems and increase land productivity, especially on marginal lands. The limitations of the agrosilvopastoral pattern in the Namaa hamlet, Pelauw village, are raising livestock without making a patent cage, lack of knowledge, management system, and limited capital. Therefore, the agrosilvopastoral management pattern is still carried out at a small scale level to fulfill daily life necessities and the celebration of major religious holidays so that the results given are not maximal [5]. On the other hand, farmers are not interested in doing business in the forestry sector since they must fulfill administrative problems to sell wood so that farmers are more likely to plant secondary crops.

In the management of agrosilvopastoral, the farmers' activities in dusung were varying, among others, as follows:

1. Planting: Before planting in the dusung, land preparation is usually carried out, namely cutting down trees and shrubs, cleaning the lianas, and burning them. After that, planting holes and planting with a combination of various types of long-life and short-life plants, such as forestry/timber, agricultural and plantation crops such as secondary crops.
2. Plant nurturing: at this stage, the activities carried out fertilizing, weeding, and clearing the land by removing grass/lianas and shrubs that grow between staple plants to provide space for plants to grow.
3. Harvesting: each plant has a different harvest age. Harvesting is carried out when the plants reach maturity, indicated by changes in the plants’ physical properties, namely color and smell. When the harvest season comes, the farmers choose to stay in the dusung to collect the dusung products.
4. Raising livestock: in addition to carrying out activities related to the agricultural sector, in an agrosilvopastoral land, farmers also carry out livestock raising activities by looking for grass/animal feed, feeding livestock, and cleaning cages.

3.3. Contribution of the Agrisilvopastura Pattern

An area's ecological conditions will affect the composition of plants that make up agroforestry [3]. Land with an agroforestry pattern has a layered canopy structure that functions to reduce rainwater’s kinetic energy. Based on observations, it was found that the main components of Agrosilvopastoral were mango (Mangifera indica), langsat (Lansium domesticum), durian (Durio zibethinus), jackfruit (Artocarpus heterophyllus) and teak (Tectona grandis), ironwood (Instia bijuga), lenggua wood. (Petrocarpus indicus). Agricultural and plantation crops are dominated by seasonal crops of chili.
(Capsicum frutescens), eggplant (Solanum melongena), long beans (Vigna unguiculata ssp), and tomato (Solanum lycopersicum). Meanwhile, annual plants or longevity plants are dominated by cloves (Eugenia aromatic), nutmeg (Myristica fragrans), bananas (Musa paradisiaca), and coconut (Cocos nucifera). The types of livestock that are kept are cows, chickens, goats, and ducks.

From the results of the analysis, it can be seen that the agrosilvopastoral pattern carried out by farmers in Namaa hamlet provides a significant contribution to the community's economy, which guarantees a long and sustainable period. Furthermore, the contribution of the agrosilvopastoral pattern can be seen in the following table.

**Table 6. Contribution of Agrosilvopastoral Patterns from Respondents in Each Sector**

| No | Agriculture  | %    | Livestock   | %    | Forestry | %    | Total       |
|----|--------------|------|-------------|------|----------|------|-------------|
| 1  | 8,504,000    | 84.50| 1,200,000   | 11.92| 360,000  | 3.58| 10,064,000  |
| 2  | 1,200,000    | 4.43 | 250,000     | 92.37| 844,000  | 3.19| 27,064,000  |
| 3  | 4,285,000    | 39.58| 6,300,000   | 58.20| 240,000  | 2.22| 10,825,000  |
| 4  | 4,985,000    | 31.26| 10,360,000  | 64.97| 600,000  | 3.76| 15,945,000  |
| 5  | 4,350,000    | 43.11| 5,500,000   | 54.51| 240,000  | 2.38| 10,090,000  |
| 6  | 1,100,000    | 8.03 | 12,300,000  | 89.78| 300,000  | 2.19| 13,700,000  |
| 7  | 1,330,000    | 18.83| 5,300,000   | 75.05| 432,000  | 6.12| 7,062,000   |
| 8  | 5,425,000    | 24.87| 16,100,000  | 73.81| 288,000  | 1.32| 21,813,000  |
| 9  | 1,250,000    | 9.35 | 11,400,000  | 85.27| 720,000  | 5.39| 13,370,000  |
| 10 | 920,000      | 9.89 | 8,200,000   | 88.17| 180,000  | 1.94| 9,300,000   |
| 11 | 900,000      | 13.98| 5,300,000   | 82.30| 240,000  | 3.73| 6,440,000   |
| 12 | 6,670,000    | 38.40| 10,300,000  | 59.30| 400,000  | 2.30| 17,370,000  |
| 13 | 1,805,000    | 17.86| 8,000,000   | 79.17| 300,000  | 2.97| 10,105,000  |
| 14 | 1,725,000    | 78.95| 340,000     | 15.56| 120,000  | 5.49| 2,185,000   |
| 15 | 1,475,000    | 15.79| 7,000,000   | 74.95| 864,000  | 9.25| 9,339,000   |
| 16 | 950,000      | 3.01 | 30,000,000  | 95.16| 576,000  | 1.83| 31,526,000  |
| 17 | 2,510,000    | 12.89| 16,000,000  | 82.18| 960,000  | 4.93| 19,470,000  |
| 18 | 7,755,000    | 53.05| 6,000,000   | 41.04| 864,000  | 5.91| 14,619,000  |
| 19 | 2,515,000    | 23.43| 8,100,000   | 75.45| 120,000  | 1.12| 10,735,000  |
| 20 | 3,000,000    | 21.77| 10,540,000  | 76.49| 240,000  | 1.74| 13,780,000  |
| Total| 62,654,000  | 22.80| 203,240,000 | 73.96| 8,908,000| 3.24| 274,802,000|

Based on Table 6 above, it can be seen that the livestock sector provides a very high contribution of IDR 203,240,000 / year or 73.96%. The agricultural and plantation sectors contribute IDR 62,654,000 / year or 22.80%, and the forestry sector gave the lowest contribution of IDR 8,908,000 / year or 3.24%. Therefore, the total contribution of the agrosilvopastoral pattern is IDR 274,802,000 / year.

The results showed that the livestock sector gave the largest contribution because farmers were more interested in raising cows and goats. After all, the price was quite high. For example, cows were sold for around Rp. 5,000,000 - Rp. 10,000,000 / tails adjusted to body size and market prices.

On the other hand, eggs and meat can be taken from chickens and ducks for sale or consumption. Meanwhile, for agriculture and plantations, farmers are more interested in planting short-lived plants.
to provide quick yields than long-life crops or timber plants. The forestry sector contributes to the sale of firewood for IDR 12,000/ inch. At the same time, commercial wood such as teak (*Tectona grandis*) has not yet entered the cutting period as well as lenggua wood (*Petrocarpus Indicus*) and ironwood (*Instia bijuga*). The farmers only do the cutting according to need/cutting to hardly provide nominal value within a year for community income. One of the efforts made to increase the interest and awareness of farmers in managing agrosilvopastoral. Therefore, the Pelauw village government in 2016 carried out various types of plants in *dusung* by planting teak wood (*Tectona grandis*), procuring agricultural equipment as well as counseling and socialization activities on the management of agrosilvopastoral.

In general, the application of the agrosilvopastoral pattern in the Namaa hamlet has several advantages. From an ecological perspective, land productivity with high yields is due to plant species' diversity (polyculture). It has a sustainable harvest season compared to monoculture crops. With a mixed crop pattern, the productivity of forest land can be increased optimally and sustainably. Besides that, it is also possible that the regeneration of nature and wildlife also supports plants' combination. The natural interactions of agroforestry components are easy to identify. The role of stands as a provider of wild animal feed (for example, fruits for various bird species) and vice versa is a simple example. Also, wildlife's function can be the process of pollination or stand regeneration and a source of animal protein for farmers [10].

Suppose the practice of agrosilvopastoral management is taken seriously. In that case, it will provide several benefits, namely: 1. the needs of the plant and animal food as well as shelter, 2. to ensuring long-term, medium-term and short-term needs, and 3. ensuring the stability of community income. It means that the agrosilvopastoral pattern provides sustainable benefits for the economic improvement and welfare of farmers [5] [6] [11]. Thus, it can be said that agrosilvopastoral is a very complicated land management pattern because it combines the agricultural, forestry, and livestock sectors. For this reason, for the development of agrosilvopastoral practices in the future, it is necessary to have intensive supervision and guidance from stakeholders to farmers. Farmers need to be guided through training to get better and mastering agrosilvopastoral techniques. The farmers also need counseling and advice regarding forest management to produce high-quality timber plants and make a more significant contribution to farmers' income [11].

4. Conclusion
   (a). Characteristics of the respondents, namely education level, income level, age level, number of family members, distance from house to *dusung*, also influence community activities in agrosilvopastoral management.
   (b). The agrosilvopastoral pattern contribution is Rp. 274,802,000 / year, with details of the livestock sector giving significant influence with Rp. 203,240,000 / year or 73.96%, then the agricultural and plantation sectors contribute Rp 62,654,000 or 22.80% and the forestry sector give the lowest contribution, namely IDR 8,908,000 / year or 3.24%.
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