Research on World Agricultural Economy
https://journals.nasspublishing.com/index.php/rwae

ARTICLE

The Impact of Partnership Programs on Coffee Farm Performance: A Propensity Score Matching Analysis from Lampung Province, Indonesia

Fembriarti Erry Prasmatiwi *, ***Wuryaningsih Dwi Sayekti***, ***Dyah Aring Hepiana Lestari***, ***Rabiatul Adawiyah***, ***Dewi Mulia Sari***, ***Tri Novi Astuti***

Department of Agribusiness, Faculty of Agriculture, Universitas Lampung, Bandar Lampung 35145, Indonesia

ABSTRACT

Global coffee consumption is increasing by 1–2% per year, making coffee a commodity with a growing market. More than 60% of the worldwide coffee supply depends on small farmers. However, small-scale coffee farmers still struggle with issues related to low coffee productivity and quality, as well as limited market access, which affect their farming performance. This study identifies critical variables that influence farmers' propensity to participate in partnerships and analyzes the impact of their participation on coffee farming performance. The Propensity Score Matching Method determines how agricultural producers can be classified as either partner farmers or non-partner farmers due to formal relationships between them or other factors. The data used for this analysis were obtained from a survey of 230 coffee farmers in three main sub-districts of Central Tanggamus. The survey included 126 partner farmers and 104 non-partner farmers. It was determined that farmer participation in partnerships was based on educational attainment, farmers' previous farming experience, the distances between the homes of farmers and their agricultural fields, and the sizes of their farms. Moreover, the partnership program increased coffee productivity by 22.29%, land productivity by 22.72%, reduced farming costs by 7.46%, and increased selling prices by 4.06%, thereby increasing farm income by 47.79% and land income by 47.51%. The findings indicate that the

*CORRESPONDING AUTHOR:
Fembriarti Erry Prasmatiwi, Department of Agribusiness, Faculty of Agriculture, Universitas Lampung, Bandar Lampung 35145, Indonesia; Email: fembriarti.erry@fp.unila.ac.id

ARTICLE INFO
Received: 26 November 2025 | Revised: 23 December 2025 | Accepted: 31 December 2025 | Published Online: 8 July 2026
DOI: https://doi.org/10.36956/rwae.v7i3.2947

CITATION
Prasmatiwi, F.E., Sayekti, W.D., Lestari, D.A.H., et al., 2026. The Impact of Partnership Programs on Coffee Farm Performance: A Propensity Score Matching Analysis from Lampung Province, Indonesia. Research on World Agricultural Economy. 7(3): 121–134.
DOI: https://doi.org/10.36956/rwae.v7i3.2947

partnership program increases coffee productivity and creates cost efficiencies, thereby simultaneously improving agricultural economic performance. Therefore, these findings support the expansion of partnership programs that take into account the sociodemographic characteristics of participating farmers.

Keywords: Agricultural Partnership; Smallholder Coffee Farming; Propensity Score Matching

1. Introduction

Global coffee consumption shows an annual growth rate of 1–2% per year[1], making coffee a commodity with a growing market. More than 60% of the global coffee supply depends on smallholder farmers[2]. However, small-scale coffee farmers face more complex problems. Relative income, vulnerability to climate change[3], limited access to resources, restricted access to information, and limited access to markets are problems that coffee farmers must face[4]. These problems not only contribute to the stagnation of farmers' welfare but also directly reduce the overall performance of coffee farming managed by farmers.

A sustainable coffee cycle can only be achieved through optimal coffee performance, which is the basis for sustainable agriculture. However, it cannot be denied that coffee farmers still face many challenges. Lack of market. In addition to the above factors, these conditions not only cause stagnation in agricultural performance but also weaken farmers' resilience to change, especially in adopting sustainable practices and obtaining certification quality, and market prices[5] hinder farmers from optimising the performance of their coffee farms. Collectively, these obstacles have resulted in reduced performance of coffee farms in Indonesia and, subsequently, coffee productivity levels, quality of coffee produced, and income levels for coffee farmers.

As the 4th largest producer of coffee in the world, Indonesia is also struggling with declining yields from coffee farms. Today, Indonesian coffee is known worldwide due to the distinct flavours and aromas of these coffees, which makes them very appealing to coffee drinkers everywhere[6]. Declining average world coffee prices generally translate into decreased prices paid to coffee farmers more quickly and heavily than any other agricultural industry[7]. In this situation, improving market infrastructure and access is essential to improve prices and thus maintain a decent standard of living for farmers[8]. When prices are low, coffee farming only generates low income, due to poor farming management, such as limited access to information, technology, and markets, low coffee productivity and quality, and uncompetitive local prices[9, 10]. It is estimated that around 65% of Indonesian coffee is of low quality and economic value, making it potentially subject to trade sanctions[5]. The above factors can lead to a decline in coffee farming performance, which in turn weakens farmers' resilience to the dynamics of change, especially in adopting sustainable coffee practices and participating in certification programs[11].

Lampung Province produces Robusta coffee with a distinctive taste quality that is famous in the world market, due to its specific agro-climatic conditions and local wisdom in plant cultivation. This regional advantage is characterized by mountains that allow coffee to be grown even at altitudes of 200–800 m above sea level and temperatures of 24 to 30 °C. This agro-climate supports the production of Lampung Robusta coffee with regional and global competitive advantages[12, 13]. In Lampung Province, Tanggamus Regency is known as a key area due to its significant contribution, with a plantation area of 41,598 hectares and a production volume of 29,522 t[14]. So far, the agro-climatic advantages and production volumes have not been converted into economic benefits due to simple post-harvest and processing methods. This process results in low-grade coffee, lowering the selling price and weakening its bargaining position in the global market[15].

One relevant strategic solution to overcome the constraints of low quality and prices is a partnership program through empowerment and certification schemes. This partnership program is a model of relationship between domestic or international companies and farmer groups that aims to increase the quantity and quality of coffee production, market access, and institutional con-

nectivity. The partnership program currently running in Tanggamus Regency is a partnership between the coffee corporation and coffee farmer groups, which is a company program to ensure a sustainable supply of high-quality coffee. Coffee farmers who join farmer groups are willing to participate in a partnership with the corporation with the aim of obtaining benefits, namely guaranteed market access and better prices, as well as the opportunity to participate in coffee certification programs such as 4C and RA. As members of the farmer groups participating in this partnership, farmers will receive knowledge, guidance, and assistance in proper coffee cultivation, as well as input support. Meanwhile, the corporation is committed to purchasing coffee beans from partner farmer groups that are part of the 4C-certified coffee sales channel through exporters.

Product certification has been responsible for product marketing's good side by providing the assurance that the product quality is up to the standards of the various health, environmental, and social requirements. In the eyes of the market, this is in line with the demand for green products. Meanwhile, product certification extends the value chain, so getting premium prices becomes a common practice. Also, it opens up a market that is not only based on price but also on quality perception, long-term contracts, and price incentives, which are all factors positively contributing to the situation of cooperatives and smallholder farmers[16].

In summation, the evidence is compelling that partnership and certification programs improved the performance of coffee farms in prior studies and indicated that the farmers involved with certification partnerships had increased earnings compared to non-partnered farmers[17]. Further studies support the trend of growing agricultural incomes and productivity through increased market access and prices[18]. Certification, by permitting the sale of certified coffee at a premium of roughly 30%, aids in enhancing market situations and solving economic problems. This is a conclusion drawn from the present research in Indonesia, as in the case of Wahyudi et al.[19], who stated in their study that Rainforest Alliance certification improves agricultural performance by improving management practices and product quality. Furthermore, Arifin et al.[17] and Dewi et al.[20] confirmed in their studies that there is a positive relationship between participation in certification partnerships and income gains, cost reductions, and market efficiency.

However, almost all previous studies have faced weaknesses in the application of this research methodology. Most previous studies directly compared the performance of partner and non-partner farmers, without controlling for differences in characteristics that influence farmers' willingness to participate in the program. In this case, the approach taken is still far from addressing the issue of self-selection bias arising from unmeasured internal characteristics (such as education, farming experience, motivation, land ownership size, or initial access to information) within the program. In other words, these characteristic differences underlie the performance differences observed after the program. The uncontrolled risk characteristics make the research results on the impact of partnerships unsound and potentially exaggerated.

The lack of alternative approaches forms the basis for the novelty of this study. The net effect of participation in a partnership program on coffee farming business performance is a key issue underlying this research. By using the PSM method, researchers can create a comparison group of non-partner farmers with observable characteristics (level of education, farming experience, land area, market access, etc.) that are very similar to, or "balanced" with, the partner farmer group. Therefore, differences in agricultural business performance (productivity, income, and profits) observed in both groups after the program can be attributed to participation in the partnership.

To achieve these objectives, this study focuses on identifying critical variables that influence farmers' tendency to participate in partnerships and on analysing the impact of farmers' participation in these partnerships on the performance of coffee farming businesses. The results of this study are expected to provide stronger empirical evidence for stakeholders and policymakers regarding the effectiveness of partnership programs. For researchers, these findings can serve as a basis for further research on the issue of formulating policies for agricultural development, particularly for sustainable coffee

plantation development.

2. Materials and Methods

This study used a survey method, conducting interviews with 126 partner farmers and 104 non-partner farmers using random sampling. The study was conducted in Tanggamus Regency, Lampung Province, specifically in the subdistricts of Air Naningan, Pulau Panggung, and Ulu Belu. The distribution of the three subdistricts is shown in **Figure 1**. The choice of the site was made after considering that the region had active partnership programs, plus a fairly equal distribution of partner and non-partner farmers, which would make it possible to carry out a detailed comparison between the two groups.

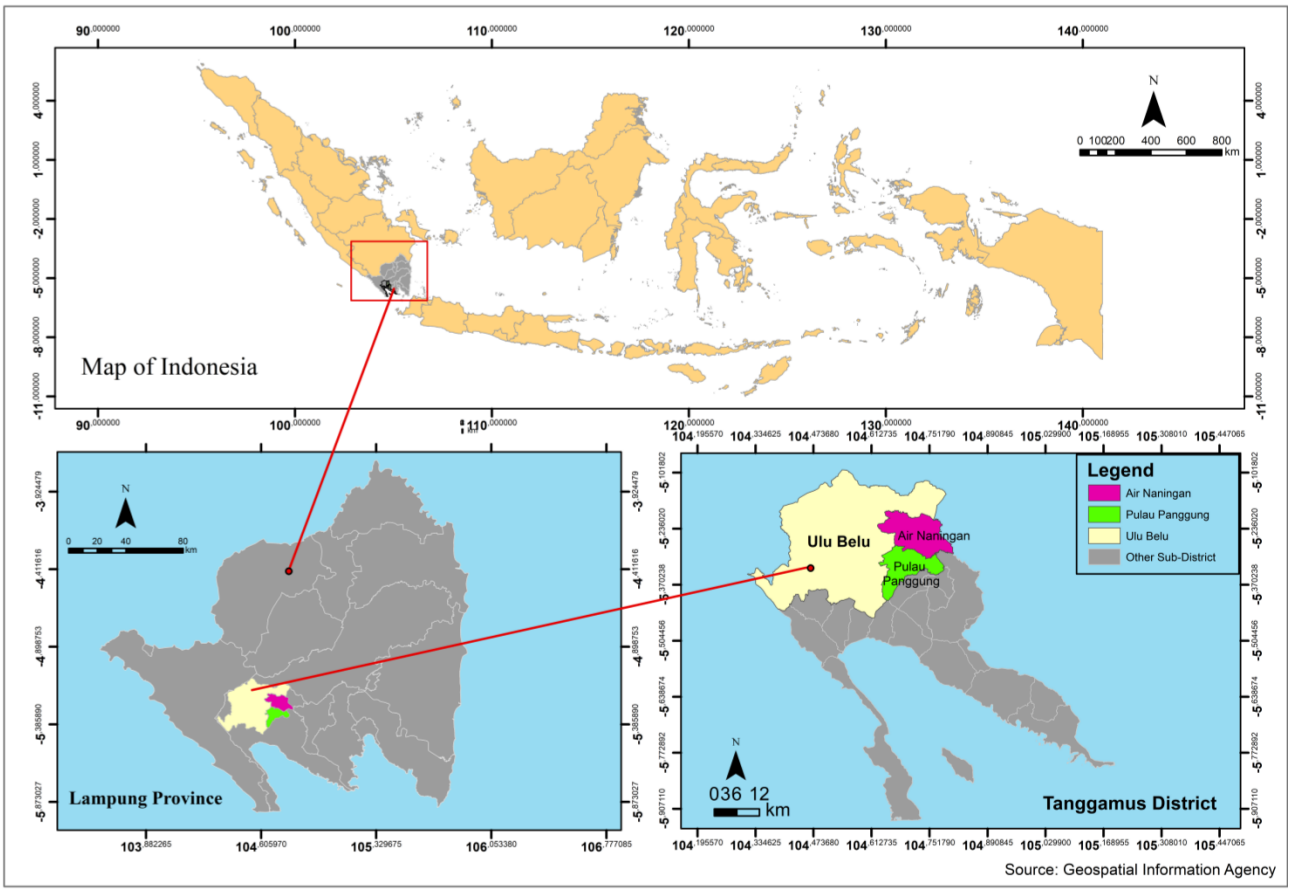


Figure 1. Survey Location Map for a Study in Tanggamus, Indonesia.

This research implicitly and conceptually utilizes two primary theoretical frameworks, namely agency theory and planned behavior theory. Agency theory explains the partnership system framework. Meanwhile, planned behavior theory explains farmers' responses related to their willingness to comply with regulations established by partner companies to increase income. The partnership between coffee farmers and coffee corporations in this study is reviewed from an institutional economic perspective. The form of partnership is contract farming. Contract farming is an economically and commercially oriented business partnership between two or more agribusiness actors for mutual benefit.

Corporation activities are determined by the continuity of the quantity and quality of coffee beans. Therefore, the need for raw material supplies and global pressure for coffee product certification have initiated a partnership program between the corporation and coffee farmers in the form of contract farming[21]. The advantages offered by corporations through contract farming include higher prices for partner farmers, guidance, counseling, field schools from corporations, assistance

with facilities and infrastructure, and assistance with high-quality coffee seeds. Additionally, partner farmers will receive coffee certification facilitation (4C) and assurance of coffee quality standards (Grade 4b) with fair and transparent coffee prices [22]. Contract farming provides benefits that can increase coffee farmers' income.

The impact of the partnership program on coffee farming performance between partner farmers and non-partner farmers in Tanggamus Regency was estimated using Propensity Score Matching (PSM). PSM was chosen because it has the advantage of reducing selection bias between partner farmers and non-partner farmers by comparing two groups with similar characteristics [10, 23]. PSM analysis begins by dividing observations into two groups, namely farmers involved in partnerships (treatment) and farmers not involved (control). Then, calculate the propensity score, which is the probability of an observation entering the treatment group based on variables determined using a logit regression model. The general form of the logit regression model follows the equation formulated by Hosmer and Lemeshow [24] in Equation (1):

$$P_i = \text{Ln}\frac{P_i}{1-P_i} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots \beta_i X_i \qquad (1)$$

(P_i) indicates farmer participation in the partnership program, where 1 represents partner coffee farmers and 0 represents non-partner coffee farmers. (X) is an independent variable that influences farmer participating in the program, namely farmer age (X_1), family members (X_2), education level (X_3), farming experience (X_4), side job (X_5), distance from home to farm (X_6), land area (X_7), and age of coffee plants (X_8).

Next, matching between partner and non-partner farmers was carried out using the Nearest Neighbour Matching (NNM) method. This method matches partner farmers with non-partner farmers based on the nearest propensity score, giving the same value for each characteristic compared. Then, a common support analysis was performed to ensure the propensity scores distribution between partner and non-partner farmers was within the same range. Meanwhile, propensity scores outside the common support range were excluded from the analysis. Covariate balancing was also tested to ensure that the average propensity score after matching did not differ significantly between the two groups.

Finally, the treatment effect was calculated by comparing the Average Treatment on Treated (ATT) of several farming performance indicators between partner farmers and non-partner farmers. ATT was calculated using Equation (2), which compares the farm performance results of the two groups after the matching process was completed. Thus, these steps ensure that the estimation of the impact of partnerships through certification is carried out accurately and in a structured manner.

$$\begin{aligned} \text{ATT} &= \text{E}\left(Y_1 - Y_0 | \text{X}, \text{M} = 1\right) \\ &= \text{E}\left(Y_1 | \text{X}, \text{M} = 1\right) - \text{E}\left(Y_0 | \text{X}, \text{M} = 1\right) \end{aligned} \qquad (2)$$

ATT shows the effect of partnership on coffee farming performance. Y_1 and Y_0 show coffee farming performance indicators (coffee yield, land productivity, farming costs, coffee price, coffee income, and land income) of partner and non-partner farmers. The variable X encompasses a set of observed farmer characteristics that are hypothesised to affect both the likelihood of joining the program and the resulting farming performance, regardless of membership status. These characteristics serve as explanatory variables in the model. Meanwhile, M is a binary variable indicating the farmer's participation decision, and M denotes the farmer's decision (M = 1 if the farmer joins the partnership, or M = 0 if not) [23].

3. Results

3.1. Socio-Demographic and Farm Profiles of Coffee Farmers

Based on **Table 1**, the socioeconomic profile of farmers shows that respondents ranged in age from 22 to 70 years old, with partner farmers being older on average (44.20 years) than non-partner farmers (41.18 years). The educational levels of both groups are relatively similar, specifically at the junior high school level. However, partner farmers have a slightly higher average education (10.04 years) compared to non-partner farmers (9.22 years). In terms of family composition, both groups of farmers are relatively similar, namely 2–3 people. Meanwhile, partner farmers have longer experience in coffee farming, with an average of 19.67 years, compared to non-partner farmers who have an average ex-

perience of 16.61 years. Less than 1% of farmers in both groups have side jobs, indicating that income from coffee is sufficient to meet farmers' basic needs [25]. In addition, the distance between the farm and the home of non-partner farmers is, on average, further (4.84 km) than that of partner farmers (2.56 km), indicating that partner farmers tend to have closer access to their land. Regarding land and production characteristics, partner farmers have a smaller average coffee land area (1.10 ha) than non-partner farmers (1.41 ha). However, the average age of partner farmers' coffee plants is older (18.02 years) than that of non-partner farmers (16.63 years).

Table 1. Socio-economic characteristics of respondents.

Description	Partner Farmers				Non-Partner Farmers			
	AVG	SD	Min	Max	AVG	SD	Min	Max
Farmers' age (yr)	44.20	8.64	25.00	70.00	41.18	8.28	22.00	62.00
Education (yr)	10.04	2.35	6.00	16.00	9.22	2.46	6.00	16.00
Family members (person)	2.56	1.34	0.00	6.00	2.83	1.21	1.00	6.00
Farming experience (yr)	19.67	7.18	3.00	38.00	16.61	8.28	2.00	40.00
Off-farm employment	0.33	0.47	0.00	1.00	0.35	0.48	0.00	1.00
Distance from home to farm (km)	2.56	3.39	0.00	30.00	4.84	8.78	0.00	50.00
Land area (ha)	1.10	0.47	0.50	2.75	1.41	0.66	0.28	4.50
Coffee plant age (yr)	18.02	6.47	3.00	25.00	16.63	6.88	3.00	25.00

Note: AVG = Average; SD = Std. Dev.

3.2. Economic Performance of Coffee Farming

The partnership program has a positive impact on coffee productivity, land productivity, prices, costs, coffee income, and land income. **Table 2** shows that the partnership program is able to boost coffee productivity higher (914.06 kg/ha) compared to non-partnership coffee farming (776.83 kg/ha). High productivity indicates that coffee farms managed by partner farmers are efficient [26]. High coffee productivity is in line with increased land productivity, with partner farmers' land income 16.27% higher than that of non-partner farmers. In addition, there has been an increase in the selling price of coffee at the farmer level as a result of the partnership program. Partner farmers receive a coffee price that is 6.83% higher than non-partner farmers. The partnership program guarantees partner farmers a higher selling price for their coffee [22]. Jena and Grote [27] and Hamid et al. [28] report that providing price incentives will motivate farmers to increase their productivity and the quality of their coffee.

In addition to output, the partnership program also optimizes coffee farming costs. Non-partner farmers spend 7.47% more on coffee farming than partner farmers. This has a direct impact on the coffee income received by both partner and non-partner farmers. Partner farmers' coffee farming income is 27.40% higher than the coffee income managed by non-partner farmers. When income from intercropping is also taken into account, the total income of partner farmers is 30.6 million, while non-partner farmers only earn 22.5 million. These findings confirm that the partnership program consistently improves coffee farming performance.

3.3. Determinants of Farmers' Participation in Partnership Programs

To assess the impact of partnerships on coffee farming, the model covariates were first identified. The next step was to select a logistic regression model in order to estimate the propensity score. The selected model is further utilized to estimate the factors influencing farmers to participate in partnerships. The Pearson Goodness-of-Fit test was employed to test the model's validity. The parameter tests were conducted both simultaneously and partially. For simultaneous testing, the Likelihood Ratio Test had a chi-square L.R. value of 40.88, a log likelihood value of 131.72562, and a Prob $>$ chi2 of 0.001, showing the significance of the regression. **Table 3** shows the factors influencing farmer partnership participation.

Table 2. Economic performance of partner and non-partner coffee farming.

Description	Partner Farmers		Non-Partner Farmers	
	AVG	SD	AVG	SD
Coffee yield (kg/ha)	914.06	279.13	776.83	235.33
Land productivity (kg/ha)	992.69	291.22	836.90	251.98
Coffee price (IDR)	36,565.22	2248.32	34,086.54	3301.55
Farming cost (IDR/ha)	5,641,237.00	1,232,185.00	6,082,917.00	1,398,747.00
Coffee income (IDR/ha)	27,700,000.00	10,100,000.00	20,400,000.00	8,940,257.00
Land income (IDR/ha)	30,600,000.00	10,500,000.00	22,500,000.00	9,546,689.00

Note: 1 USD = 16,735 IDR; AVG = Average; SD = Std. Dev.

Table 3. Determinants of farmers' participation in partnership programs.

Variable	Coefficient	Std. Err.	z	$p > z$	Odd Ratio
Farmers age	0.0179	0.0232	0.7700	0.4400	1.0181
Family members	0.0044	0.1265	0.0300	0.9720	1.0044
Education	0.1846***	0.0690	2.6800	0.0070	1.2028
Farming experience	0.0560**	0.0276	2.0300	0.0420	1.0576
Off-farm employment	0.3069	0.3395	0.9000	0.3660	1.3593
Distance from home to farm	−0.0617*	0.0335	−1.8400	0.0650	0.9402
Land area	−1.3158***	0.3166	−4.1600	0.0000	0.2683
Coffee plant age	0.0223	0.0243	0.9200	0.3580	1.0226
Constant	−2.0659	1.2957	−1.5900	0.1110	
Log likelihood	−131.7256				
Pseudo R2	0.1343				
LR chi2(8)	40.8800				
Prob > chi2	0.0000				

Note: Symbols ***, **, and * significant at the 1%, 5%, and 10% levels.

The educational attainment of farmers exhibits a positive and statistically meaningful influence on their decision to engage in partnership. The higher a farmer's educational background, the greater their likelihood of participating in partnership programs. More precisely, each additional unit of education increases the probability of engagement by 1.2028 times. This outcome aligns with the discovery of Anh et al.[29]. According to the researchers, the most educated farmers will be those who engage in farmer cooperative decisions and actions more frequently, thus being motivated to join sustainable coffee production partnerships. Likewise, Arifin et al.[17] pointed to a strong relationship between the education level of household heads and the involvement of farmers in sustainable certification partnerships through their decision-making process. Higher education is correlated with an increased likelihood of joining partnerships, which ultimately has a positive impact on agricultural income through improved market access and increased productivity.

Beyond education, farming experience also demonstrates a positive and statistically significant effect on farmers' participation in partnership schemes. Producers with longer experience in coffee cultivation generally exhibit a stronger inclination to participate, with each additional unit of experience increasing the probability of engagement by 1.0576 times. This evidence aligns with the findings of Barone et al.[30], who reveal that the farmers' decision to enter into partnership agreements is heavily governed by their accumulated experiential knowledge. In support of this, Bitzer et al.[31] present similar findings which suggest that farmers' experience plays an important role in their comprehension of the advantages associated with such partnerships. The producers who have been in coffee cultivation for a long period are likely to have a better understanding of the certification process and the market demands, hence they are able to realize the advantages of being part of a partnership in terms of knowledge transfer, adoption of better agronomy practices, and price premium.

On the contrary, land area depicts a notably negative influence on farmers' participation in partnerships,

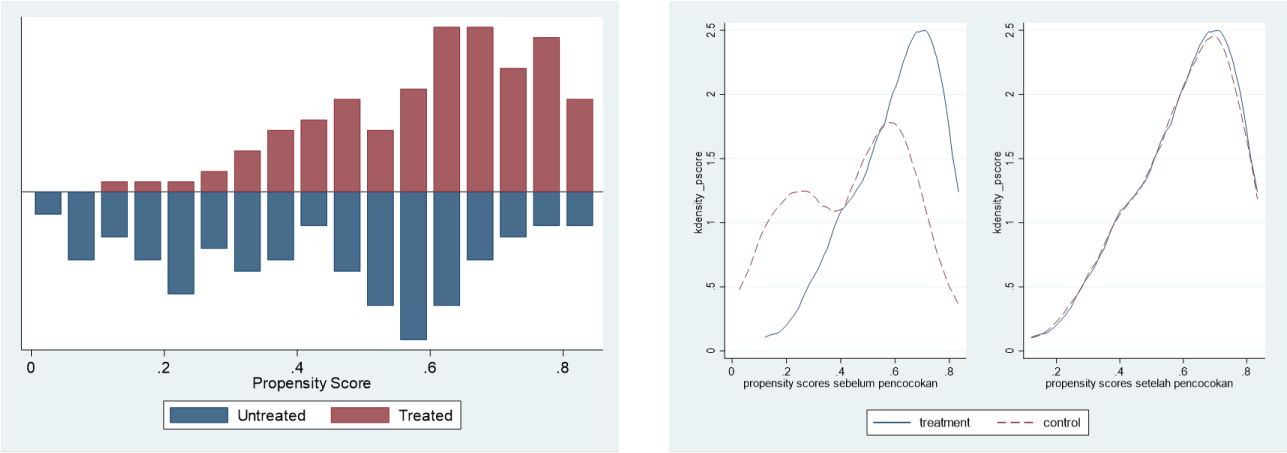
with the negative coefficient suggesting that farmers with more extensive landholdings have a lower likelihood of engaging in partnerships. Each additional unit of land area decreases the probability of engagement by 0.2683 times. This is due to the tendency of farmers who possess large areas of land to prioritize independent resource management rather than partnership participation. Farmers believe they do not require external support as they are capable of managing their own farm [32]. These results align with Zana's [33] research, which deduced that farmers who own large areas of land receive a sufficient income from their own businesses. Consequently, the benefits of partnerships are less appealing to them as they are generally more attractive for small-scale farmers. Thus, the larger the land area, the less likely farmers are to engage in partnerships.

The distance between homes and farms and its negative impact on partnerships are among the other factors that contribute to this case at 10%, where every one-unit increase in distance results in a decrease of the likelihood of partnership participation by a factor of 0.9402. Hence, it appears that a greater distance from the farm leads to a lower probability of partnership. The longer distance one must travel to reach the farm is associated with higher travel expenses and travel time, thus reducing the benefit associated with participating in partnerships [6]. In contrast, farmers located near coffee farms have a greater tendency to get involved due to the fact that they can access the resources and support services with less difficulty [32]. This proximity not only facilitates access but also fosters better communication and builds trust between farmers and partners.

3.4. Propensity Score Matching Estimation

Before estimating the impact of the partnership program, a quality matching evaluation was conducted to ensure a balance of observable characteristics between the partner and non-partner groups. The Propensity Score Matching (PSM) The Matching Method was performed on 230 farmer households, which included 126 partner of coffee farmers and 104 non-partner coffee farmers. The findings of the study depicted good matching quality as shown by two complementary pieces of evidence. **Figure 2a** exhibits the density plot after matching, reflecting a similarity in the distribution of observable characteristics where the curves of the two groups overlap. This is further strengthened by **Figure 2b**, confirming the presence of an area of common support indicated by the X-axis, which represents the propensity score's logit value. The logit value of the propensity score (linear predictor, which ranges from 2 to 6) is then converted into a probability value between 0.88 and 0.97. The existence of this area further demonstrates that the two groups have comparable characteristics across a sufficiently broad range, allowing valid matching. Thus, the matching process successfully created a comparative control group, and the differences in post-program outcomes can be attributed to the impact of the partnership program intervention.

Based on the results of the post-matching covariate balance test (**Table 4**), it can be concluded that most covariate variables did not show significant differences between the partner and non-partner groups. *p*-values greater than 0.05 for variables such as education (0.788), farming experience (0.164), side jobs (0.134), distance from home to farm (0.926), and land area (0.357) indicate that the matching process has successfully balanced the distribution of covariates on these variables. However, several variables still show significant differences, including the number of family members (*p*-value = 0.039), where non-partner farmers tend to have more family members than partner farmers, and the age of coffee plants (*p*-value = 0.050), indicating that partner farmers tend to have older coffee plants. Meanwhile, the difference in farmer age between the two groups is nearly significant (*p*-value = 0.089), with non-partner farmers tending to be slightly older than partner farmers. The coffee plants of partner farmers (17 years) and non-partner farmers (15 years) are still within the productive age range of coffee plants (5–20 years), the family size of partner farmers is 2.56 and non-partner farmers 2.91, or around 2–3. However, partner farmers receive counseling and guidance from partners on proper coffee cultivation according to GAP, resulting in higher productivity.



(a) **(b)**

Figure 2. Propensity score distributionof partner and non-partner farmers: (**a**) kernel density of propensity scores; (**b**) before and after matching.

Table 4. Post-matching covariate balance test results.

Variable	Mean		% Bias	*t*-Test	
	Partner Farmers	Non-Partner Farmers		*t*	$p > t$
Farmers age	43.852	45.739	−21.900	−1.710	0.089
Family members	2.565	2.913	−27.000	−2.080	0.039
Education	9.783	9.870	−3.700	−0.270	0.788
Farming experience	19.113	20.600	−19.200	−1.400	0.164
Off-farm employment	0.304	0.217	18.500	1.500	0.134
Distance from home to farm	2.566	2.606	−0.600	−0.090	0.926
Land area	1.122	1.174	−9.100	−0.920	0.357
Coffee plant age	17.748	15.930	27.000	1.970	0.050

Overall, the level of balance achieved in this study is adequate for continuing the analysis of the program's impact. Although some variables were not perfectly balanced, the resulting bias percentages were within acceptable limits. These results provide confidence that the differences in farm performance that will be estimated later can be attributed more to participation in the partnership program rather than solely to differences in the basic characteristics between the two groups. The fulfilment of good standard support criteria and the balance achieved in most key variables provide a strong foundation for analysing the partnership program's impact on coffee farm performance in the next stage.

3.5. Impact of Partnership Program on Coffee Farming Performance

Overall, the partnership program has been shown to have a significant impact on improving coffee farming performance (**Table 5**). All observed performance variables showed statistically significant differences between partner and non-partner farmers. These findings confirm the effectiveness of the partnership program in transforming the economic performance of coffee farming in the study area.

Table 5. Average treatment effect of the partnership program on coffee farming performance.

Variable	Partner Farmers	Non-Partner Farmers	Difference (ATT)	S.E.	*t*-Stat
Coffee yield (kg/ha)	914.06	710.26	203.80***	42.85	4.76
Land productivity (kg/ha)	992.69	767.08	225.60***	45.35	4.97
Farming cost (IDR/ha)	5,641,236.66	6,096,166.50	−454,929.84*	266,891.99	1.70

Table 5. *Cont.*

Variable	Partner Farmers	Non-Partner Farmers	Difference (ATT)	S.E.	*t*-Stat
Coffee price (IDR)	36,565.22	35,078.26	1486.96**	648.07	2.29
Coffee income (IDR/ha)	27,741,005.20	18,771,493.80	8,969,511.40***	1,536,426.38	5.84
Land income (IDR/ha)	30,610,015.30	20,750,361.90	9,859,653.40***	1,635,483.51	6.03

Note: Symbols ***, **, and * significant at the 1%, 5%, and 10% levels.

In terms of productivity, the partnership program successfully increased coffee productivity by 203.80 kg/ha (22.29%) and land productivity by 225.60 kg/ha (22.72%). These results align with the research by Astuti et al.[32], which suggests that participation in partnerships significantly contributes to increased productivity. This increase is driven by access to credit, technology, and training that enable farmers to adopt better production practices[34, 35]. In addition, building trust and strengthening social capital through partnerships also supports productivity improvement[36]. Hence, the partnership programs not only increase production yields but also promote cooperation and trust among the participants of the program.

The partnership program has brought about a considerable decrease in the farming costs by IDR 454,929.84 or 7.46%, which in turn has permitted farmers to conduct their farming more economically as they are availing of the financial and technical assistance provided by their partner companies and are making the most of their limited production resources. Moreover, one more significant cause of savings is the provision of agricultural inputs to farmers in these programs, either on credit or at subsidized prices, as well as collective purchasing facilitated by partnerships, which also contributed to reducing farmers' production costs[37].

The partnership program was successful in raising the retail price of coffee by 4.06%, demonstrating the higher quality of coffee produced by the partner farmers. It has been pointed out by Arifin et al.[17] and Dewi et al.[20] that one of the benefits of certification partnerships is the potential for income increase through higher yields and selling prices. The positive combination of increased productivity, reduced costs, and the increase in their prices, farmers in partnership programs are experiencing considerable income growth. The average coffee income has grown by 47.79% while land income has increased by 47.51%. Sellare et al.[38] note that it is within partnership arrangements that farmers gain access to international markets and secure pricing arrangements more advantageous to them.

Furthermore, the stronger bargaining position, increased vertical integration, and technological assistance that farming partnerships offer all make a significant contribution to farmer incomes. Overall, the outcomes of partnership programmes include increased productivity and efficiency in cost and pricing, and greater income growth for partner farmers. The synergy of increased outputs and decreased inputs generates a compound effect whereby the overall influence on income is better than the sum of the individual influencing factors. Such findings are a powerful empirical support for the advocacy of partnership programs as a means of giving power to small coffee producers.

4. Discussion

The findings of this research support the complicated connection between farmers' degree of participation in the partnership program and their socioeconomic characteristics. The findings of the present study corroborate those of Anh et al.[29] and Barone et al.[30] regarding the substantial and positive impact of education level and farming experience, and also support the view of the individual's skill as the main factor in the adoption of agricultural innovations. The higher educational farmers not only get better partnership schemes but also give more power to farmers when they are negotiating with partners[39]. Farmers' experiences with farming form a type of social capital because they aid farmers in understanding the benefits and disadvantages associated with partnerships. The finding that larger farms are less likely to participate in partnerships supports the idea that these types of programs are more appeal-

ing to smaller farmers with limited access to resources, as stated by Astuti et al.[32], who showed that farmers managing larger-scale businesses are typically more independent in farm management.

The partnership program has made farming more productive. This is clear from the 22.29% rise in overall productivity and the 22.72% rise in land productivity, indicating the program's effectiveness in optimizing resources. Costs have decreased by 7.46%, which means coffee farming has achieved simultaneous improvements in output and cost efficiency, with more output and fewer inputs. Furthermore, the market perceives the items as being of better quality than their previous quality, as partner farmers received a 4.06% increase in selling price. These results are in line with the study by Arifin et al.[17], Sustainability certification through partnership programs combined with better cultivation and farm management practices have a great impact on the income of both coffee and land, an increase of 47.79% for coffee and 47.51% for land, thereby showing the great influence of partnership programs on the economic performance of coffee farmers.

Special extensive support services should cater to every farmer in the case of lacking formal education and no experience in farm management, in order to raise their technological and managerial skills. Moreover, larger farmers' participation should be encouraged via the provision of incentives that are in accordance with the size of the business. It should also be an important factor in determining where the place is located. When planning programs, it's best to pick places that are easily accessible to minimize access-related constraints. These strategic adjustments can make partnership programs more inclusive for agricultural development and enhance farmers' resilience to the challenges posed by climate change.

However, this study has several limitations. The main limitation lies in the focus of the analysis, which only covers the socioeconomic background of the farmers observed, while other factors that were not observed, such as risk preferences, may also be crucial in determining farmers' participation decisions. Therefore, future studies are recommended to use panel data or experimental designs to improve this research.

5. Conclusions

The results of the Propensity Score Matching analysis showed that partnership programs have a significant influence on improving the performance of small-scale partnership coffee farming, contrasting with non-partnership coffee farming. Education and experience are driving factors for participation in partnership programs, while the size of the area and the distance from the garden to the house are inhibiting factors. By participating in partnership programs, farm productivity was increased by 22.9%, production cost was decreased by 7.46%, and selling price was increased by 4.06% due to improvement of coffee quality, resulting in coffee farm income increment by 47.79%.

As a policy implication, our findings suggested that partnership programs should implement a different approach and strategies based on farmers' socio-economic background. Farmers with low education and farming experience need intensive assistance programs. Meanwhile, for farmers who possess larger land areas and commonly have a higher education level, incentives need to be provided and adjusted to the scale of their business. In the broader context, these findings confirm the effectiveness of partnerships as a strategy for increasing the productivity and efficiency of coffee farming. More importantly, the research highlights the role of partnership programs as a transformative method for building the economic resilience of smallholder farmers.

Author Contributions

This research was written by F.E.P., W.D.S., D.A.H.L., R.A., D.M.S. and T.N.A. Conceptualization and methodology, F.E.P., T.N.A. and D.M.S.; software and validation, D.M.S, W.D.S. and R.A.; formal analysis and data curation, D.A.H.L., D.M.S. and T.N.A; writing—original draft preparation and writing—review and editing, F.E.P., T.N.A. and W.D.S. All authors have read and agreed to the published version of the manuscript.

Funding

This research was financially supported by the Universitas Lampung through the Basic Research Grant

scheme (Number: 2513/UN26.14/PN.01.00/2025).

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data in this study are limited by ethical considerations and privacy protection. Anonymous datasets can be obtained from the authors upon request.

Acknowledgments

We gratefully acknowledge the coffee farmers in Tanggamus, Lampung, for their generous cooperation and invaluable insights during data collection, and Universitas Lampung for its financial support and facilities provided throughout the research process.

Conflicts of Interest

The authors declare that there is no conflict of interest in this study.

References

[1] International Coffee Organization, 2023. Coffee Report and Outlook (CRO). Available from: https://share.google/tA3WkkxZvH8OmAwAK (cited 10 July 2025).

[2] Poncet, V., Van Asten, P., Millet, C.P., et al., 2024. Which diversification trajectories make coffee farming more sustainable? Current Opinion in Environmental Sustainability. 68, 101432. DOI: https://doi.org/10.1016/j.cosust.2024.101432

[3] Jacobi, J., Lara, D., Opitz, S., et al., 2024. Making specialty coffee and coffee-cherry value chains work for family farmers' livelihoods: A participatory action research approach. World Development Perspectives. 33, 100551. DOI: https://doi.org/10.1016/j.wdp.2023.100551

[4] Fromm, I., 2023. Agricultural Value Chains. In: Stanton, J., Caiazza, R. (Eds). Reducing Inequalities in the Coffee Value Chain: Threats and Opportunities for Small-Scale Farmers in Central America and East Africa. IntechOpen: London, UK.

[5] Kaido, B., Takashino, N., Fuyuki, K., 2021. Challenges of Arabica Coffee Marketing: A Case Study in Kerinci Regency, Indonesia. Asian Journal of Agriculture and Rural Development. 11(1), 53–62. DOI: https://doi.org/10.18488/journal.ajard.2021.111.53.62

[6] Faradillah, Y., Saany, S.I.A., El-Ebiary, Y.A.B., 2019. E-Marketing and Challenges among Indonesian Coffee Farmers. In Proceedings of the 2019 International Conference of Computer Science and Information Technology (ICoSNIKOM), Medan, Indonesia, 28 November 2019; pp. 1–5.

[7] Kamaruddin, Masbar, R., Syahnur, S., et al., 2021. Asymmetric price transmission of Indonesian coffee. Cogent Economics & Finance. 9(1), 1971354. DOI: https://doi.org/10.1080/23322039.2021.1971354

[8] Marbun, P.M.P., Sihombing, F.N., Lahay, R.R., et al., 2025. Indonesia Coffee Export Performance to the Primary Destination Countries. Tekirdağ Ziraat Fakültesi Dergisi. 22(4), 1072–1085. DOI: https://doi.org/10.33462/jotaf.1701495

[9] Lamare, D.M., Ngome, A.F., Eyenga, E.F., et al., 2017. Harvesting Date Influences Cassava (Manihot Esculenta Crantz) Yield and Quality of Based-Products. Current Research in Agricultural Sciences. 4(3), 75–83. DOI: https://doi.org/10.18488/journal.68.2017.43.75.83

[10] Nguyen, T.M.C., Chien, L-.H., Chen, S-.E., 2015. Impact of certification system on smallhold coffee farms' income distribution in Vietnam. Asian Journal of Agriculture and Rural Development. 5(6), 137–149. DOI: https://doi.org/10.22004/AG.ECON.244281

[11] Ibnu, M., 2023. Implementation of Standards and Certification in the Coffee Value Chain: Opportunities and Constraints for Farmers. Jurnal Litbang: Media Informasi Penelitian, Pengembangan dan IPTEK. 19(1), 1–16. (in Indonesian)

[12] Towaha, J., Aunillah, A., Purwanto, E.H., et al., 2014. The Effect of Elevation and Processing on the Chemical Content and Flavor of Lampung Robusta Coffee. Jurnal Tanaman Industri dan Penyegar. 1(1), 57–62. (in Indonesian)

[13] Hartoyo, B., Dewanti, J.I., Nurlaili, E.P., et al., 2024. Tastes of Robusta Coffee from Various the Altitude Plantation Locations. Jurnal Agrifoodtech. 3(1), 40–48. DOI: https://doi.org/10.56444/agrifoodtech.v3i1.1888 (in Indonesian)

[14] BPS-Statistics Tanggamus Regency, 2024. Tangga-

mus Regency In Figures 2024. Available from: https://tanggamuskab.bps.go.id/id/publication/2024/02/28/ce4799c26139228c4c4070d1/kabupaten-tanggamus-dalam-angka-2024.html (cited 17 July 2025). (in Indonesian)

[15] Triana, E.F., Hasanuddin, T., Nurmayasari, I., 2019. Coffee Farmers' Perceptions of the Rainforest Alliance Coffee (RFA) Certification Program in Pulang Panggung District, Tanggamus Regency. Jurnal Ilmu Ilmu Agribisnis: Journal of Agribusiness Science. 7(3), 397–404. (in Indonesian)

[16] Bekere, Y.B., Megersa, G.R., 2021. Coffee Certification Participation and Its Impact on Smallholder Farmers' Income in Jimma Zone, Southwestern Ethiopia. Agricultural Social Economic Journal. 21(02), 87–102. DOI: https://doi.org/10.21776/ub.agrise.2021.021.2.2

[17] Arifin, B., 2022. Partnership for Sustainable Coffee Certification: Linking Up Smallholder Farmers to Global Coffee Market. Sustainability Science and Resources. 2(1), 24–44. DOI: https://doi.org/10.55168/ssr2809-6029.2022.2003

[18] Sebaio, A.G., 2024. Impact of Quality Certification on the Visibility and Competitiveness of Coffee Production in the Cerrado Mineiro. In Multidisciplinary Research and Practice. Seven Editora: São José dos Pinhais, Brazil. DOI: https://doi.org/10.56238/sevened2024.029-056

[19] Wahyudi, A., Wulandari, S., Aunillah, A., et al., 2020. Sustainability certification as a pillar to promote Indonesian coffee competitiveness. IOP Conference Series: Earth and Environmental Science. 418(1), 012009. DOI: https://doi.org/10.1088/1755-1315/418/1/012009

[20] Dewi, A.N.C., Arifin, B., Marlina, L., 2019. Certified Coffee Agribusiness Value Chain in West Lampung Regency. Jurnal Ilmu Ilmu Agribisnis: Journal of Agribusiness Science. 7(3), 283–291. (in Indonesia).

[21] Rosanti, N., Sinaga, B.M., Daryanto, A., et al., 2020. The Impact of Contract Farming on Coffee Farming Performance in Lampung. Agriekonomika. 9(2), 140–149. DOI: https://doi.org/10.21107/agriekonomika.v9i2.8789 (in Indonesian)

[22] Yoansyah, A., Ibrahim, A., Abidin, Z., 2020. Analysis of Coffee Farmers Partnership with PT Nestle And Its Effect On Coffee Farmers Income in Simberjaya Subdistrict, Lampung Barat District. Journal of Tropical Upland Resources. 2(2), 191–203. (in Indonesian)

[23] Getachew, Z., Beyene, F., Haji, J., et al., 2023. Impact of Membership to Certified Coffee Marketing Cooperatives on the Income of Smallholder Farmers in Jimma Zone of Oromia Region, Ethiopia. International Journal of Economics. 8(1), 100–126. DOI: https://doi.org/10.47604/ijecon.2047

[24] Hosmer, D. W., Lemeshow, S., 2013. Applied Logistic Regression, 3rd ed. John Wiley & Sons: Hoboken, NJ, USA. Available from: https://dl.icdst.org/pdfs/files4/7751d268eb7358d3ca5bd88968d9227a.pdf

[25] Hartatri, D.F.S., Neilson, J., 2021. Livelihood strategies of smallholder coffee farmers: case study in Simalungun, North Sumatera. E3S Web of Conferences. 306, 02051. DOI: https://doi.org/10.1051/e3sconf/202130602051

[26] Navichoc, D., Alamneh, M., Mortara Batistic, P., et al., 2024. Voluntary sustainability standards and technical efficiency of Honduran smallholder coffee producers. World Development Perspectives. 36, 100637. DOI: https://doi.org/10.1016/j.wdp.2024.100637

[27] Jena, P.R., Grote, U., 2022. Do Certification Schemes Enhance Coffee Yields and Household Income? Lessons Learned Across Continents. Frontiers in Sustainable Food Systems. 5, 716904. DOI: https://doi.org/10.3389/fsufs.2021.716904

[28] Hamid, A.H., Nugroho, A., Pospos, T.H., et al., 2023. Impact of coffee sustainability schemes on rural coffee producer households' living standard in Aceh province, Indonesia. Acta agriculturae Slovenica. 119(1). DOI: https://doi.org/10.14720/aas.2023.119.1.2472

[29] Hung Anh, N., Bokelmann, W., Thi Nga, D., et al., 2019. Toward Sustainability or Efficiency: The Case of Smallholder Coffee Farmers in Vietnam. Economies. 7(3), 66. DOI: https://doi.org/10.3390/economies7030066

[30] Barone, P., Deugd, M., Wille, C., 2017. Experience and Experimentation: From Survive to Thrive. In The Craft and Science of Coffee. Elsevier: London, UK. pp. 161–179. DOI: https://doi.org/10.1016/B978-0-12-803520-7.00007-4

[31] Bitzer, V., Glasbergen, P., Arts, B., 2013. Exploring the potential of intersectoral partnerships to improve the position of farmers in global agrifood chains: findings from the coffee sector in Peru. Agriculture and Human Values. 30(1), 5–20. DOI: https://doi.org/10.1007/s10460-012-9372-z

[32] Astuti, L.T.W., Flores, D.S.H., Arman, I., et al., 2022. The impact of farmer partnerships on arabica coffee farming in Simalungun Regency, North Sumatra Province, Indonesia. Agriekonomika. 11(2), 115–129. DOI: https://doi.org/10.21107/agriekonomika.v11i2.14810

[33] Zana, T., 2017. Determinants of Smallholder Farmers' Participation in Certified Coffee Value Chain: Evidence from Members of Coffee Cooperatives in Dale District, Sidamo, Southern Ethiopia. International Journal of Africe and Asian Studies. 38, 26–

33. Available from: https://iiste.org/Journals/index.php/JAAS/article/view/38658

[34] Wambua, D.M., Gichimu, B.M., Ndirangu, S.N., 2021. Smallholder Coffee Productivity as Affected by Socioeconomic Factors and Technology Adoption. International Journal of Agronomy. 2021, 1–8. DOI: https://doi.org/10.1155/2021/8852371

[35] Wanzala, R.W., Marwa, N., Lwanga, E.N., 2024. Impact of agricultural credit on coffee productivity: An analysis of the perceptions of smallholder farmers. Journal of Agribusiness and Rural Development. 72(2), 161–180. DOI: https://doi.org/10.17306/j.jard.2024.01761

[36] Haryono, A., Juniarti, I., Matajat, K., et al., 2024. Partnership Development of Smallholder Coffee Cultivation: A Model for Social Capital in the Global Value Chain. Economies. 12(12), 349. DOI: https://doi.org/10.3390/economies12120349

[37] Ton, G., Vellema, W., Desiere, S., et al., 2018. Contract farming for improving smallholder incomes: What can we learn from effectiveness studies? World Development. 104, 46–64. DOI: https://doi.org/10.1016/j.worlddev.2017.11.015

[38] Sellare, J., Meemken, E., Kouamé, C., et al., 2020. Do Sustainability Standards Benefit Smallholder Farmers Also When Accounting For Cooperative Effects? Evidence from Côte d'Ivoire. American Journal of Agricultural Economics. 102(2), 681–695. DOI: https://doi.org/10.1002/ajae.12015

[39] Agustin, E.S.A.S., Offermans, A., Arifin, B., 2023. The Impact of Partnership Forms on the Improvement of Coffee Farmers' Welfare. Sustainability Science and Resources. 5, 20–32. DOI: https://doi.org/10.55168/ssr2809-6029.2023.5002