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Does Social Forestry Contribute to Farmers' Income?: A Case Study of Two Mountainous Villages on Java Island, Indonesia

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ABSTRACT

Social Forestry has been implemented in Indonesia to address environmental conservation and poverty alleviation. However, the effectiveness of this initiative in increasing household income is often subject to scrutiny. This study examines the impact of Social Forestry on household income by comparing Social Forestry members and non-members in two mountainous villages on Java Island. Specifically, the analysis focuses on household surveys conducted in Tombo village in Central Java and Cibulao sub-village in West Java. A negative correlation between membership and household income is observed in Tombo, whereas a positive correlation between membership and farm income is observed in Cibulao. Considering these findings, we posit that pre-implementation land tenure and accessibility may affect the economic outcomes of the program.

Keywords: Farm income, Forestry Partnership, Land tenure, Social Forestry.

INTRODUCTION

Deforestation and forest degradation globally contribute to the loss of biodiversity and wildlife habitats. In Indonesia, significant deforestation has occurred over the past decades, resulting in a decline in total forest cover from 119 million hectares in 1990 to 92 million hectares in 2020, representing approximately 2.3% of the world's forest (FAO, 2020). Additionally, forest degradation has been related to poverty issues. Across the country, there are 9.2 million households living in the villages located within or at the fringe of forest area, and 1.7 million are classified as living in poverty (MoEF, 2020).

Community-based management, a form of common-pool resource management, is recognized as an effective strategy for addressing the "tragedy of the commons," initially identified by Hardin (1968). Participatory forest management is particularly relevant in developing countries as it aims to promote environmental conservation and sustainable livelihoods for local communities.

In Indonesia, the nation's land is divided into two areas: state forest and other use areas. Forest areas are categorized as Production Forest, Protection Forest, and Conservation Forest (MoEF, 2020). The Social Forestry (*Perhutanan Sosial*) scheme, one of participatory forest management initiatives in Indonesia, is implemented in state forest areas, granting communities legal access to forests to utilize specific land areas. This scheme has been active since the 1980s (Amaruzaman *et al*., 2022), and until 2023, achieved 4.24 million hectares across 4,788 units in five forms: 2.52 million hectares as Village Forest, 1.03 million hectares as Community Forest, 0.18 million

hectares as Community Plantation Forest, 0.26 million hectares under Forestry Partnership, and 0.24 million hectares as Customary Forest (MoEF, 2023). These five forms differ in their purposes and land allocation classifications (Rustiadi & Veriasa, 2022; Meijaard *et al.*, 2021; Firdaus, 2018).

Researchers have examined the benefits of Social Forestry schemes from economic, environmental, and social perspectives. Previous studies have presented scattered evidence on the potential of Social Forestry to improve local socio-environmental issues. On one hand, De Royer *et al.* (2018) analyzed cases in three provinces (Jambi, West Kalimantan, and Gorontalo), where case villages had applied for Village Forest, Community Forest, and Community Plantation Forest. They concluded that the scheme succeeded in solving land tenure and forest rehabilitation issues; however, community empowerment and social justice remain challenging. On the other hand, Pender *et al.* (2008) assessed the economic impact of Community Forest in West Lampung. They found that the program significantly increased the planting of timber and multipurpose agroforestry trees; however, owing to differences in the profitability of tree types, the economic impacts of the scheme are ambiguous. They argued that farmers' perceptions of tenure security lead to higher investment in the land and may result in higher profits. While scholars have observed different impacts of the Social Forestry scheme on livelihoods, they have failed to consider what determines such variation.

Thus, this study investigates the contribution of the Social Forestry scheme to household income and examine its relationship with land tenure outside Social Forestry areas by analyzing household surveys at two sites on Java Island. The two sites differ in land tenure and accessibility to urban areas, both being in mountainous areas where the Forestry Partnership initiative has been implemented. Drawing upon conflicting findings on the relationship between Social Forestry scheme membership and household income, this study discusses pre-implementation land accessibility and strategies for sustaining livelihoods as determinants of such differences in membership gains.

METHODOLOGY

Study sites

Primary data were collected from two study sites in May 2023. The locations of the study sites are as follows: 1) Tombo village in Bandar Subdistrict, Batang Regency, Central Java Province; 2) Cibulao sub-village in Tugu Utara village, Cisarua Subdistrict, Bogor Regency, West Java Province. Both sites are in mountainous areas on Java Island, the most populous island in Indonesia, facing high demand for land use conversion. These sites are adjacent to forest areas where villagers have occupied the land. A Forestry Partnership, which is a form of a Social Forestry program, has been implemented at both sites. The scheme involves cooperation between local communities and those with management rights. Under the Forestry Partnership agreement, members are entitled to manage a maximum of two hectares of forest area per household head (MoEF, 2016).

Tombo village

Tombo is a village (desa) located approximately at 7°11'S, 109°78'E. Covering an area of 587 hectares, the village is home to a population of 3,593 residents, distributed among 1,068 households across three sub-villages. The Forestry Partnership initiative has been active in Tombo village since 2019 (MoEF, 2019), facilitated by the cooperation between Lembaga Masyarakat Desa Hutan (LMDH, Forest Village Community Institution) Rekso Tri Mulyo and Kesatuan Pemangkuan Hutan (KPH, Forest Management Unit) Pekalongan Timur. The KPH is an organization under the State Forestry Public Company, Perum Perhutani. The area under this agreement is 500.7 hectares in the Permanent Production Forest Area. The number of initial members who engaged in this agreement was 256 across three sub-villages: Tombo, Centuko, and Tampingan.

Under LMDH Rekso Tri Mulyo, there are two Kelompok Usaha Perhutanan Sosial (KUPS, Social Forestry Business Group): KUPS Kopi and KUPS Ternak. KUPS Kopi focuses on coffee production, while KUPS Ternak concentrates on livestock production. Some villagers are members of both KUPS. Previously, from 2017 to 2019, Tombo sub-village had established the Kelompok Tani Hutan (KTH, Forestry Farmers Group) under the LMDH; however, it did not last long because of institutional and financial problems. Despite this, informal groups continue to operate at the sub-village level under the LMDH, collaborating weekly in the Social Forestry area. As mutual support is mandatory, those who fail to participate in such activities are required to make financial contributions.

Cibulao sub-village

Cibulao is a sub-village (kampung) located approximately at 6°69'S, 106°99'E in Tugu Utara village, which is in the Puncak area of Bogor Regency. It is a popular weekend tourist spot, particularly for urban residents of Jakarta Metropolitan. Tugu Utara village spans a total area of 1,703 hectares, with a population of 11,307 and 2,677 households. Cibulao, registered as RT 2 RW 6 in Dusun 2 in Tugu Utara village, hosts a population of 443 and 150 households. The sub-village was established in 1992 to accommodate employees of a tea plantation company PT Sumber Sari Bumi Pakuan (PT SSBP) (Veriasa *et al.*, 2020). The company owns the area and visitors are required to pay entry fees at the gate. The Forestry Partnership, initiated in Tugu Utara village in 2018 (MoEF, 2018), is a collaboration between LMDH Puncak Lestari and KPH Bogor, covering 610.64 hectares in the Permanent Production Forest Area and the Limited Production Forest Area. The number of initial members who engaged in this agreement was 75 across eight sub-villages: Cibulao, Cikoneng, Cisuren, Neglasari, Pondok Lengkeng, Pondok Rawa, Rawa Gede, and Tugu.

Under the LMDH Puncak Lestari, there are five KTH and four KUPS. The five KTH are Cibulao Hijau, Cikoneng Letari, Rawa Gede, Cisuren Keben, and Pondok Rawa. Each KTH is based on its geographical area. The coffee yields from KTH Rawa Gede and KTH Cikoneng Letari are collected and transferred to KTH Cibulao Hijau for processing and sale. The four KUPS—Puncak Lestari Hiji, Puncak Lestari Dua, Puncak Lestari Tilu, and Puncak Lestari Opat—offer specialized productions and services in the Social Forestry. KUPS Puncak Lestari Hiji was founded for coffee production, KUPS Puncak Lestari Dua for ecotourism, KUPS Puncak Lestari Tilu for watersheds, and KUPS Puncak Lestari Opat for honey production.

Data collection

Participants for the household survey were chosen using both random and stratified random sampling. The participants in Tombo comprised 121 households, including LMDH member (N=61) and non-member households (N=60). Member households were randomly chosen from an active member list provided by the leader of the LMDH. Participants from non-member households were recruited through door-to-door visits, employing a stratified random sampling method to ensure nearly equal representation from the Rukun Tetangga (RT) [1] in the three sub-villages. The Tombo, Centuko, and Tampingan sub-villages encompass 9, 3, and 4 RT, respectively. In each RT, approximately two households in Tombo sub-village, seven households in Centuko sub-village, and five households in Tampingan sub-village were chosen as non-member respondents.

Participants in Cibulao encompass 118 households, including LMDH member (N=58) and non-member households (N=60). All

[1] RT (Rukun Tetangga) is the smallest neighborhood unit in Indonesia.

members of KTH Cibulao Hijau were selected as respondents. Participants from non-member households were randomly chosen from the list of residents, excluding LMDH member households.

Five local villagers were employed as enumerators to conduct household surveys at each site. They underwent a one-day training session and were tasked with collecting approximately 24 household surveys per enumerator. A paper questionnaire in Indonesian was used, and enumerators used the local languages—Javanese in Tombo and Sundanese in Cibulao—when they completed the questionnaire. Data collection took place at respondents' homes, with each questionnaire typically completed within 15 minutes.

The questionnaire comprised three parts. The first part collected demographic information such as age, gender, educational background, occupation, monthly income, and marital status of each household member. The second part delved into Social Forestry programs and land use. LMDH member households were asked about the year in which they joined the group, the area they manage in hectares, the distance from the house to the managed area in kilometers, types of crops cultivated, main crop and purpose, meeting attendance frequency, training participation, activities, decision-making, and financial access to Social Forestry. Questions on land use were answered by both member and non-member households. The third part focused on households' financial and socioeconomic status. Information on monthly income, monthly expenditure, ownership of a bank account, debt in the past year, and house ownership were collected. Monthly income was categorized into on-farm, off-farm, and non-farm incomes.

In addition to household surveys, in-depth interviews were conducted to gather qualitative data on forest management structure and history. The interviewer followed a predetermined question list. Interviewees included the leaders of KUPS Kopi, LMDH, and the previous leader of LMDH in Tombo (N=3), KUPS Puncak Lestari Hiji and KTH Cibulao Hijau in Cibulao (N=2). Interviews were conducted at participants' homes and lasted approximately 60 minutes.

Data Analysis

This study investigates the relationship between income and Social Forestry membership across two distinct study sites, employing Mann-Whitney *U* tests and ordinary least squares (OLS). Two income specifications are used: *Household income* and *Farm income*. *Household income* is the sum of on-farm, off-farm, and non-farm income, while *Farm income* is the sum of on-farm and off-farm income. The regression equations, estimated using Stata 18, are presented in Equations (1) and (2).

$$Household\ income_i = b_0 + b_1 I(Member)_i + \boldsymbol{b_2} \cdot \boldsymbol{x_i} + \varepsilon_i \quad (1)$$

$$Farm\ income_i = b_0 + b_1 I(Member)_i + \boldsymbol{b_2} \cdot \boldsymbol{x_i} + \varepsilon_i, \quad (2)$$

where i represents household, $I(Member)_i$ is an indicator variable equating to 1 if the household is a LMDH member and 0 otherwise, $\boldsymbol{b_2}$ is column vector of corresponding variables, $\boldsymbol{x_i}$ represents control variables, and ε_i is the error term. Control variables encompass socioeconomic information and land use. All variables are explained in Table 1. In Cibulao, the absence of timber production led to the exclusion of this variable from the analysis.

Table 1. Variable descriptions

Variable	Description
Member	Social Forestry membership dummy (1: SF member, 0: non-SF member)
Household income	Sum of on-farm income, off-farm income, and non-farm income per household per month (IDR 1,000/household/month)
Farm income	Sum of on-farm income and off-farm income per household per month (IDR 1,000/household/month)
Household size	The number of family members in the household
Female labor	The ratio of female workers to all workers in the household (ratio)
HH Age	Age of household head (year)

Variable	Description
HH Primary school	Household head graduated from primary school (1: Yes, 0: No)
Bank	Owns bank account (1: Yes, 0: No)
Debt	Has lent money in the past year (1: Yes, 0: No)
Work ratio	The ratio of workers to household size (ratio)
Livestock	Owns livestock (1: Yes, 0: No)
Timber	Produces timber (1: Yes, 0: No)
Outside area dummy	Utilizes land outside Social Forestry (1: Yes, 0: No)
Outside area	The area outside the Social Forestry area (Hectare)

Source: Authors (2023).

RESULTS AND DISCUSSION

Descriptive statistics by member status, including mean and standard deviations, are presented in Tables 2 and 3 for Tombo and Cibulao, respectively. The results of the Mann-Whitney *U* tests for comparing Social Forestry (SF) members and non-SF members are provided in the final columns.

As shown in Table 2, differences in some variables are statistically significant based on member status in Tombo. Specifically, the *Household income* of SF members is lower than that of non-SF members. Non-SF members in Tombo tend to have better access to resources such as education, banks, and land outside the forestry. In Cibulao, as shown in Table 3, only two variables exhibit statistically significant differences based on member status. The *Farm income* of SF members is higher than that of non-SF members, and SF members tend to have older household heads.

Table 2. Descriptive statistics by member status in Tombo

	Member (N=61)		Non-member (N=60)		Difference
	Mean	SD	Mean	SD	*p*-value
Household income	1569	1310	3411	6350	0.02
Farm income	361	388	1765	6050	0.26
Household size	3.62	1.34	3.45	1.24	0.41
Female labor	.24	.25	.30	.31	0.29
HH Age	53.52	12.26	52.92	10.77	0.92
HH Primary school	.51	.50	.78	.42	0.00
Bank	.30	.46	.62	.49	0.00
Debt	.30	.46	.38	.49	0.40
Work ratio	.58	.30	.59	.29	0.81
Livestock	.41	.50	.43	.50	0.94
Timber	.16	.37	.17	.38	1.00
Outside dummy	.69	.47	.95	.22	0.00
Outside area	.08	.16	.41	.88	0.00

Source: Data analysis results (2023). Difference shows *p*-value from the Mann-Whitney *U* test for the comparison between members and non-members.

Table 3. Descriptive statistics by member status in Cibulao

	Member (N=58)		Non-member (N=60)		Difference
	Mean	SD	Mean	SD	*p*-value
Household income	2629	2109	2131	1094	0.46
Farm income	545	1658	8	44	0.00
Household size	3.62	1.44	3.25	1.28	0.10
Female labor	.26	.26	.25	.32	0.62
HH Age	43.40	10.45	40.03	14.93	0.04
HH Primary school	.71	.46	.85	.36	0.10
Bank	.93	.26	.83	.38	0.17
Debt	.21	.41	.10	.30	0.17
Work ratio	.56	.28	.53	.25	0.81
Livestock	.12	.33	.10	.30	0.95
Timber	.00	.00	.00	.00	-
Outside dummy	.10	.31	.05	.22	0.46
Outside area	.02	.13	.01	.06	0.30

Source: Data analysis results (2023). Difference shows *p*-value from the Mann-Whitney *U* test for the comparison between members and non-members.

The results of the regression analysis for *Household income* (Equation (1)) are presented in Tables 4 and 5 for Tombo and Cibulao,[2] respectively. Column (2) of Tables 4 and 5 shows the results of the regression with *Outside area* added as a control variable. In Table 4, the coefficients of *Member* show a negative correlation between membership and household income in Tombo at the 5% and 10% significance levels in Columns (1) and (2), respectively. The coefficients of *Bank* are positively correlated with household income at the 10% level in both columns. The coefficient of *Outside area* is positively correlated with household income at the 10% level, as shown in Column (2). These results indicate that in Tombo, SF members have lower household incomes, while households with bank accounts and those that cultivate larger areas outside of SF tend to report higher incomes.

In Cibulao, the coefficients of *Member* in Table 5 show a positive but statistically insignificant correlation. Additionally, larger households and those with younger household heads and more workers tend to report higher household incomes. The negative correlation between household income and *Outside area* suggests that land use outside the SF area is not as effective in increasing income compared to land use within the SF area.

Table 4. Results of the regression analysis of the relationship between household income and observed variables in Tombo

	(1)	(2)
	Tombo	
Member	-946.2**	-803.0*
	(450.0)	(454.8)
Household size	-52.30	-47.88
	(582.3)	(584.9)
Female labor	1,305	1,355
	(1,729)	(1,735)
HH Age	20.58	18.65
	(36.83)	(36.99)
HH Primary school	959.3	971.7
	(647.1)	(650.3)
Bank	1,188*	1,044*
	(611.8)	(598.3)
Debt	1,611	1,722
	(1,284)	(1,281)
Work ratio	-1,929	-2,062
	(2,933)	(2,946)
Livestock	1,836	1,941
	(1,184)	(1,198)
Timber	-1,323	-1,350
	(950.7)	(955.7)
Outside area		529.0*
		(278.8)
Constant	565.6	497.1
	(2,133)	(2,140)
Observations	121	121
Adjusted R2	0.0886	0.0853

Source: Data analysis results (2023). Notes: Robust standard errors are shown in parentheses. ** and * denote significance at the 5% and 10% levels, respectively[3].

Table 5. Results of the regression analysis of the relationship between household income and observed variables in Cibulao

	(1)	(2)
	Cibulao	
Member	207.5	220.7
	(255.8)	(256.6)
Household size	664.4***	662.3***
	(131.5)	(130.7)
Female labor	-201.4	-186.5
	(506.7)	(506.4)
HH Age	-22.59**	-20.10*
	(11.25)	(11.36)
HH Primary school	-313.2	-275.6
	(536.8)	(535.8)
Bank	27.68	19.27
	(248.2)	(246.2)
Debt	140.3	147.5
	(518.9)	(521.5)
Work ratio	2,437***	2,431***
	(792.8)	(790.4)
Livestock	-104.0	-131.5
	(580.6)	(588.6)
Outside area		-1,098*
		(557.7)
Constant	-131.1	-237.6

[2] The selection of control variables in the regression is guided by the value of the Variance Inflation Factor (VIF) test to mitigate the effect of multicollinearity on the results.

[3] We employ the White standard error, which is robust to heteroskedasticity, in our analysis to account for potential heteroskedasticity in the dependent variables between SF members and non-SF members.

	(1)	(2)
	Cibulao	
	(782.7)	(785.4)
Observations	118	118
Adjusted R2	0.201	0.198

Source: Data analysis results (2023). Notes: Robust standard errors are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The results of the regression analysis for *Farm income* (Equation (2)) are presented in Tables 6 and 7 for Tombo and Cibulao, respectively. Similar to the analysis of household income, Column (2) of Tables 6 and 7 shows the results of the regression with *Outside area* added as a control variable. The coefficients of *Member* in Table 6 show a negative correlation between membership and farm income in Tombo but are not statistically significant. However, the coefficients of *Livestock* show a positive correlation with farm income in both columns, indicating that households that own livestock as an income source tend to report higher farm incomes.

On the other hand, in Table 7, the coefficients of *Member* show a positive correlation between membership and farm income in Cibulao, which is statistically significant at the 1% level. This indicates that, in Cibulao, SF members tend to obtain higher farm incomes than non-SF members.

Table 6. Results of the regression analysis of the relationship between farm income and observed variables in Tombo

	(1)	(2)
	Tombo	
Member	-623.2	-555.1
	(395.7)	(401.4)
Household size	-703.7	-701.6
	(588.1)	(590.6)
Female labor	1,699	1,723
	(1,541)	(1,553)
HH Age	47.00	46.09
	(35.42)	(35.55)
HH Primary school	750.8	756.7
	(601.4)	(602.8)
Bank	813.6	745.3
	(535.9)	(532.2)
Debt	1,089	1,141
	(1,241)	(1,245)
Work ratio	-3,975	-4,039
	(2,877)	(2,891)
Livestock	1,919*	1,969*
	(1,148)	(1,158)
Timber	-1,248	-1,261
	(952.7)	(956.3)
Outside area		251.5
		(304.5)
Constant	1,398	1,366
	(1,965)	(1,975)
Observations	121	121
Adjusted R2	0.0340	0.0265

Source: Data analysis results (2023). Notes: Robust standard errors are shown in parentheses. * denotes significance at the 10% level.

Table 7. Results of the regression analysis of the relationship between farm income and observed variables in Cibulao

	(1)	(2)
	Cibulao	
Member	537.4***	540.7***
	(197.7)	(199.6)
Household size	-18.22	-18.76
	(81.28)	(81.52)
Female labor	269.9	273.7
	(273.0)	(274.0)
HH Age	-8.078	-7.446
	(6.818)	(7.031)
HH Primary school	-261.7	-252.1
	(453.0)	(451.2)
Bank	-100.3	-102.4
	(154.9)	(155.2)
Debt	-47.18	-45.34
	(449.3)	(450.5)
Work ratio	279.5	278.0
	(532.3)	(533.5)
Livestock	131.9	124.9
	(489.3)	(495.5)
Outside area		-279.3
		(280.5)
Constant	470.8	443.7
	(430.7)	(435.3)
Observations	118	118
Adjusted R2	-0.003	-0.012

Source: Data analysis results (2023). Notes: Robust standard errors are shown in parentheses. *** denotes significance at the 1% level.

The results of the Mann-Whitney *U* tests and regression analysis indicate opposing results

in the two study sites concerning different dependent variables: *Household income* and *Farm income*.

First, the disparity in household income results between the two study sites can be attributed to the strategies employed by villagers to sustain their livelihoods. Cibulao may exhibit homogeneity in accessibility to agricultural land, finance, and education, whereas Tombo may present heterogeneity in these aspects. Furthermore, Cibulao offers more employment opportunities than Tombo because of its proximity to urban areas, and total household income may not differ between SF and non-SF members. In Tombo, access to education, financial services such as bank accounts, and agricultural land excluding SF are limited to SF members (*Outside dummy* and *Outside area* in Table 2). No significant differences were observed in the variables for Cibulao, as shown in Table 3. Household income in Tombo is positively correlated with accessibility to banks and land, whereas it is negatively correlated with SF membership. In contrast to the relatively higher proportion of bank access in Cibulao, as shown in Table 3, the bank access of SF members in Tombo is significantly lower than that of non-SF members, as shown in Table 2. Additionally, compared to Cibulao, where land availability is limited to SF, we observed heterogeneity in private agricultural land areas in Tombo (Table 2).

Second, to rationalize the results for farm income, the differences in land accessibility characteristics should be considered. Tombo may represent a case in which SF provides access to agricultural land for farmers encountering minor difficulties in land inaccessibility. As shown in Table 2, SF members in Tombo have relatively smaller agricultural land areas than non-SF members. In contrast, SF in Cibulao provides agricultural land access to farmers facing complete land inaccessibility. The non-SF land in Cibulao is owned solely by a private company, leaving villagers with no private land, resulting in a low proportion of non-SF land use (Table 3). We found that farm income is a factor resulting in significant differences between SF and non-SF members in Cibulao. The tendency of SF members to earn higher farm income than non-SF members (as shown in Table 3) is also statistically significant in the regression analysis controlling for corresponding variables (as shown in Table 7). This finding aligns with Veriasa *et al*. (2020), who estimated that coffee production under Pengelolaan Hutan Bersama Masyarakat (PHBM, Joint Community Forest Management) scheme, significantly increases income compared to tea plantation workers in Cibulao. Meanwhile, neither a significant difference nor a positive correlation was observed in the regression analysis for farm income in Tombo. Therefore, greater land inaccessibility may have caused a comparatively more significant impact of SF on increasing farm income in Cibulao. Additionally, the local market price of SF crops may have played a role in the significantly higher farm income in Cibulao. According to interviews with middlemen and farmer leaders, prices in Cibulao (IDR 320,000/kg for robusta) are higher than those in Tombo (IDR 180,000/kg for robusta), potentially leading to higher profits as farm income for farmers in Cibulao.

Although the contract scheme (Forestry Partnership) and main crop (coffee[4]) are the same at both sites, the analysis in this study indicates that the program's implementation over four (Tombo) and five (Cibulao) years yielded different impacts on income. We emphasize that SF at both sites could further increase farm income in the future if the potential economic benefits from SF are constrained by the lack of knowledge and skills (Irawanti *et al*., 2014) and the limited harvests obtained from young forests (Maryudi & Krott, 2012).

[4] Coffee is main crop in Tombo (75.4% of SF members) and in Cibulao (100% of SF members).

CONCLUSIONS

This study analyzed data obtained from household surveys conducted at two study sites on Java Island to investigate the impact of the SF scheme on farmers' income. We discovered that SF membership negatively correlates with household income in Tombo, and positively correlates with farm income in Cibulao. Household income in Tombo significantly correlates with financial access and private land size. Farm income in Tombo tends to be higher if households own livestock. Household income in Cibulao tends to be higher for larger households, those with younger household heads, more employed family members, and if areas outside SF are not utilized. Farm income in Cibulao correlates only with SF membership.

We discussed that these differences may be attributed to the varying characteristics of accessibility to agricultural land, finance, and employment. We pointed out that while intra-rural inequality corresponds to SF memberships, land inaccessibility determines farm income, which can be further addressed in future studies. This study has two limitations. First, owing to the structure of the survey we employed, we were unable to distinguish farm income obtained from SF and other sources. Farm income includes income obtained from agricultural production in farmlands, yards, livestock, and fisheries. To gain a more detailed understanding of income composition, we propose that future studies categorize farm income by source. This could offer deeper insights into the economic impacts and consequences of SF. Second, there may be concerns of external validity. The primary data used in this research are cross-sectional data from only two sites on Java Island, while SF is widely implemented across the country in five forms. Further discussions based on data from a broader range of regions is essential to assess the success of SF.

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