Strategy option to improve income sustainability of private forest farmer in Ciamis District, West Java

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Abstract. Traditional farmers often show illogical behavior to manage their private forests. They heavily depend on forest products, but some of them are unwilling to maintain the forest properly. This discrepancy led the economic contribution of forest products to farmer incomes to fall into a subsistence level. The private forest is also characterized by a low absorption capacity of the laborer, which makes the target decrease of unemployed farmers hard to achieve. Regarding this condition, the government should make a strategy to intensify on-farm management as well as to improve farmers' capacity. This study was conducted in Ciamis District through an interview of 13 key persons. Collected data were then analyzed using the SWOT approach. The research proposed a set of strategies that the government should provide a guide about agroforestry system based on elevation range and management unit, which has a potential product with high economic and environmental values, to meet the increasing market demand of timber. Also, farm laborers around the forest should be trained and introduced with the technology to inspire them to create a new source of income. Technology has to be considered as the primary reference at any program related to private forest development to improve the forest roles in solving the problem of the unemployed farm laborer. The government also has to facilitate forest product processing to gain added value.

1. Introduction
The livelihood of many rural communities across the tropic area highly depends on forest resources [9, 12]. This is because the private forests still produce forest products for farmers, although managed traditionally. This is also related to the characteristics of most rural communities in Indonesia, where land owned is relatively small, and financial capital is usually low. These characteristics are very dominant. These cause management of private forests to remain less intensive then make farmers being subsistence. Since rural community realizes that they usually manage forest less-intensively, then they lean on non-timber forest product (NTFP) as a better alternative income [6]. Such management often leads to land degradation, mainly decrease soil fertility.

Meanwhile, the soil fertility rate will continue to decline if the plant cultivation pattern is not selected correctly. Soil fertility could be improved by employing a proper agroforestry system. Appropriate plant components, such as the banana-coffee agroforestry farming system in East Africa, will have more beneficial effects on soil fertility and C sequestration compared to the banana monoculture system in the study area [3]. Extension officers should also consider this in training farmer groups. This is because, in the long run, the decline in fertility results from decreasing
productivity and unsustainable timber supply. This condition would continue for generations if the government did not intervene there. Farmer group, strengthened by government, is believed to increase the success of private forest management [6]. It could be practiced by the government to act as a bridge to cooperate among groups or between groups with industry [14].

The growth of community timber-based industries in Ciamis Regency and its surroundings have become an excellent opportunity for local community timber farmers. The industries could get higher prices of timber to provide cash quickly. Community timber business in Ciamis Regency has become a commodity with a quick return. By the age of 4-year, *sengon* (*Falcataria moluccana*) tree can be harvested and sold already. Buyers even visit farmer places to do transactions. The existence of community timber business in Ciamis Regency cannot be separated from the existence of two pallet industries in Tasikmalaya and Banjar districts. Both industries have export markets. They produce furniture components such as doors with the core made of *sengon* pallets and coated by teak or oak veneers.

External and internal factors influence the development of the timber business community in Ciamis Regency. Meanwhile, the results that occur now are the product of various factors. So far, community timber has been exploited to fulfill industrial raw materials, with very little evaluation either by the owner or government agencies regarding future capability in supplying industrial raw materials. In connection with the application of traditional cultivation technology, it is done without fertilizing and thinning. If the factors acting as driving force and state parameters are not identified, then the future development of the community timber business may be difficult to anticipate in terms of sustainability. Uncontrolled forest product extraction activity could be a potential driving force for the depletion of the private forest [7]. Timber extraction, particularly *sengon* species from a private forest in Ciamis regency, tends to be uncontrolled, and this needs to be anticipated.

This study aims to identify the factors that influence the community forest sustainable and find alternative solutions to maintain its sustainability using the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis. The SWOT analysis is an instrument of strategic planning which scans internal strengths and weaknesses of organizations and illuminates the opportunities and threats of the environment [11]. Therefore, ways area unit developed, which can rest on the strengths, eliminate the weaknesses, exploit the opportunities, or counter the threats [4]. Scientific and technical information can increase the ability of policymakers to make strategic decisions [7]. The results of this study are expected to be used as material for policymakers further to advance the community timber business in Ciamis Regency.

2. Methodology

2.1. Location
The study was conducted at three elevation regions of Ciamis regency, i.e., low elevation region, medium elevation region, and high elevation regions. The areas are mostly utilized to practice agroforestry systems with relatively similar crops and tree species. The mean annual temperature varies between 20° C and 30° C, while the annual rainfall varies between 67 (mm) and 10 991 (mm) [13]. Ciamis regency is located between 108°20’ to 108°40’ E and 7° 40’20” to 7° 41’20” S. The locations of the study were described further as 1) Panjalu sub-district which represents high elevation region, i.e., over 400 m asl, 2) Banjarsari sub-district which represents moderate elevation region, i.e., between 200 to 400 m asl, and 3) Cimerak sub-district which represents low elevation region, i.e., less than 200 m asl.

2.2. Data collection
Data for formulating a strategy of improving the welfare of rural communities were obtained from an interview with 13 key informants consisting of 3 extension officers, three farmers from different farmer groups, three village headmen, one sub-district chief, one chief officer of forestry and plantation services (Kadis Hutbun), one officer of Implementing Agency for Agricultural, Fisheries and Forestry Extension (BP4K) and one officer of Development Planning Agency at Sub-National
Level (Bappeda). The key informants were selected because they know well about the development of the agroforestry system at research locations. Interviews with the subdistrict headman, extension officers, village headmen, and farmer groups were conducted at three villages, namely Ciomas (capital of Panjalu sub-district), Kalijaya (capital of Banjarsari sub-district) and Kertaharja (capital of Cimerak sub-district). The interviews with the chief of forest and plantation office (Kadishutbun), the chief of BP4K, and Bappeda were carried out at the corresponding offices. The data consist of dominant factors denoted as strengths, weaknesses, opportunities, and threats faced by community forests in their role to improve the welfare of farmers.

2.3. Data analysis
To improve the socio-economic welfare of village communities around the forest, strategy formulation used was the SWOT method through the identification of strength (S), weakness (W), opportunity (O), and threat (T) of the community forest contribution to farmers’ income. The steps taken in the SWOT analysis consist of determining internal and external factors, weighting the factors and rating calculations. Giving a rating and the weight of the factors follows the procedure proposed by [11] as follows:

2.3.1. Determine the SWOT weight. The weight has a value between 0.0 (not significant) and 1.0 (very important). Sum of the all weight values in the corresponding factors (internal or external) are not exceed the total score = 1.0. The weight values are given to each factor based on the strategic position effect. The sum of weights for the opportunity (O) and threat (T) is 1.0. The sum of weight for strength (S) and weakness (W) is 1.0

2.3.2. Determine the SWOT rating. Ratings were determined by starting at 1.0 (very low), 2.0 (average), 3.0 (good), and 4.0 (very high). The strength factor (S) and the opportunity factor (O) are positive. This means that the strength (S) or the opportunity (O) are big, then the factor has a rating value of +4.0, but if the strength (S) and opportunity (O) are small, they have a value of +1 rating. However, the rating of weakness (W) and threat (T) are valued other way around. If the weakness (W) and the threat (T) is massive, then the rating is 1.0. Otherwise, if the weakness (W) and the threat (T) are small, then the rating is 4.0. The score obtained will determine whether opportunities (+) or threats (-), and whether strength (+) factors outperform weaknesses (-). The results are plotted on the Cartesian diagram to obtain the direction of recommendations. Recommendations on the 4 (four) quadrants are as follows:

Quadrant 1: Community forest has the strength to be able to utilize and maximize the opportunities that exist. The strategy that must be implemented is (SO strategy) that which is using strengths to exploit opportunities or support growth strategies

Quadrant 2: Community forest face various threats, but still have internal strength. The strategy that must be implemented is (ST strategy), that which is to use the strengths to overcome threats (diversification strategy)

Quadrant 3: Community forest has a very high opportunity, but faces several internal weaknesses. The strategy implemented is (WO strategy) that which is to continuously improve weaknesses to take advantage of opportunities (Stability strategy).

Quadrant 4: Development faces various threats and internal weaknesses. The strategy implemented is (WT strategy) that which is minimizing weaknesses and avoiding threats (Defence strategy).

Furthermore, the total score of each factor is described based on corresponding factors: S1, W1, O1 and T1. The strategy is obtained by mapping the scores on the Cartesian diagram by subtracting the strength scores from the weaknesses scores (X value) and subtracting Opportunities scores from the Threats scores (Y value). After we found the coordinates (X, Y), then they are mapped into the Cartesian diagram of the SWOT analysis. Furthermore, the quantitative strategies built are prioritized
based on the highest score on the SWOT matrix, followed by the second, third and so on. The strategy is then used as a basis for formulating policies so that implementation in the field has scientific legitimacy.

3. Results and Discussion
The SWOT analysis begins with the identification of internal and external factors affecting the sustainable community forest management system. This aimed to support the improvement of the socio-economic welfare of rural communities around the forest in Ciamis Regency. Subsequently, weighting and rating to the factors are given. A summary of the weighting and rating are presented in Table 1 below.

**Table 1. Summary of identification of internal factors (IFAS).**

| No | Description                                                                 | Weighting | Rating | Score |
|----|-----------------------------------------------------------------------------|-----------|--------|-------|
| S1 | Private forest has been developed by farmers for generations                | 0.10      | 4      | 0.34  |
| S2 | Contribution of income and environmental functions of the forest           | 0.12      | 3      | 0.39  |
| S3 | Availability and ease of obtaining seeds                                   | 0.10      | 3      | 0.33  |
| S4 | Availability of technology (cultivation, volume estimator, species selection) | 0.09      | 3      | 0.24  |
| S5 | Potential to absorb labour                                                | 0.09      | 3      | 0.28  |
|    | Sub Total for Strength                                                    |           |        | **1.59** |
| W1 | Small area forest ownership                                                | 0.09      | 3      | 0.22  |
| W2 | Low ability to estimate tree volume and choose the                        | 0.07      | 3      | 0.20  |
| W3 | Farmers have not fully adopted technology                                  | 0.08      | 2      | 0.16  |
| W4 | Farmer's capital is relatively small                                       | 0.09      | 2      | 0.19  |
| W5 | Lack of extension officers                                                | 0.10      | 2      | 0.23  |
| W6 | There are still a lot of low-quality seeds                                | 0.09      | 2      | 0.18  |
|    | Sub Total for Weakness                                                    |           |        | **1.19** |

Ciamis has become an essential market for *sengon* seedlings, which are supplied from Central Java. On average, 4 million *sengon* seedlings are sent to Ciamis every year. These seedlings trigger new business sources (nurseries) and significantly increase the income of farmers. However, the quality of seedling is usually low, so that they need to be improved. Improving the skill of nurseries operators could improve the quality of tree seedling [4]. The synergy between seedlings availability and the hobby of farmers in planting trees makes Ciamis regency becomes a center of private timber for West Java. Furthermore, to develop this promising business, the government needs to make policy to avoid diseases contagious from Central Java through seedling transportation.

Based on Table 1, it is known that the sub-total value for strength is 1.59 and the sub-total value for weakness is 1.19, which results in the total value of internal factors is 2.78 (1.59 + 1.19). The value of strength was higher than the value of weakness with a difference of 0.40 (1.59 - 1.19) and was set as the value of X on the Cartesian diagram. External factors were also analyzed with results as summaries in Table 2.
Table 2. Summary of identification of external factors (EFAS).

| No | Description                                                                 | Weighting | Rating | Score |
|----|-----------------------------------------------------------------------------|-----------|--------|-------|
| O1 | The market and demand for community timber continues to                      | 0.20      | 4      | 0.73  |
| O2 | Government programs are available every year (there is government support)   | 0.14      | 3      | 0.47  |
| O3 | There are quite a lot of labor available and do not need specific qualifications | 0.12      | 3      | 0.32  |
| O4 | The value of forest services (carbon, water, natural beauty) is increasing   | 0.10      | 2      | 0.21  |

Sub Total for Opportunities 1.72

| T1 | Lifestyle for young people (city orientation)                              | 0.08      | 3      | 0.20  |
| T2 | Government / assistance programs are less coordinated                     | 0.09      | 3      | 0.24  |
| T3 | Technology to control cancer rust has not been found                       | 0.14      | 2      | 0.24  |
| T4 | Infrastructure has not supported (damaged roads, difficult transportation) | 0.14      | 2      | 0.23  |

Sub Total for Threats 0.91

Y-Axis 0.82

In most developing countries, young farmers in a rural area usually reluctant to be a farmer and prefer to migrate to an urban area to get a job with cash incomes [11]. Based on Table 2, it is known that the sub-total value for opportunity is 1.72 and the sub-total value for threat is 0.91, which results in the total value of external factors is 2.63 (1.72 + 0.91). The value of opportunity (O) was, therefore, higher than the value of threat with a difference of 0.82 (1.72 – 0.91) and was set as the value of Y on the Cartesian diagram. Through the Cartesian diagram, the coordinates of internal and external factors can be mapped to give policy directions that must be formulated. The ordinate points (X) and abscissa (Y) were then mapped with the results, as shown in Figure 1 below.

![Figure 1. Cartesian diagram of the SWOT analysis.](image-url)
To formulate alternative policy strategies, we used additional coordinate reference from the Cartesian diagram that falls in quadrant I. Also, the preparation of the SWOT matrix was formulated, as shown in Table 3 below. The SWOT matrix was obtained by accumulating internal and external factors. The resulting score was an alternative priority policy that must be done.

Table 3. Formulation of a combination of SWOT matrix.

| IFAS   | Strength (S) | Weakness (W) |
|--------|--------------|--------------|
| EFAS   |              |              |
|        | Strategy (SO)| Strategy (WO)|
|        | 1.59 + 1.72 = 3.31 | 1.19 + 1.72 = 2.91 |
|        | Strategy (ST)| Strategy (WT)|
|        | 1.59 + 0.91 = 2.50 | 1.19 + 0.91 = 2.10 |

To analyze the quantitative formulation of SO, WO, ST and WT strategies, the SWOT matrix was compiled based on IFAS and EFAS matrix in Table 1 and Table 2. The results of the analysis are shown in Table 3, while the elaboration of each strategy combination is explained in Table 4.

Table 4. Combination of SWOT matrix strategies.

| Internal Factor | Strength (S) | Weakness (W) |
|-----------------|--------------|--------------|
| Opportunity (O) | Create a strategy that uses strength to use existing opportunities | Create a strategy that minimizes weakness to use existing opportunities |
| Threats (T)     | Create a strategy that uses strength to overcome threats | Create a strategy that minimizes weakness and avoid threats |

Based on the SWOT Cartesian diagram, the most suitable strategy to be executed is in quadrant I, a strategy that supports aggressive growth policy. Based on the matrix strategies in Table 3 it is necessary to refer the highest scores as the first priority in generating the strategy followed by second highest score etc., as follow: Strategy (SO) which has the highest score is = 3.31, followed by strategy (WO) with a score = 2.91 then (ST) with score = 2.50 and the last strategy (WT) with a score = 2.10

3.1. SO Strategy
1) The cultivation habits and farmer interest in forest development (S1) should be directed to implement agroforestry systems that bring the most significant economic and environmental benefits (S2). The system should be based on elevation and management units through technology (S4) adoption (maintenance and ideal spacing) to meet the increasing market demand (O1). The previous study revealed that the leading cause of unsustainable private forest management in Ciamis District was the low standing stock in the private forest [1]. This condition could give a strong background for the government in introducing appropriate cultivation technology to push timber production from the private forest.
2) Continuity of government support (O2) must be used as an incentive for technology transfer for management and training of labor (S4, O2, and O3)
3) Existing technology must be used to improve the quality of seeds, which are very abundant in the Ciamis Regency. So that the forest productivity in the future can meet the increasing demand and can be used as an alternative source of potential income for farmers. (S2, S3, S4, O1)
4) Technology must be used as the main reference for the preparation of government programs to develop community forests (O3). So that the potential of community forests to absorb labor can be increased as a solution to a large number of labors around the forest (S4, S5, O2, and O3).

5) In the future, forest services will play a more important role (O4) both economically and environmentally. In this regard, the income and environmental contributions from the forest (S2) should be able to explore the potential of forest service optimally.

4. Conclusion and Recommendations
The SWOT approach has proven its usefulness in giving the direction of strategy options that are built based on internal and external factors. Based on the formulation of the SWOT matrix, a set of strategic recommendations could be generated, started from the SO (Strength-Opportunity) strategy, which has the highest score, followed by WO, ST and WT strategies. However, by considering the government's budget limitation and the workforce, the execution of strategy would be focused on the highest score (SO).

The SO strategy consists of following four sequence strategy options, i.e., the government should provide a guide about the agroforestry system based on elevation range and management unit, which has a potential product with high economic and environmental values, to meet increasing market demand for timber. Also, farm laborers around the forest should be trained and introduced with the technology to inspire them to create a new source of income. Technology has to be considered as the primary reference at any program related to private forest development to improve the forest roles in solving the problem of the unemployed farm laborer. The government also has to facilitate forest product processing to gain added value.

Furthermore, a policy scenario is needed to implement the strategies that have been prepared based on priorities as follows:

1) **Main Policy.** Extension officer should encourage and give continuous assistance to farmers to practice the cropping patterns which are environmentally and economically most profitable based on management unit in each altitude region. Gradually, conditions need to be created to encourage changes in the mindset of farmers in managing community forests from the traditional mindset to the entrepreneurial mindset where business profits are a factor that must be considered.

2) **Supporting Policy.** A substantial amount of financial capital is needed to support the implementation of the prospective cropping pattern. At the same time, farmers also need income for their daily needs. For this reason, the regional government needs to facilitate the growth of potential new sources of income (e.g., seed business), considering that there are around 4 million seeds each year sent from Central Java to Ciamis regency. The facilitation from the government could be in the form of technical training to produce good quality of seedlings and providing the certificate of qualified seedlings to improve the market chance.

Besides, every assistance from the local government needs to be adjusted to the farmers' needs (inline), especially those that support the implementation of cropping patterns. Furthermore, good community forest management requires adequate skills so that farmers need to be provided with proper forest management training.

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