The Impact of Joint Community Forest Management (PHBM) on Local Community Income in Upstream of Ciliwung Watershed, Bogor Regency-Indonesia

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Abstract. Forest area in the upstream of Ciliwung watershed is one of the last remaining forests in the hinterland of Jakarta metropolitan. Forest degradation and the rapid pressure of land use change are serious issues in the Greater Jakarta area that need to be addressed. In 2009, Joint Community Forest Management (PHBM) was initiated by Perum Perhutani in the upstream area of Ciliwung watershed at Kampung Cibulao, Tugu Utara Village, Bogor Regency. This PHBM program involved a forest farmer group in managing village forests, particularly through the management of shade-grown coffee and mountain bike trails. This study investigates the impact of the PHBM program on the local economy improvement using the latest datasets of financial management of forest farmer group in 2017. The aims of this study are to analyse: 1) farmers income from PHBM activities; 2) feasibility of shaded-grown coffee and mountain bike trails activities by using benefit and cost analysis (NPV, IRR, Nett B/C Ratio). The results show that there has been a significant increase of income namely 16.55% or IDR 248,333/hectare/month of cherry and 47.77% or IDR 716,563/hectare/month of green beans. Meanwhile, the management of mountain bike trails has increased the farmers’ income by 32% or IDR 480,000/person/month. The finding of feasibility study shows that Mountain Bike Trails Management is financially not feasible for communal business if it uses the current proportion of business sharing. Therefore, it is necessary to renegotiate the proportion of sharing in order to provide more economic benefits for the local people.

Keywords: forest degradation, PHBM, local economy, financial management

1. Introduction

The upstream of Ciliwung watershed or commonly known as "Puncak area” has been established by UNESCO as Biosphere Reserve since 1977. As a buffer area of Gunung Gede Pangrango National Park (GGNP), the upstream of Ciliwung watershed has an important role as water catchment that flows into Ciliwung river to the bay of Jakarta [1]. Because of its very important role for national, social and environmental economic development, the Ciliwung watershed was then designated as a national strategic area by Government Regulation (PP) no. 26/2008 concerning National Spatial Plan.

The history of the development regulations in the Ciliwung watershed upstream actually has begun in 1963 through Presidential Regulation No. 13 of 1963 which regulates the control of new construction
along the Jakarta-Bogor-Cianjur road. Currently, a number of specific policies related to the area have been established, i.e. Government Regulation (PP) no. 26/2008 concerning National Spatial Planning; President Regulation No. 54 of 2008 concerning Spatial Planning for the Areas of Jakarta, Bogor, Depok, Tangerang, Bekasi, Puncak, Cianjur (Jabodetabekpunjur); Local Regulation of Bogor Regency Number 19 of 2008 concerning Local Spatial Plan 2005-2025. In substance, these policies aim to control land utilization, to regulate land use for the purpose of conserving soil and water in the region with considering ecological balance and preserving the environment [2].

At present, the landscape in puncak area has been experiencing rapid changes. Land conversion generally occurs in the use of forest land for plantation and farming areas, plantation areas into agricultural lands and settlements or agricultural areas into residential and industrial uses [3, 4, 5]. During the period of 1990-2010, there was a large change of landuse/cover for settlements in upstream Ciliwung Watershed. The development of settlements had increased by 245.73%: from 883.3 hectares in 1990 to 2,170.6 hectares in 2010 [4]. These settlement areas have occupied unsuitable areas located in the protected zone (57.46%) and agricultural cultivation zone (22.65%) and even some have occupied landslides prone zone [3].

The main function of Ciliwung river upstream area is as a water catchment area: protecting downstream areas that are very sensitive to flooding due to surges in river water discharge [4]. The fact shows, there has been extreme flooding in the Greater Jakarta area in January 1996, February 2002, February 2007, January 2013, January and February 2014. The flood disaster which inundated up to 60% of the Jakarta area in February 2007 caused 80 flood victims, around 190,000 with flood-related diseases and experiencing financial losses of US $ 453,000,000 [5].

As a fragile ecosystem, the upstream of Ciliwung watershed needs sustainable area management that prioritizes the preservation of the function of the forest area as a provider of environmental services and considers the carrying capacity of the area [6, 7] as well as providing benefits to communities near forest areas One of the efforts to reduce the excessive use of natural resources in this region is to provide access to forest areas to the community through Community Forest Management Program (PHBM) managed by Perum Perhutani [8]. At national level, the legal basis of this program is the Decree of the Board of Directors of Perhutani Number 1061 / Kpts / Dir / 2000 which was later replaced by the Decree of the Perhutani Supervisory Board Number 136 / KPTS / DIR / 2001. PHBM as the latest program of Perum Perhutani policy is a collaborative forest management model between professional forestry institution (Perum Perhutani) and forest village communities [9, 10].

The basic principle of PHBM allows the Perhutani to act as facilitator and the PHBM participants to obtain clarification certainty of their rights and obligations [11]. In PHBM system, an empowerment process for forest village communities is conducted with the intention to achieve sustainable forest resource management and to improve the welfare of forest village communities [12]. In the context of upstream Ciliwung watershed management, PHBM program is directed to strengthen community participation in the management of production forests: buffer areas that bordering to the conservation areas (i.e Telaga Warma Nature Reserve and Gunung Gede Pangrango National Park).

Since 2009 Perum Perhutani has begun introducing the PHBM program by establishing the Hutan Pangkuan Desa (HPD) or Village Forest in Tugu Utara Village. Community development started with the formation of Kelompok Tani Hutan (KTH) or forest farmer groups, which later became Village Forest Community Organization of "Puncak Lestari" (LMDH Puncak Lestari). LMDH is granted the right to manage forests through agroforestry and ecosystem services activities [11]. The first introduced commodity was robusta coffee which was planted in 4 hectares of production forest and was managed by KTH Cibulao Hijau of Kampung Cibulao. Furthermore, KTH Bike Park has also started ecotourism activities by managing mountain bike trails since 2014 in the Village Forest (HPD) of Tugu Utara.

This paper is based on the study of the working of PHBM on the upstream of the Ciliwung River. The main research question of the study was, does the Joint Community Forest Management (PHBM) has a positive impact on the local economy?
2. Study Area and Methods

2.1. Study Area
The study was conducted in Kampung Cibulao area, Tugu Utara Village, Cisarua, Bogor Regency, 30 km south of City of Bogor, Indonesia (figure 1). Kampung Cibulao is located in the upstream of Ciliwung river and bordering with production forest and conservation area. Production forest is managed by Perum Perhutani Bogor, which covers more than 600 hectares. The conservation area is divided into Telaga Warna Nature Reserve (368.35 hectares) and Telaga Warna Nature Park (5 hectares). Both were managed by the Natural Resource Conservation Agency (BBKSDA).

The location of the study was deliberately carried out with the consideration that this location was upstream (0 Km) from the Ciliwung watershed, which if there was damage would have a major impact to the downstream area. In addition, the majority of PHBM participants were residents living in Kampung Cibulao.

Figure 1. Location of the field study.

2.2. Data collection
This study uses case study approach. The case study is a research design that develops in-depth analysis of a case. Cases are limited by time and activity and researchers gather complete information using various data collection procedures based on the time specified [13]. Data were collected from April to July 2018. We did observation of the harvesting process and post harvesting process of coffee, as well as mountain bike trails management activity. During the survey, we have selected participants and did an indepth interview to collect information of both activities and analyzed the latest financial datasets (2017) as well as other relevant financial historical information.

The selected participants are leaders who have been conducting and managing of both activities. Furthermore, we facilitated several focus group discussion with both KTH member with total 40 people to gather and verify the information about PHBM implementation, e.g. division of stakeholder roles, business sharing model, land allocated, PHBM Policy and regulation.

2.3. Data analysis
To analyze the income derived from PHBM activity, we use the basic income equation for income from self-employment, e.g. agriculture or business referring to [14]. Revenue from coffee cultivation activities is calculated from total revenues minus production costs that include raw materials, labor, overhead and social costs. Revenue from mountain bike trails activities is calculated only from the sum of total daily wage in a month. The equation is as follows:

\[ I = \sum_{i=1}^{n} p_i y_i - \sum_{j=1}^{m} q_j v_j \]  

Where \( I \)-Nett income; \( n \)-types of products; \( p_i \)-product price \( n \) at year \( i \); \( y_i \)-product quantity \( n \) at year \( i \); \( m \)-types of production inputs; \( q_j \)-price of production input \( m \) at variable \( j \); \( v_j \)-quantity of production input \( m \) at variable \( j \).
Financial feasibility study of PHBM activities is using a benefit and cost analysis, i.e. Net Present Value (NPV), Internal Rate Return (IRR), Nett Benefit Cost Ratio (Nett B/C Ratio). NPV is a useful tool to determine whether a business project will result in a net profit. The business project may be accepted or continued if NPV is positive [15, 16, 17].

All of data are then analyzed by descriptive and narrative form. The strength of the descriptive method with emphasis on the discussion of cases is to provide a thorough understanding of the context of the existing reality [18].

3. Results

3.1. The PHBM implementation in Kampung Cibulao

3.1.1. The Kampung Cibulao. Kampung Cibulao is an official residence for workers of the Ciliwung Tea Plantation which is managed by PT Sumber Sari Bumi Pakuan (SSBP). The total population of this kampung is 139 households. Kampung Cibulao was established in 1992, with an initial population of 12 households. It was obvious here that the main livelihoods of Cibulao villagers are plantation workers, both permanent and non-permanent workers. The largest number of tea plantation workers are tea pickers, while the rest of them are tea plant maintenance workers, pest sprayers, road maintenance workers, foreman, supervisor, security and administration staffs.

Community involvement in the PHBM program is an alternative to increase household income. The income of tea pickers per day is IDR 22,000 to IDR 28,000 or IDR. 750,000 per month on average. This number is far below the Bogor Regency Minimum Wage (UMK) in 2016 which is IDR. 2,590,000. This was made worse by the condition of PT SSBP which experienced a significant decline in production in recent years. Even, PT SSBP no longer processes its own tea production and only harvests and sells it to other tea processing companies.

3.1.2. Institutional arrangement of PHBM. The Joint Community Forest Management (PHBM) in Kampung Cibulao, Tugu Utara Village has begun since 2009 marked by the signing of a Memorandum of Understanding (MoU) between Perum Perhutani Bogor and the Forest Community Organization (LMDH Puncak Lestari). LMDH Puncak Lestari manages Pangkuan Desa Forest (HPD) covering an area of 610 hectares, where the permitted activity is a forest management model with agroforestry systems and environmental service activities [11]. Of the total area of HPD, most of the forest area is around Kampung Cibulao.

![PHBM Organisational Structure and Level of Agreement](image)

**Figure 2. PHBM Organisational Structure and Level of Agreement.**

In practice, the PHBM is strengthened by a Cooperation Agreement between the two parties whose performance is evaluated every 2 years. Furthermore, to optimize the management of the HPD area, LMDH Puncak Lestari formed a Forest Farmer Group (KTH) in several sub-villages, one of which was in Kampung Cibulao namely KTH Cibulao Hijau and KTH Bike Park. LMDH and KTH Cibulao Hijau as well KTH Bike Park then made derivative cooperation agreements for each type of business activity carried out by the forest farmer groups (Figure 2). KTH Cibulao Hijau consists of 38 households with
the main business of conducting coffee cultivation under tree (shaded-grown coffee) in the Perum Perhutani production forest. Of the total number of KTH Cibulao Hijau members, 8 (eight) households of them are members of KTH Bike Park. The number of members of KTH Bike Park is not too much because the activities of managing mountain bike trails require special skills and strong interest in this particular area.

3.1.3. PHBM Activity. The PHBM program provides an opportunity for Cibulao people to get economic benefits from managing shaded-grown coffee cultivation and mountain bike trails in production forest areas. KTH Cibulao Hijau has started to manage 4 hectares of productive coffee since 2009. Furthermore, in 2017, the farmer group received an additional permit to manage 30 hectares of land, planted with Arabica Coffee (25 hectares) and Robusta Coffee (5 hectares) with a total of 25,000 trees. All coffee trees are Sigararuntang variety that have a productivity of 10 years and are a grant aid from the West Java provincial government.

Post-harvest coffee processing has been introduced since 2014 by the Consortium of Save Puncak and Center for Regional Systems Analysis Planning and Development (CRESTPENT), Bogor Agriculture University. Both institutions strengthen Cibulao farmers’s capacity by bringing coffee experts to provide knowledge and skills related to post-harvest coffee processing (figure 5). At present, these institutions still provide some assistances to forest farmer groups, especially in strengthening coffee quality standards (figure 3) and building niche market networks. In 2016, Robusta Cibulao coffee was selected as the best of Indonesia's Robusta coffee in the Indonesian Specialty Coffee Contest, Takengon, Aceh. This award has significantly impacted the demand and selling price of Cibulao coffee products.

Figure 3. Pruning the coffee branch that aims to make the coffee tree not too high and also to increase fruit productivity in each branch.

Figure 4. Stripping a fruit skin of cherry by using manual pulper. That is one of Post-harvest coffee processing in Kampung Cibulao.

Figure 5. Sorting and grading are done when the green bean is completely dry.
Since 2014, KTH Bike Park has been managing mountain bike trails along 6 km in the production forest area (52.84 hectares) with an average visitor of more than 200 bikes per week (figure 6). Until 2017, mountain bike activities have developed: the KTH Bike Park has been able to organized several activities both at the local and national levels. Some of these activities (figure 7) are Fun/family Bike (almost every week since 2014); Fun Enduro (every few months); Asian Enduro (2015); Indonesian Enduro (2016).

Currently, there are 3 (three) models of tracks managed by KTH Bike Park, namely the AM Trail Expert Class, XC Class and Enduro Class which are located at 3 entrances to the OG track, the Kondang track and the AT (AM Trial) track (figure 8).

![Figure 6](image1.png)
**Figure 6.** Managing the community group of mountain bike trails is one of KTH Bike Park Activities.

![Figure 7](image2.png)
**Figure 7.** Modify tracks, make new challenges become routine track maintenance activities every week.

![Figure 8](image3.png)
**Figure 8.** The skills and ideas in managing/modifying of tracks must continue to be built and developed so that bikers always come to try new challenges.

3.1.4. Business sharing model and land allocation in PHBM program. The PHBM business sharing scheme set by Perum Perhutani for coffee cultivation is 25%: 75% of the wet harvest of coffee (cherry). It means that 25% of the total wet coffee yield for Perum Perhutani and 75% for farmers. Until now, the basis for determining the proportion of business sharing is still not widely understood by farmers given it is largely determined by Perum Perhutani as the "owner" of the land.

For the management of mountain bike trails, the business sharing scheme is determined by Perum Perhutani: 70% of the revenue of ticket sales is given to KTH Bike Park while 30% is given to Perum Perhutani. However, in reality the 70% portion of the KTH Bike Park is further divided into 50% for KTH Bike Park and 20% for LMDH Puncak Lestari. The final composition of business sharing in the farmer level is determined by LMDH as it acts as the authority to sign a cooperation agreement with Perum Perhutani.
The total land allocation for coffee cultivation is 24.59 hectares (38 household) with an average land allocation per farmer of 0.5 hectares. KTH Bike Park develops special interest tourism, namely mountain bike tourism by managing a 6 km mountain bike track in the Perum Perhutani production forest area (52.84 ha).

3.2. Revenue from shaded-grown coffee cultivation
In production process, there are two types of product produced by farmer, i.e. cherry (coffee fruits) and green bean coffee. In Cibulao case, production cost of coffee cultivation is low, consisting only of labor costs. Even these labors are usually their own family members. Furthermore, in the production process there are also no distribution costs because the product is taken directly by the buyer.

The calculation of the production input in Cibulao is based on the day of work and the daily wage standard (table 1). For product selling price, we referred to the prevailing market price in Cibulao and Puncak area, Bogor regency. From the farmers’ information within the 4 hectares area, the type of coffee planted is mostly robusta and it produced at least 600kg-800kg of cherries/hectare. Based on the data in 2012-2016, the average production of Cibulao coffee was 750 kg/hectare [19]. For post-harvest processing, green beans are reduced to 25% from the total production of cherries in one hectare (table 2). Product selling price referred to prevailing market price in Cibulao and Puncak area, Bogor regency.

Table 1. Revenue of Cherry Coffee Production.

| Production Inputs | Production Sales | Revenue of Cherry Coffee |
|-------------------|------------------|--------------------------|
| Types of Production Input | Number of work day | Daily wage (v<sub>j</sub>) | Total Costs (IDR) (q<sub>j</sub>v<sub>j</sub>) | Yields (y<sub>i</sub>) (Kg/Ha) | Product Price (p<sub>i</sub>) (IDR/Kg) | Total Sales (IDR) (p<sub>i</sub>y<sub>i</sub>) | Nett Revenue (IDR) (p<sub>i</sub>y<sub>i</sub> - q<sub>j</sub>v<sub>j</sub>) |
|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Land clearing     | 20               | 40,000           | 800,000          |                  |                  |                  |                  |
| Copping/pruning   | 4                | 40,000           | 160,000          |                  |                  |                  |                  |
| Harvesting        | 14               | 40,000           | 560,000          |                  |                  |                  |                  |
| Total             |                  | 1,520,000        |                  | 750              | 6,000            | 4,500,000        | 2,980,000/year or 248,833/month |

Table 2. Revenue of Green Bean Coffee Production.

| Production Inputs | Production Sales | Revenue of Green Bean Coffee |
|-------------------|------------------|-----------------------------|
| Types of Production Input | Number of work day | Daily wage (v<sub>j</sub>) | Total Costs (IDR) (q<sub>j</sub>v<sub>j</sub>) | Yields (y<sub>i</sub>) (Kg/Ha) | Product Price (p<sub>i</sub>) (IDR/Kg) | Total Sales (IDR) (p<sub>i</sub>y<sub>i</sub>) | Nett Revenue (IDR) (p<sub>i</sub>y<sub>i</sub> - q<sub>j</sub>v<sub>j</sub>) |
|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Costs of Cherry Production |                  |                  |                  |                  |                  |                  |                  |
| Drying            | 17               | 40,000           | 680,000          |                  |                  |                  |                  |
| Hullering         | 1                | 40,000           | 40,000           |                  |                  |                  |                  |
| Sortir            | 187.5 kg         | 1,500 / kg       | 281,250          |                  |                  |                  |                  |
| Grading           | 2                | 40,000           | 80,000           |                  |                  |                  |                  |
| Gasoline          | 5 liter          | 10,000           | 50,000           |                  |                  |                  |                  |
| Total             |                  | 2,651,250        | 187.5            | 60,000           | 11,250,000       | 8,598,750/year or 716,563/month |

To calculate the increase of the farmers income, we use the main households’ income of tea worker as a baseline. The average households’ income as a tea worker is IDR 1,500,000/month (head of household plus his wife). Following the equation (1), we can see that there is an increasing revenue of 16.55% or IDR 248,333/month/hectare if the coffee is processed to cherry. A significant increase in revenue occurs if the coffee is processed to green bean, i.e. 47.77% or IDR 716,563/month/hectare.
3.3. Revenue from mountain bike trails management
Community income from mountain bike trails management is calculated from daily wages of working as a tracks’ maintenance and customer service officer (ticketing staff). If a farmer works as a ticketing staff, the weekly income is IDR 80,000 (two days of work) and if working as a track maintenance officer, the weekly income is IDR 40,000 (one day of work). If the farmer works in both positions, their weekly income is IDR 120,000 (three days of work) or IDR 480,000/month. Often, KTH Bike Park members work for both positions. The percentage of increasing revenue of farmers as mountain bike trails management’s officers is 32% or IDR 480,000/month.

3.4. Feasibility study of Shaded grown coffee management
To analyze the feasibility of shaded-grown coffee managed by KTH Cibulao Hijau, we used the 4 hectares of robusta coffee production latest data (year 2017) as a baseline. Based on this data, the initial investment needs of shade-grown coffee management is IDR 50,000,000. From this investment funds, IDR 36,000,000 is used for seedlings (approximately 8,000 trees) and IDR 14,000,000 is used for the maintenance of coffee plants and for fertilizers in the first three years. The investment economic life is estimated to be 10 years based on productivity of Sigararuntang variety. The business turnover is estimated at IDR 18,000,000 (cherry) and IDR 45,000,000 (green bean). The interest rate used is 7%, referring to the interest rate of the small-scale business credit. The national standard tax rate for small businesses (SME’s) is 1% of the total value of business turnover. The profit margin of 75% refers to the proportion of profit sharing that occurs in the field (the remaining 25% is for Perum Perhutani). Operational costs are estimated at IDR 6,080,000 (cherry) and IDR 10,605,000 (green bean). The details of operational costs or product inputs can be seen in table 1 and table 2. In this context, we assumed that the price of coffee, productivity and its operational cost is stable. It means the business turnover growth per year is also stable.

| Financial Analysis Tools | Value\textsuperscript{a} | Value\textsuperscript{b} | Criteria | Results |
|--------------------------|--------------------------|--------------------------|-----------|---------|
| NPV                      | -34,267,177              | 74,282,275               | NPV > 0, Accepted | Value\textsuperscript{c} rejected Value\textsuperscript{c} recommended to be done |
| IRR                      | below 0%                 | 34.2811%                 | IRR > prevailing discount rate\textsuperscript{c}, Accepted | |
| Nett B/C Ratio           | 0.31466                  | 2.48565                 | NB/C Ratio >1, Accepted | |

\textsuperscript{a} Cherry Coffee Product
\textsuperscript{b} Green Beans Product
\textsuperscript{c} Discount Rate 7%

The results of the financial feasibility study of shaded-grown coffee management shows that producing cherry coffee is financially not feasible (value\textsuperscript{a} table 3). The NPV value is IDR 34,267,177, meaning that until the end of its economic life (10 years), the business experiences a loss of IDR 34,267,177 (not profitable). The IRR value is below 0% and could not be calculated. It means that the interest rate of return on capital from cherry coffee production is not able to cover the capital interest during the economic life of the investment. Net B/C Ratio value is 0.31466 (less than 1), meaning that the business is financially not profitable because the costs outweigh the benefits.

The result is different if the farmers do post-harvest processing. The financial feasibility study shows that processing green bean coffee is financially feasible (value\textsuperscript{b} table 3). The NPV value is IDR 74,282,275, meaning that until the end of its economic life (10 years), the business experiences a profit of IDR 34,267,177. The IRR value is 34.2811% (higher than 7% of discount rate), meaning that the rate of return on capital from green bean coffee products will be able to cover capital interest during the economic life of investment. Net B/C Ratio value is 2.48565 (more than 1), meaning that the business is financially very profitable.
3.5. Feasibility study of mountain bike trails business

In analyzing the feasibility of mountain bike trails, we used the latest financial datasets in year of 2017 and other financial historical information. Based on this data, the initial investment needed is IDR 150,000,000. Of the investment fund, IDR 126,000,000 is used for working capital to develop 3 (three) off road tracks and IDR 24,000,000 for initial operational costs. The investment economic life is estimated to be 10 years. The basis of business turnover is the turnover value in 2017, which is Rp 120,000,000, with an average business turnover growth estimated at 10% per year based on 2015-2017 financial data. The discount rate used is 7%, referring to the national interest rate of the small-scale business credit. The national standard tax rate for small businesses (SME’s) is 1% of the total value of business turnover. The profit margin (50%) refers to the proportion of profit sharing that occurs in the field (the remaining 30% is for Perum Perhutani and 20% for LMDH). Operational costs are estimated at 60% of gross profit. Operational costs are used for labor (ticketing and tracks maintenance), tools and equipment for tracks maintenance, security costs, social costs, and other operational costs.

The results of the financial feasibility study show that the business of mountain bike trails management is considered not feasible to be developed if it is based on the existing proportion of profit sharing (see value° in table 4). The NPV value is IDR -13,273,094, meaning that until the end of its economic life (10 years), the business experiences a loss of IDR 13,273,094 (not profitable). The IRR value is 5.48%, meaning that the interest rate of return on capital from the mountain bike trails management is still below the prevailing discount rate (7%) so that it has not been able to cover the capital interest during the economic life of the investment. Net B/C Ratio value is 0.9111 (less than 1), meaning that the business is financially not profitable because the business costs outweigh the benefits.

However, if the proportion of profit sharing is changed to 60% for KTH Bike Park, 25% for Perum Perhutani and 15% for LMDH, the result shows that the business of mountain bike trails management is considered feasible to be developed (see value° in table 4).

| Financial Analysis Tools | Value\(^a\) | Value\(^b\) | Criteria | Results |
|--------------------------|------------|------------|----------|---------|
| NPV                      | -13,273,094 | 37,691,249 | NPV=Positive, Accepted | Value\(^a\) rejected |
| IRR                      | 5.48%      | 11.19%     | IRR > prevailing discount rate\(^c\), Accepted | Renegotiate to Value\(^b\) |
| Nett B/C Ratio           | 0.91151    | 1.25127    | NB/C Ratio >1, Accepted |         |

\(^a\) Existing proportion of sharing i.e 50% KTH Bike Park, 30% Perum Perhutani, 20% LMDH Puncak Lestari
\(^b\) Increased proportion of sharing i.e 60% KTH Bike Park, 25% Perum Perhutani, 15% LMDH Puncak Lestari
\(^c\) Discount Rate 7%

4. Discussion

Based on our analysis on the results of PHBM activities in Cibulao, PHBM activities have directly impacted on the increase of households’ income. From shade-grown coffee management, farmers gained increasing revenue by 16.55% or IDR 248,333/hectare/month of cherry and by 47.77% or IDR 716,563/hectare/month of green beans. In the short run, from the management of mountain bike trails, farmers have increased their revenue by 32% or IDR 480,000/person/month.

The findings of financial feasibility study by using benefit cost and analysis shows that producing cherry coffee is not financially feasible (value\(^a\) table 3) to the sustainable shaded-grown coffee business. Its sustainability can only be achieved by producing green beans for premium or specialty coffee (value\(^b\) table 3). This analysis has also included a variable of agreed proportion of sharing, i.e. 75% for KTH Cibulao Hijau and 25% for Perhutani. Due to the limited land area for coffee production, green beans or others post-harvest coffee processing is a better choice to shaded-grown coffee management. Post-harvest processing will increase the added value of coffee products and have implications for better prices, the creation of niche markets and loyal consumers [19].
However, the processing of green beans requires knowledge of post-harvest technology that needs to be trained by the farmers. The majority of KTH Cibulao Hijau members have no post-harvest processing skills. They still process coffee in the cherries’ product. In addition to knowledge and skills in post-harvest processing, it is important to develop institutional capacity of farmers group in the coffee business management, including strengthening coffee quality standards.

To ensure the sustainability of the business, niche market networks of premium and specialty green beans must continue to be built and developed by KTH Cibulao Hijau as well as by their strategic partners.

Positively, in the case of Cibulao, some farmers have been processing green beans products and the market share is well established. Green beans of Cibulao are sold directly to the coffee shops in Jakarta, Bogor, Depok, Tangerang, Bekasi and other cities. Cibulao green beans have significantly cut the market chain from producers to consumers without intermediaries. This shorter chain has an impact on the purchasing price of cherries at the farm level.

In the case of KTH Bike Park, the findings of financial feasibility study shows that Mountain Bike Trails Management is financially not feasible for communal business if it uses the current proportion of business sharing (value* table 4). Their business will not be able to continue because after 10 years, they do not have enough capital to continue the activities. It means, although the farmers have generated income from the PHBM program, the business will not be sustainable and stop at the end of its economic life. Based on our analysis (value* table 4), it is necessary to renegotiate the proportion of sharing of this business in order to provide economic benefits for the local people and to ensure its sustainability.

In general, the PHBM program still suffers from some problems, such as access rights, institution, the participation of stakeholders, collaboration agreement, profit sharing, and internalization of PHBM [11], including in the upstream Ciliwung Watershed. In the context of Cibulao, engaging the stakeholders especially Perum Perhutani and LMDH Puncak Lestari is still unsuccessful. As strategic partners in PHBM agreement, both institutions have not engaged in the KTH’s business activities. The profit-sharing taken by both of institutions are considered too high because they only act as an institution that provides legality and does not participate in its management. Thus, all the risks of loss and profit are borne by the KTH.

So far, there is no clear measurement to be used as the basis for determining the proportion of sharing. Based on the findings of this study, we argued that it cannot generalize the value of the sharing proportion in all situations and in all places. The proportion value used by Perum Perhutani should be based on a feasibility study for each agricultural commodity and for each environmental service. The value of the proportion is certainly influenced by the initial investment, production capacity (the context of coffee is related to the land area, while environmental services are related to the type of environmental services activities), production inputs, distribution costs, promotion and marketing costs.

Furthermore, in the context of the upstream Ciliwung river as fragile ecosystem, PHBM business cannot be carried out conventionally on a mass production scale. Therefore, discussion and negotiation rooms should be accommodated by Perhutani’s state company, based on a clear basic measurement and balanced distribution of roles and responsibilities according to the portion and objectives of PHBM, namely reducing forest conflict, improving forest sustainability by providing access to forest management in order to improve the economy of local communities.

Finally, the analysis of this study can provide, at least, a reference for determining a better proportion especially in the context of Cibulao. KTH, Perhutani and LMDH need to have further discussion in terms of determining the proportion of sharing based on a clearer economic valuation. Perhutani and LMDH should be involved in KTH's business, mainly to increase capacity in post-harvest processing and to strengthen the KTH's small-scale business management.
5. Conclusion
PHBM activities have had direct impact on the increasing households’ income. Shaded-grown coffee management has increased the income by 16.55% /month (cherry) and by 47.77% /month (green beans), while mountain bike trails has increased the income by 32% /month in the short run. Yet, economically, shaded-grown coffee management needs to be encouraged in post-harvest processing to ensure the sustainability of its business. On the other hand, the management of mountain bike trails is financially not feasible if it uses the current business sharing proportion.

There is a need for capacity building for the farmers and a better institutional management at the farmer group level as well as a renegotiation of a fairer business sharing proportion that can guarantee the sustainability of farmers’ business. To ensure this, Perhutani and LMDH need to be involved more closely in KTH's business activities, especially in improving post-harvest processing skills and strengthening the KTH's small-scale business management. Furthermore, KTH, Perhutani and LMDH need to re-discuss the PHBM sharing proportion based on a clearer economic valuation. A clear proportion of business sharing will strengthen the roles and responsibilities of the parties.

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