

# Strategy to improving community economic through on-farm agroforestry using community forestry scheme in KPH Yogyakarta

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**Abstract.** The enhancement of land productivity using the agroforestry mechanism with the scheme of community forestry program has been practiced as a strategy to improve the economic growth of the community surrounding *Kesatuan Pengelolaan Hutan* (KPH) or Forest Management Unit of Yogyakarta. This approach is expected to become the solution in reducing deforestation and degradation as impacts of the decreasing quality of forest resources. Forest co-management with the community through a commodity diversification scheme has been practiced for several years. The objective of this research is to understand the economic profile of the farmers' households who have become part of the program using several parameters. These parameters include the financial feasibility of the agroforestry scheme, the economic contribution from on-farm and off-farm income to farmers' total income in a specified period, and the discrepancy between farmers' income, and income per capita as initial input to measure the social-economic level in regional basis. From 100 respondents interviewed, we could provide the following information: (a) the farmers as respondents are categorized into four land share areas, namely (a)  $\leq 0.25$  Ha (b) 0.26-0.50 Ha (c) 0.51-0.60 Ha and (d) 0.61-1.00 Ha. The average income in Gunungkidul District for (a) Production forest is 1,612,500 IDR (b) Conservation forest is 1,893,750 IDR while the average income in Kulon Progo District for (a) Production forest is 1,568,250 IDR and (b) Conservation forest is 1,612,500 IDR. The income from areas managed by the farmers as stated above represent the economic contribution from the on-farm and off-farm income of the program. The income contribution for farmers from agroforestry within the research remains low (<10%), and the income discrepancies calculated using the Gini Ratio coefficient are (a) 0.38-0.42 for Gunungkidul District and (b) 0.34-0.46 for Kulon Progo District. Both of the regions studied have low to moderate discrepancy levels.

**Keywords:** Economic valuation, agroforestry, income contribution, Gini ratio

## 1. Introduction

Disturbance to (State-owned) the forest resources in Indonesia that threaten their sustainability has been a growing concern these days. The phenomenon has caused serious damage to the forest, such as (1) declining forest resources quality in terms of technical area (degradation, deforestation) (2) forest products



robbery (timber, non-timber) and services (3) widespread horizontal (among affected communities) and vertical conflicts (between the community, the government, concession right owners, and related institutions) (4) conflicting and inconsistent policies and regulations, not to mention other undetected detrimental effects on forest resources [1,2,3]. On the other hand, a poverty issue is found among the communities living in the surrounding area of State-owned forest, though its quantitative effects are yet to be properly measured [4].

In Indonesia, the poverty issue persisted with the Gini ratio of 0.41 in the last decade [5,6]. The same is also faced by most communities living around State-owned forests. The condition may lead to the forest products robbery (timber and non-timber) and services to make people's ends meet [7,8,9]. Therefore, the Ministry of Forestry of the Republic of Indonesia in their Strategic Plan 2010-2014 laid down the strategies to manage the forests through a Community Forestry Program, using four (4) schemes, those being: (a) *Hutan Kemasyarakatan* (HKm) or Community Forest (b) *Hutan Desa* (HD) or Village Forest (c) *Hutan Tanaman Rakyat* (HTR) or Community Plant Forest and (d) forest management under REDD initiative [1,4,9,10,11]. This paper focuses on analyzing the findings of research on increased agricultural business income from agroforestry (timber and annual plants) using the HKm scheme which is expected to improve the livelihood of the communities living around the forest. The forest management under the HKm scheme is executed under several laws, i.e. Regulations of the Minister of Forestry of the Republic of Indonesia (MoF Regulation) No. P.37/Menhut-II/2007, P.18/Menhut-II/2009, P.13/Menhut-II/2010, and P.52/Menhut-II/2011. They comprehensively cover from related technical directives to management licensing procedures, i.e. forest management permit for Community Forest (IUP/*Izin Usaha Pengelolaan*-HKm) in production and protection forests.

### *1.1. Forest Management Strategies under Community Forestry Program (HKm)*

Forest resources management strategies are expected to work simultaneously with the national strategic plans (*Rencana Strategis Nasional/Renstranas*) in various aspects, being pro-environment, pro-growth, pro-job, and pro-poor. The concept, in micro-scale, is deemed suitable for the execution at the Forest Management Unit development designed by the government, e.g. Community Forestry Program (HKm), with agroforestry on-farm technique, in the forest areas managed by KPH Yogyakarta. This strategy is expected to improve the community economic conditions in parallel and minimize deforestation [4,22], in addition to preserving the balance of forest resources' roles towards ecosystems, societies, and economies. It is important to keep the balance of forest resources' diverse roles whose characteristics need to be understood by every party, those being (1) Forest as an income-generating factor in forest resources management [2,12] has various roles, i.e. maintaining balanced ecosystem, improving social welfare, and community economics, while at the same time generating tangible/intangible benefits. In theory and application, trade-off (negative correlation between forest resources as public and private/business function) between products (tangible output) and services (intangible output) often occur; (2) Environmental services are the intangible output of forest resources which possess use-value, with economic proxy higher than products/tangible output; and (3) The management strategies employed by the government and communities in managing forest resources, strive to empower the communities and optimize the roles of forest resources [15,16]. In addition, forest resources are secured against vulnerability given the fact that not only receiving an economic benefit from forest resources, the community also plays an important role as the "tenant" or the holder of management right during a specified period in accordance with the regulation [16, 17].

Based on the above description of forest resources characteristics, MOF Regulation No. P.37/Menhut-II/2007 about Community Forests/HKm devised two basic principles, i.e. (1) Implementation: forest resources utilization must comply with the principle of comprehensive preservation which covers the aspects of ecology, economy, sociocultural, amicability, and fairness; and (2) Management, by complying

with the following principles (a) the status and function of forest resources area must remain unchanged (b) timbers can only be harvested from planted trees (c) natural and cultural diversities must be maintained (d) business diversification strategies for the products and services must be promoted in accordance with the applicable regulations (e) social welfare must be sustained (f) forest resources must be managed by the communities (g) HKm partnership program must provide legal certainty (h) parameters of every quantitative management element must be transparent and accountable and (i) every decision made must be based on fair and participatory policy [1,17].

### *1.2. Strategy to Developing Economic Potential of On-Farm Agroforestry*

Agroforestry is characterized by its various natures, i.e. competitive, diverse, profitable, and sustainable in its commodity management. Based on economic analysis, the on-farm scheme can be studied using several parameters, i.e. NPV, CR, IRR, ERR, Payback Period, AEV/EAI, actual interest rate, optimization of land use, economic resilience, commerce and agribusiness, organization, and regulation [1,2,7,13]. The findings of the economic analysis will be adopted as input towards decision maker in policy strategy to improve the economy of the communities living surrounding the forest. In KPH Yogyakarta area, the economic potential of the agroforestry business structure generates significant results as to income contribution to HKm members' households [1,8,19,20,21]. Therefore, real intervention from the government is called for, which is essential to be adopted in a community forest scheme. The Indonesian agroforestry business is indeed worth to be considered as a solution for land management model given its potential in solving national issues on social welfare [7,18,23].

### *1.3. Improved Regional Economic Contribution as the Effect of HKm Program Application*

Forest resources, i.e. products (tangible) and services (intangible), actually generate significant economic contributions in terms of potential valuation. However, currently, only actual tangible products are regarded as economic contributions from forest resources. In fact, the communities are well-aware that forest resources support their lives while giving invaluable intrinsic and economic rent value [2,7]. The government aims for such a regional economy improvement as described above, despite the use of the HKm scheme in managing the resources of agroforestry. To quantitatively find the exact regional economy contribution value, this research is called for. Therefore, the objectives of this research are: (a) to understand the technical profile of forest resources following the implementation of HKm program; (b) to understand the household economic profiles of the program participants on regular basis, in terms of micro-economic contribution; (c) to understand the regional economic profile using the Gini coefficient; (d) to find the strategies to improving community economy by adopting engineering alternate analysis of on-farm agroforestry which is currently on progress and the expected improvement.

## **2. Research Methods**

### *2.1. Research Site and Methods*

The research was conducted in a state-owned forest areas stipulated under HKm management scheme and licensed with the community forestry utilization permit (IUP-HKm), under the authority of *Kesatuan Pengelolaan Hutan* (KPH) or Forest Management Unit of Yogyakarta. The state-owned forests with production and protection function are located in the administrative areas of Gunungkidul and Kulon Progo District. Several primary and secondary data were collected from interviews (with predetermined list of questions asked to select stakeholders, informants, key persons, officers from the relevant institution, NGOs, and other related communities/organizations), crop measurement, mapping, and commodity analysis, to accommodate technical (bio-physics), social, and economic aspects. These aim for answering the objective of this research, i.e. to develop an economy-improving strategy for the communities, through on-farm agroforestry under HKm scheme. The respondents were selected from

several villages around the areas, within HKm villages. Meanwhile, the research objects were a number of respondents based on various profiles and level found on site. From the above description, the details in determining micro-location and classification of the respondents are explained in the following narrative:

## 2.2. Sample Plot Location and Respondent Profiles

2.2.1. *Sample Plot Location.* The sample plots to understand forest resources profile as the effect of area management under HKm scheme in Gunungkidul and Kulon Progo District are explained in Table 1.

**Table 1.** Land management profile under HKm scheme

No.	Description	Gunungkidul District		Kulon Progo District	
		Production Forest	Protection Forest	Production Forest	Protection Forest
1.	Plot size (Ha)	115.00	155.50	94.20	99.60
2.	HKm management land size (Ha)	14.00	17.40	39.60	29.00
3.	Plot number	161,162	108	34	28.29
4.	Starting year	1985 (SK 2007)	1999 (SK 2007)	2000 (SK 2007)	2006 (SK 2007)
5.	Number of Sample Plot (Unit)	12	8	20	12
6.	Type of crops (staple food, non-staple food)	teak, rosewood, corn, groundnut, soy, cassava, MPTS	teak, corn, groundnut, soy, cassava, grass	teak, mahogany, acacia, herbs, MPTS	teak, mahogany, acacia, herbs, grasses
7.	Number of stands (plant)	58,391	2,175	15,263	8,400
8.	Numbers of HKm members (Family Head)	263	45	165	115

## 2.2.2. Administration areas of respondents' village

1. Gunungkidul District: (1) Production Forest: Ngeposari Village, Semanu Sub-district, 40 respondents, HKm name: Sedyo Makmur; (2) Protection Forest: Giri Suko Village, Panggang Sub-district, 30 respondents, HKm name: Sidomulyo.
2. Kulon Progo District: (1) Production Forest: Hargorejo Village, Kokap Sub-district, 40 respondents, HKm name: Nuju Makmur; (2) Protection Forest: Hargowilis Village, Kokap Sub-district, 30 respondents, HKm name: Mandiri.

The profile of the respondents' field ownership and tenant-operated land with management rights are explained in Table 2.

**Table 2.** Profile of landowner and the size of managed field under HKm scheme (tenant-operated land)

No.	Description	Gunungkidul District		Kulon Progo District	
		Unirrigated open field (%)	Tenant-operated land (% , number of respondents)	Unirrigated open field (%)	Tenant-operated land (% , number of respondents)
A. Owned land					
	≤0.25 Ha	94	-	89	-
	0.26-0.5 Ha	5	-	8	-
	0.51->1 Ha	1	-	3	-
B. Tenant-operated land					
	0.15-0.25 Ha (1 tenant-operated land)	-	44	-	46
	0.26-0.50 Ha (2 tenant-operated lands)	-	30	-	32
	0.51-0.60 Ha (3 tenant-operated lands)	-	21	-	15
	0.61-1.00 Ha (4 tenant-operated lands)	-	5	-	7

**Table 3.** Number of respondents by tenant-operated land stratum

No.	Description	Production Forest		Protection Forest	
		Gunungkidul District	Kulon Progo District	Gunungkidul District	Kulon Progo District
1.	One tenant-operated lands	13	16	10	10
2.	Two tenant-operated lands	10	9	6	7
3.	Three tenant-operated lands	5	4	3	2
4.	Four tenant-operated lands	2	1	1	1
	Total	30	30	20	20

**Table 4.** Ownership of *pesanggem*\* unirrigated open field by the level of tenant-operated area

No.	<i>Pesanggem</i> with tenant-operated area...	Contract farmer corps field area (Ha) in production forest		Contract farmer corps field area (Ha) in protection forest	
		Gunungkidul District	Kulon Progo District	Gunungkidul District	Kulon Progo District
1.	One tenant-operated land	0.10-0.60	0.20-0.50	0.25-0.50	0.20-0.50
2.	Two tenant-operated lands	0.20-0.50	0.10-0.60	0.10-0.50	0.10-0.25
3.	Three tenant-operated lands	0.15-0.70	0.50-1.00	0.30-0.50	0.10-0.50
4.	Four tenant-operated land	0.20-0.80	0.25-0.50	0.10-0.50	0.20-0.60
.	Total (Family Head)	30	30	20	20

\**Pesanggem* = tenant farmer of Perhutani-owned land

### 2.3. Analysis of Forest Resource Potential

To understand the stands potential, we listed the potentials found within the area of production and protection forests, as described in the Table above. The stages of the potentials listing are specified as follow: (a) creating sample plots in the production and reservation forests to measure the stands potential of teak, mahogany, acacia, *sengon* (*Albizia chinensis*), cajuput, pines, which are dominantly found in the forest area under HKm scheme (b) analyzing the data covering the following activities: (1) determining stands volume by measuring the trees' circumference (cm), diameter (cm), TBBC (m), height (m), LBDS (m<sup>2</sup>), estimated volume (m<sup>3</sup>) (2) calculating the number of the trees per hectare (3) calculating LBDS per Ha (m<sup>2</sup>/Ha) and (4) predicting the volume per hectare (m<sup>3</sup>/Ha). Based on the sample plots, the prediction of forest resources potential for each working area of the HKm in the research area could be drawn.

**2.3.1. On-Farm Analysis.** The farmers (HKm member/*pesanggem*) receive income from: (a) on-farm activities and (b) off-farm activities, e.g. from occupations such as merchants, employees, industry staff, construction workers, craftsmen, and others. The analysis stage is described as follows:

**2.3.1.1. Analysis of On-Farm Income.** On-farm income comes from physical production per type of commodities multiplied by sale price under certain condition [24,25]. The formula is total revenue (TR) = Q (total of physical production) X PQ (product price).

If there is more than one type of plant cultivated (e.g. on-farm system applied is agroforestry, community forestry, and multiple cropping structure), the formula for on-farm income/revenue (Total Revenue/TR) is [1,7,12,25]:

$$TR = \sum_{i=1}^n QP_Q$$

Note: n represents the total of cultivated crops

**2.3.1.2. On-Farm Costs.** The types of on-farm costs include fixed costs (production equipment, facilities), misc. costs (production equipment, work force, harvest, post-harvest, overhead cost, operational/daily costs).

**2.3.1.3. On-Farm Profit/Loss Analysis.** The formula for business eligibility is explained as follows [25]:

- (1) Profit/benefit,  $\rightarrow \pi (+)$ .....IDR/area/time = TR (Total revenue) – TC (Total cost); and  
 (2) Loss,  $\rightarrow \pi (-)$ .....IDR/area/time = TR (Total revenue) – TC (Total cost)

**2.3.1.4. On-Farm Financial Feasibility Analysis.** The financial feasibility analysis for on-farm management can be theoretically classified into time dimensions, i.e. (a) short-term (b) medium-term and (c) long-term. These classifications were made to understand the value of financial feasibility for on-farm activities and the possibilities of development should there be change(s) in business technology [16,25]. The followings are the feasibility parameters:

**2.3.1.4.1. Financial Analysis of On-Farm Technology.** In brief, the on-farm feasibility analysis stages are described in [25].

**2.3.1.4.2. Partial Budget Analysis.** This is the simplest method for on-farm financial feasibility analysis [25]. The analysis stages are described as follows: (1) Calculating the Return Cost Ratio (R/C) which is the ratio between on-farm income and operation cost during a certain period of time, = R/C; TR (R) = P<sub>Q</sub>

Q; TC (C) = Fixed Cost + Variable Cost, where  $a = P_Q Q / \{(FC + VC)\}$  (2) analysis of on-farm costs – income for perennial crops, where the cost allocation is classified as on-farm cost before and after the revenue is generated from crops (3) On-farm financial feasibility analysis with ongoing changes in technology, and (4) Analysis of contribution/ proportion, i.e. an analysis to find out income proportion by comparing on-farm and off-farm income.....I (on-farm income) =  $Y_A / Y_B \times 100\%$  (where  $Y_A$  is on-farm income and  $Y_B$  is off-farm income).

2.3.1.4.3. *Gini Ratio Analysis (Gini Ratio Index)*. The formulation for income disparity (Gini ratio) is [5,19]:

$$GR = 1 - \sum_{i=1}^n [f p_i (F_{ci} + F_{i-1})] \dots$$

Note:

GR = Gini coefficient (Gini ratio)

$f p_i$  = frequency of population in the class i of expenditure

$F_{ci}$  = cumulative frequency of total expenditure in the class i of expenditure

$F_{ci-1}$  = cumulative frequency of total expenditure in the class (i-1) of expenditure

(note: variables required are the community income categorized by level, income level, total number of target community, total income, percentage (%) of resident ( $F_i$ ), K% income ( $Y_i$ ),  $(Y_i + Y_{i-1})$ ,  $\sum F_i \times (Y_i + Y_{i-1})$ ; Gini coefficient =  $1 - F_i \times (Y_i + Y_{i-1})$ ).

The income distribution is considered equal when the Gini coefficient is below zero (0) and unequal when the Gini coefficient is below one. If: (a)  $GR \leq 0.4$ , then the disparity level is low; (b) GR between 0.41-0.5, then the disparity level is moderate; and (c)  $GR \geq 0.5$ , then the disparity level is high.

### 3. Analysis and Discussion of Findings

#### 3.1 On-Farm Agroforestry Feasibility in the Tenancy Area under HKm Program

A. *Farmers' incomes from owned-land and tenant-operated land*. The HKm schemes in KPH Yogyakarta operation area, both in Gunungkidul District and Kulon Progo District, were adopted in the production and protection forests. Teak and mahogany were the dominant plants grown alongside multi-purpose tree species (MPTS) such as jackfruit, clove, bitter bean, coconuts, and *Gnetum gnemon* using agroforestry scheme.

To improve the contribution of forest resources for the communities living around the forests, members of HKm program were encouraged to plant seasonal plants (staple and non-staple food crops, medicinal herbs, and grass) in the area of the state-owned forests, as the government's tangible strategies in improving the communities' economy. The types of plants cultivated in the two districts studied were: (1) Staple-food crops: cassava, corn, soy, and groundnut; (2) Medicinal herbs: ginger, turmeric, curcuma; and (3) Napier grass. The tenant farmers (HKm members) would possess all the yields from the annual plants they cultivate. The respondents of this study were HKm members in KPH Yogyakarta operation areas, in production and protection forests, which are by law under the administrative areas of Gunungkidul District and Kulon Progo District. The brief recap is as follows:

A. Gunungkidul District: (1) Production Forest/Resort *Pemangkuan Hutan* (RPH) or Forest Stewardship Resort Semanu, *Bina Desa Hutan* (BDH) or (Forest Village Program Karang Mojo, HKm Sedyo

Makmur, cultivated vegetation: cassava, groundnut, soy, corn, coconut, jackfruit, teak; and (2) Protection Forest/RPH Bibal, BDH Panggang, HKm Sido Mulyo, cultivated vegetation: those grown in production forest plus grass. The distribution of tenant-operated land for HKm members in production forest (Semanu Sub-district) and in protection forest (Panggang Sub-district), on average is: (a) managing one (1) tenant-operated land by 44%, (b) managing two (2) tenant-operated lands by 30%, (c) managing three (3) tenant-operated lands by 21%, and (d) managing four (4) tenant-operated land by 5%.

- B. Kulon Progo District: (1) Production Forest/RPH Kokap, BDH Kulon Progo, HKm Nuju Makmur, cultivated vegetation: teak, mahogany, acacia, corn, groundnut, medicinal herbs, breadfruit, clove; and (2) Protection Forest /RPH Sermo, BDH Kulon Progo, HKm Mandiri; cultivated vegetation: those grown in production forest, dominated by medicinal herbs. the distribution of tenant-operated land for HKm members, both in production forest (Kokap Sub-district) and protection forest (Kokap Sub-district, Kalibiru Sub-district) on average is: (a) managing one (1) tenant-operated land by 46%, (b) managing two (2) tenant-operated lands by 32%, (c) managing three (3) tenant-operated lands by 15%, and (d) managing four (4) tenant-operated land by 7%.

The profile of on-farm average income from staple food crops and perennial plants per season for respondents of HKm members in the tenant-operated land areas and owned-land for production and protection forests is presented in Table 5, as follow:

**Table 5.** Profile of HKm members' on-farm income (from owned-land and tenant-operated land)

No.	Total Tenant-Operated Land	Income (owned, unirrigated field) IDR/year*	Income (tenant- operated land) IDR/year	Total income (on Farm) IDR/year
<b>Gunungkidul District</b>				
<b>a.1 Production Forest (HKm Sedyo Makmur, Semanu Sub-district)</b>				
1.	One tenant-operated land (to ≤ 0.25 Ha)	2,160,000.00	640,000.00	2,800,000.00
2.	Two tenant-operated lands (0.26-0.50 Ha)	4,620,000.00	1,680,000.00	6,300,000.00
3.	Three tenant-operated lands (0.51-0.60 Ha)	682,000.00	1,870,000.00	2,550,000.00
4.	Four tenant-operated lands (≥ 0.61-1.0 Ha)	1,260,000.00	2,260,000.00	3,520,000.00
<b>a.2 Protection Forest (HKm Sido Mulyo, Panggang Sub-district)</b>				
1.	One tenant-operated land (to ≤ 0.25 Ha)	960,000.00	1,055,000.00	2,015,000.00
2.	Two tenant-operated lands (0.26-0.50 Ha)	2,430,000.00	1,080,000.00	3,510,000.00
3.	Three tenant-operated lands (0.51-0.60 Ha)	780,000.00	2,980,000.00	3,760,000.00
4.	Four tenant-operated lands (≥ 0.61-1.0 Ha)	3,670,000.00	2,460,000.00	6,130,000.00



<b>Kulon Progo District</b>			
<b>a.1 Production Forest (HKm Nuju Makmur, Kokap Sub-district)</b>			
1.	One tenant-operated land (to $\leq 0.25$ Ha)	1,465,000.00	2,213,000.00
2.	Two tenant-operated lands (0.26– 0.50 Ha)	3,470,000.00	4,585,000.00
3.	Three tenant-operated lands (0.51 - 0.60 Ha)	2,890,000.00	5,030,000.00
4.	Four tenant-operated lands ( $\geq 0.61$ - 1.0 Ha)	2,560,000.00	4,830,000.00
<b>a.2 Protection Forest (HKm Mandiri, Kokap Sub-district)</b>			
1.	One tenant-operated land (to $\leq 0.25$ Ha)	980,000.00	2,110,000.00
2.	Two tenant-operated lands (0.26– 0.50 Ha)	2,420,000.00	3,500,000.00
3.	Three tenant-operated lands (0.51 - 0.60 Ha)	1,650,000.00	3,810,000.00
4.	Four tenant-operated lands ( $\geq 0.61$ - 1.0 Ha)	2,880,000.00	4,960,000.00

Source: analysis of primary data from HKm member respondents

Note:\* owned-land analyzed in this research is unirrigated open land.

*Pesanggem* farmers' income by stratum of tenant-operated area is the average annual income for the current year (present value, with real per annum ratio equal to its social opportunity, with distribution of land ownership at 0.20–0.65 Ha, and the average area of tenant-operated land between 0.25–0.80 Ha. There were significant disparities in-terms of income between tenant and non-tenant operated lands (from unirrigated open land), regardless of the fact that owned-land (unirrigated open land) and tenant-operated land are almost the same size. Several distinguishing aspects are factors such as: (1) the size of owned and tenant-operated land, in each forest function (2) the types of vegetation cultivated and the proportion of land used for each commodity (3) land productivity due to business factors: cultivation technologies (seeds, fertilizer, pesticide, mono-culture, and mixed farming), soil fertility, maintenance frequency, types of products (4) vegetation lifespan, related to cycle and rotation of annual plants continuously cultivated (5) geographical situation of the cultivated land (6) availability of subsidies and education for plantation growing strategies (7) marketing system and negotiation by the producer against market organization [23], and (8) government policies on the development of commodities and micro-objectives (producer/*pesanggem*), macro-objectives for domestic demands or other objectives (export), and regulation governing on-farm management policies from upstream to downstream [24,25].

This research explains that agricultural business revenue for contract farmers, other than from corps field and the fields they manage (in state-owned forest with HKm scheme) as a group on-farm, were gained from rice fields and their own yards [25]. As the percentage of respondents owning rice fields is low, with small area of rice fields and yards, the non-regular income from these lands were not included in the on-farm revenue.

From Table 5 above, it can be concluded that HKm members working on only one tenant-operated land (from seasonal vegetation such as staple food crops, horticulture, plantations, herbs, grass, and later thinning and logging) earn the lowest compared to those cultivating more than one tenant-operated lands, be it in the production and the protection forests. Therefore, on-farm revenue (tenant-operated land, particularly) has positive correlation with the extent of the tenant-operated land area a farmer operates. However, there is no positive correlation either in the aggregate of the on-farm revenue (other than tenant-operated land) or in the off-farm revenue. This means that it is possible for respondents with small tenant-operated land portion to receive higher revenue from off-farm activities as compared to HKm members more tenant-operated lands to work on. This was actually found in several respondents, from farmers (members of HKm) of production and protection forests in both districts sampled in this research. Therefore, the revenues from tenant-operated lands in the total farmers' revenue (aggregate of total on-farm + off-farm revenue) were highly varied and non-correlated. In other words, more tenant-operated lands cultivated does not mean larger contribution to the total revenue of a farmer, both individually and collectively. Nevertheless, if the revenue of farmers member of HKm is to be increased, each of the members have to cultivate more than one tenant-operated lands. According to the technology level of the agricultural business and the commodity chosen for business, it will best to allocate  $\geq 0.5$  Ha of tenant-operated lands (equal to two tenant operated lands) to each farmer. The recap of the average revenue from the member' share in the areas of study is: (1) Gunungkidul District: (a) Production Forest, 1,160,000 IDR (1-2 tenant-operated lands on average), and 2,065,000 IDR (3-4 tenant-operated lands on average) and (b) Protection Forest, 1,067,500 IDR (1-2 tenant-operated lands on average), and 2,720,000 IDR (3-4 tenant-operated lands on average), and (2) Kulon Progo District:(a) Production Forest, 931,500 IDR (1-2 tenant-operated lands on average), and 2,205,000 IDR (3-4 tenant-operated lands on average), and (b) Protection Forest, 1.105,000 IDR (1-2 tenant-operated lands on average), and 2,120,000 IDR (3-4 tenant-operated lands on average).

### 3.2 Contribution of HKm farmers' revenue

The contribution of HKm farmers' revenue in the farmers' total revenue from on-farm and off-farm activities in this research is not detailed by the ownership of tenant-operated lands, but rather by the proportional average revenue of all the tenant-operated land strata in the production and protection forests during the period of one year, i.e. several seasons for staple and non-staple food crops; and the annual average of perennial commodities, calculated using present value method (AEV/EAI) on off-farm revenue during the year of the research. Therefore, the real value was gained as the level of changes was taken into consideration (inflation and productivity per commodity have considered product volume proportion, with the concept of joint product, to the level of derivatives). The contributions are briefly explained in Table 6 as follows:

**Table 6.** Contribution of HKm farmers' total revenue (off-farm + non-tenant-operated lands)

No.	Type of cultivated field	Forest function (%)	
		Production Forest	Protection Forest
A. Gunungkidul District (HKm Sedyo Makmur/Production Forest; HKm Sido Mulyo/Protection Forest)			
1.	Tenant-operated land	5.9-6.7	11.4-13.6
2.	Non-tenant-operated land + off-farm	93.3-94.1	86.4-88.6
B. Kulon Progo District (HKm Nuju Makmur/Production Forest; HKm Mandiri/Protection Forest)			
1.	Tenant-operated land	6.4-8.7	4.8-8.2
2.	Non-tenant-operated land + off-farm	91.3-93.6	91.8-95.2

Source: Analysis of primary data

From Table 6, we can see a variation in the revenue contributions from tenant-operated lands and the farmers' total revenue which is the summation of revenue from tenant-operated lands and farmers' revenue from off-farm activities and revenue from on-farm activities at owned lands (KPLH Formula (%)) =  $KPLH (IDR/year) / [KPLH (IDR/yr) + On-farm exc. KPLH (IDR/yr) + Off-farm (IDR/yr)]$ . Several causative factors were previously explained, which include internal (HKm members) and external factors (beyond the authority of HKm members).

### 3.3. Economic Roles of HKm Program in Community Welfare

To measure economic role as the effect of HKm program implementation, this research uses two parameters, i.e. Gini coefficient (Gini Ratio Index) and income per capita measured regionally, using the information on the level of community welfare (regional poverty) from the statistic data of Gunungkidul and Kulon Progo District. The secondary data in relation to the aspect studied in this research were taken mostly as the basic data which, using areal economics justification study, would be subsequently used to predict the value in question, in order to measure the community welfare level. In brief, the result of the analysis can be explained as follows:

*A. Gini Coefficient and National Gross Regional Domestic Product (GRDP) per Capita.* Income per capita is a common parameter used to understand the social welfare level, i.e. household income from on-farm and off-farm activities (GRDP) in certain area during a certain period, usually on an annual basis. Whereas the parameter to identify the gap in community income, in order to see different social status, categorize income gap as low, moderate, and high. In brief, the national Gini ratio and GRDP 2016 (Statistics Indonesia, 2017) were: Indonesia's Gini ratio (2016) was 0.397, GRDP per capita, at current prices, Indonesia's GRDP per capita (2016), 47.96 million IDR (equal to 3,605.1 USD). The Gini ratio of Yogyakarta Special Region compared to other provinces is considered high (the second highest after South Sulawesi), and based on Statistics Indonesia data of Yogyakarta in 2014-2016, Yogyakarta had the highest Gini index throughout Indonesia. In details, both districts in this research, Gunungkidul and Kulon Progo Districts, are have moderate income gap as seen from their Gini coefficients, at 0.396 for Gunungkidul, and 0.391 for Kulon Progo (as per September 2016). According to Statistics Indonesia, the perfect method to measure poor population is the basic needs approach. With that as a reference, poverty is defined as a condition where the people (be it individually or as a group) are unable to financially meet their basic needs of food and non-food, as measured by expenditure.

According to the Statistics Indonesia, poor population is defined as those with average spending per capita per month, below the poverty line. Here is the mathematic equation:

Poverty Line = Food Poverty Line (equal to 2,100 kilo calorie/per capita per day + Non-Food Poverty Line (calculating minimum non-food needs, such as housing, clothing, education, and health.))

Using that as a basis, in brief, we can understand the condition of the communities around forest areas of KPH Yogyakarta (Forestry Department, Yogyakarta) based on the data collected from HKm members (KTHKm Sedyo Makmur, KTHKm Sido Mulyo, KTHKm Nuju Makmur, and KTHKm Mandiri). The results are as follow: (1) in Gunungkidul District, the total poor population was 43%-62% and non-poor population was 38%-57%, and (2) in Kulon Progo District, the total poor population was 18%-33% and non-poor population was 67%-82%.

To calculate the Gini ratio, the stages done in this research were as follows: (1) developing classification for community spending based on profile and proportion; (2) developing community proportion cumulatively, with the following formula:  $(P_k)$ ; (3) calculating the amount of community spending; (4) from item (3), calculating cumulative spending  $(E_k)$ ; (5) calculating  $(P_k) - (P_{k-1})$ ; (6)

calculating  $(E_k) - (E_{k-1})$ ; (7) calculating the results from item (5) X item (6); and (8) subtracting the result of item (7) from the value of 1, i.e. the Gini ratio.

Based on the analysis of calculation as described in the Gini ratio calculation procedure above, the Gini ratios of the areas studied are estimated as follows: (1) KTHKm Gunungkidul District, 0.38-0.42 (low-moderate), and (2) KTHKm Kulon Progo District, 0.34-0.46 (low-moderate). In relation to the income gap, it was apparent that the community's income per capita in the studied areas, as explained by the GRDP per capita, were low. The income per capita in KTHKm Sedyo Makmur (in Semanu Sub-district) was low, at 9,100,999 IDR/year, the income per capita in HKm Sido Mulyo (Panggang Sub-district) was moderate, at 9,700,000 IDR/year, and the income per capita in Kokap Sub-district (Kulon Progo District) was moderate, at 10,280,000 IDR/year. The average poor population in Gunungkidul and Kulon Progo District were 21.73% and 21.4%, respectively. Therefore, regional government's effort in improving community income is called for. One of the strategies performed through on-farm activities is to improve productivity, both in quantity and economic value. Regionally, Yogyakarta's income per capita (GRDP per capita) was 29,589,070 IDR (as per 2016).

### 3.4. Community Economic Improvement Strategies

It is known that the community forest management permits (IUP-HKm) within the area of KPH Yogyakarta were granted to 42 farmers' groups, with the following distribution: (1) Gunungkidul District, 35 KT-HKm units consisting of 3,104 members, with 1,088 Ha operated fields, spread in state-owned forest area of 3,460 Ha, and (2) Kulon Progo District, 7 KT-HKm units consisting of 673 members, with 196.8 Ha operated fields. This research took respondents from HKm program in two districts, i.e. Gunungkidul and Kulon Progo. Most of the samples (74%-78%) were HKm farmers working on averagely 1-2 tenant-operated lands, whereas the remaining (22%-26%) operated averagely 3-4 tenant-operated lands. From the result of the analysis of the on-farm activities on staple and non-staple food crops, herbs, grass, and perennial crops, non-optimized revenue gain was identified, at low-moderate level. Similarly, the contribution was not yet significant against the total revenue per year, although the same scheme was capable of generating high contribution in Perum Perhutani areas, at 17.5%-47.5% [19,20,21]. Therefore, in brief, it can be drawn that in this paper, the overall economic roles for the community welfare is not yet significant. The strategic efforts in improving economy is yet to be realized.

The strategy to improve community's economy in this research is generated to achieve three important roles, so that HKm program can bring benefit as a component of revenue, especially in agroforestry (on-farm) business. These three roles are: (1) as the main element of agricultural business activity; (2) as a result of item (1), as the target of economic improvement; and (3) as a result and outcome of item (2), as the input for sustainable policies. In fact, the strategy mentioned is the effort to optimize input factors that achieve maximum technical and non-technical outputs (e.g. in economy). To realize this, several factors can be improved as a suggestion: (1) Area of operated field; (2) Type of cultivated commodities; (3) Agricultural technology; (4) Proportion of land use per commodity; (5) Productivity; (6) Form of traded products, upstream-in-between-downstream; (7) Marketing strategies; and (8) Sufficient supporting policies.

## 4. Conclusion and Closing

### 4.1. Conclusion

The execution of HKm program in KPH Yogyakarta within the administrative areas of Gunungkidul District and Kulon Progo District is considered satisfactory in the aspect of technicality, in relation to the condition of stands/forest resources potentials. On the other hand, the economic benefit for the farmers was capable of providing significant financial addition to farmers' groups both collectively and

individually, for their subsistent needs. The economic value generated from agricultural business activities in tenant-operated lands gives enough diversity for the participants of the program, thanks to the different proportion of land use per field, albeit the similar types of crops. From the analysis of the respondents cultivating tenant-operated lands, there were no proportions in the physical production and economy between the extent of fields, type of commodities, and the generated economic value. The management strategy of each person within a farmers' group differs. The revenues from tenant-operated lands, generated from multiple types of plants cultivated, i.e. staple and non-staple food crops, herbs, grass, groves, and timbers give the following average: (1) Gunungkidul District: (a) production forest, at 1,612,500 IDR (1-4 tenant-operated lands on average), and (b) protection forest, 1,893,750 IDR (1-4 tenant-operated lands on average), (2) Kulon Progo District: (a) production forest, 1,568,250 IDR (1-4 tenant-operated lands on average), and (b) protection forest, 1,612,500 IDR (1-4 tenant-operated lands on average). The tenant-operated land revenue is the contribution for the total revenue of the program's participant, partially from on-farm and off-farm activities. Although the contribution to the total revenue is low (<10%), the economic profile is expected to improve when a proper policy is in place (covering internal and external aspect on both on-farm and off-farm management).

#### 4.2 Closing

The execution of the HKm program is a staple for KPH Yogyakarta. It needs to be continued with improvements to some regulations, particularly to cut the red tape. Periodical and comprehensive evaluation for the achievement of program execution is mandatory for the regulator at site management, as well as the regional and national level as, until currently, no comprehensive, complete, and organized data and information are available.

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