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# Exploring the Relation between Farmer Group Membership and Agricultural Productivity: Evidence from Indonesian Rice Farming

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## ABSTRACT

Farmer groups have been critical in pursuing agricultural development, particularly in developing countries. Indonesia's government has promoted the development of farmer groups in recent years, mainly in the rice sector, as a strategic agricultural commodity. This paper explored the relations between farmer group membership, farming practices, and productivity in the Indonesian rice sector. Propensity Score Matching (PSM) and regression analysis were employed to examine the 2014 National Agricultural Survey data. The empirical findings confirmed the positive relations between farmer group membership and productivity in the Indonesian rice sector. Furthermore, farmers' characteristics covering age, gender, education level, and farming practices, such as land status and access to irrigation, all played a role in determining the extent to which farmers participated in farmer groups.

**Keywords:** Farming productivity; Farming practices; Farmer's characteristics; Group participation; Propensity Score Matching (PSM)

## INTRODUCTION

Farmer groups have been highlighted in agricultural literature to further agricultural development and rural economy (Agarwal, 2018; Gyau, Franzel, Chiatoh, Nimino, & Owusu, 2014; Ito, Bao, & Su, 2012; Koguashvili, 2016). Small farmers tend to dominate in many developing countries. However, these farmers are commonly vulnerable in the market with low bargaining power (García-Germán, Bardají, & Garrido, 2016; Markelova, Meinzen-Dick, Hellin, & Dohrn, 2009; Mojo, Fischer, & Degefa, 2017). Moreover, this challenge would likely threaten small farmers with low productivity and inefficient as the market becomes increasingly competitive and globalized (Fanzo, 2017; Graeub et al., 2016). Therefore, this situation supports the argument for small farmers' need for collective action. Farmer groups view an approach as an institutional arrangement to deal with constraints in exploiting the market and production opportunities. For instance, farmer groups can assist in minimizing transaction costs and information asymmetry, allowing for more competitive output and input pricing to be negotiated. Furthermore, along with the recent growing transformation of the

agrifood value chain, coupled with the importance of high-quality standards and new procurement system developed by large and formal agribusiness companies in developing countries, farmer group participation can be an effective strategy for small farmers to access to those formal institutions (Barrett et al., 2012; Bellemare, 2012; Reardon, Barrett, Berdegué, & Swinnen, 2009; Verhofstadt & Maertens, 2015).

Various studies have explored the role of farmer groups in developing agricultural practices. Some research, such as (Ainembabazi et al., 2017), have emphasized the role of farmer groups in enhancing the adoption of innovation and technology in the agricultural practices in some developing countries. Furthermore, other studies focused on investigating how farmer group participation affected the efficiency and productivity in the agricultural sector (e.g., (Abate, Francesconi, & Getnet, 2014; Abdul-Rahaman & Abdulai, 2020; Ainembabazi et al., 2017; Utami & Harianto, 2021; Wossen et al., 2017). Several studies discovered a positive effect of farmer groups in improving agricultural productivity and efficiency. Nevertheless, other studies by Wollni and Brümmer (2012) and Gedara, Wilson, Pascoe, & Robinson (2012). revealed the insignificant role of farmer group participation. These inconsistent findings might be attributed to the nature of farmer groups for each case and the use of the analytical methods.

Despite the growing empirical studies on the issue of farmer collective action, the study on the Indonesian context, especially in the rice farming system is still require more exploration. In Indonesia, the government has paid much attention to develop farmer groups, including cooperatives. The interest in aggregating farmers into groups for agricultural production and marketing has begun since the 1990s, and by 2018 about 63,409 farmer groups existed (Ministry of Agriculture, 2018). The increasing growth of farmer group formation was driven mainly during 2008 when the government, through the Ministry of Agriculture, introduced a program for rural agribusiness development called *Program Usaha Agribisnis Pedesaan* (PUAP) or Rural Agribusiness Program. Through this program, the government granted 100 million rupiahs for each farmer group as a revolving fund, particularly for developing financing schemes for farmers. In doing so, each farmer group in every village was accompanied and supervised by one agriculture extension service linked to the Ministry of Agriculture. The implementation of PUAP (2008-2012) involved 44,173 farmer groups, generating 4.4 trillion rupiahs.

However, this political support from the government has not automatically brought no constraint. Several challenges should be overcome in managing the institutional aspects of the agricultural system. Even though the Indonesian government has paid attention to the importance of farmer groups in developing the agricultural system, it has not been followed by the same awareness of the people. It is particularly due to the common assumption that farmer groups are solely utilized as a political tool rather than truly giving economic advantages or improving farming productivity.

This study explored the role of farmer groups in agricultural practices and productivity, especially in rice farming in Indonesia. Rice is Indonesia's most strategic food commodity, with a cultivated area of about 10,903,835 hectares and a production of 56,537,774 tons

(Statistics Indonesia, 2019). As the main staple food for the people, the demand for rice has continuously increased following population growth. Therefore, national food security greatly relies on the availability of rice both physically and economically for most of the population. The Indonesian Government has worked hard to improve rice productivity within the country for years to achieve the goals. Rice self-sufficiency has become the government's main agenda, especially for the Ministry of Agriculture. As rice is the main food commodity in Indonesia, rice farmers dominate the agricultural system. The Ministry of Agriculture of Indonesia reported that the total agricultural workforce reached 35,268,405 in 2016, consisting of 13,443,350 (38%) females and 21,645,473 (62%) males. Of these numbers, 15,779,402 (44.97 %) worked in the food sector. Male farmers also dominated the food sector, contributing around 9,485,414 (60%). Furthermore, as commonly happens in most developing countries, rice farmers in Indonesia are characterized as smallholders cultivating less than one hectare with a low level of education.

Following the importance of farmer groups in providing better access to the input and output market, this study tried to discover empirical evidence of whether differences exist in agricultural practices between farmers joining farmer groups and those not associating with any collective action. Furthermore, does farmer group membership also relates to the farmers' productivity? Do farmers who join the farmer groups experience higher productivity than those who do not? Subsequently, factors affecting farmer group memberships decision were also investigated.

## RESEARCH METHOD

This study utilized data from the Food Crop Survey (STP 2014), a National Agricultural Survey covering 87,330 rice farm households across Indonesia, derived from Statistics Indonesia. This survey was conducted regularly every three years and targets farm households in Indonesia for several strategic agricultural commodities. Missing data were excluded from the dataset. In addition, to deal with the time-related selection bias, this study only focused on farmers with the same harvest time, i.e., the rainy season in 2013. Therefore, this study employed 53,537 respondents from the survey.

As commonly assumed, the decision to become a member of a farmer group is motivated by the expectation of the benefit generated from the membership. Intuitively, if a farmer can obtain even a small benefit by joining, they will most likely undertake it. However, this benefit was empirically unobservable, termed a latent variable. The actual membership participation in farmer groups was measured. Therefore, a latent variable framework was employed to build this benefit as a function of observable characteristics.

$$Gi^* = \beta Zi + \varepsilon i,\ Gi = 1 \mid Gi^* > 0 \mid \quad (1)$$

$Gi$ referred to the farmer group participation indicated by the value of 1, and 0 otherwise, $\beta$ represented the parameter to be estimated, $\varepsilon i$ was the error term with 0 mean and variance of $\sigma 2$, $Zi$ implied a vector of observable variables assumed to affect the decision to participate in a farmer group.

The probability of participating in a farmer group was specified as follows.

$$Pr\ (Gi = 1) = Pr\ (Gi^* > 0) = Pr\ (\varepsilon i > -Zi\beta) = 1 - F(-Zi\beta) \quad (2)$$

*F* was the cumulative distribution function for $\varepsilon i$.

Some research reported that the farmers' decision to join a farmer group was influenced by the demographic, socioeconomic, and physical characteristics of the households (e.g Abadie & Imbens, 2006; Abate et al., 2014; Mojo et al., 2017). In this study, several proxy variables, including age, gender, level of education, farm size, and others, as detailed in Table 1, were observed to investigate the factors affecting the farmer group participation.

As popularly conducted within the existing literature (e.g., (Abdul-Rahaman & Abdulai, 2018; Mojo et al., 2017; Wossen et al., 2017), this study applied Propensity Score Matching (PSM). PSM is one of the matching methods to overcome the selection bias in observational studies by pairing treatment and control groups with similar covariates. The basic idea under PSM is to match each treated respondent with a similar untreated respondent and then measure the average difference in the outcome variable between the treated and untreated respondents. In this study, the PSM modeled the treatment effect of farmer group membership on rice production as the outcome variable. As underlined in previous studies (e.g., Caliendo & Kopeinig, 2008; Heinrich, Maffioli, & Vázquez, 2010; Mojo et al., 2017), several underlying assumptions should be addressed in working with PSM.

Firstly, the assumption of conditional independence or unconfoundedness indicates that after controlling for the observable covariates, the potential outcomes were independent of the treatment assignment. This assumption implied that participating in a farmer group depends on observable characteristics. In other words, it does not consider any unobservable differences. In addition, the common support or overlap condition was assumed to be satisfied, meaning that every respondent (farmer) with the same values of the covariates (*Z values*) had a positive probability of being treated and untreated. Finally, the fulfillment of the balancing property applied that the mean of the covariates between members and non-members should be similar after matching. This condition signifie that treatment was independent of unit characteristics after conditioning on *Z*.

Several matching algorithms exist, each with pros and cons depending on the neighborhood definition for each treated individual, the treatment of common supports, and the weight assigned to the neighbors. This study employed nearest-neighbor matching developed by Abadie and Imbens (2006), which imputes the missing potential outcome for each subject using an average of similar subjects' outcomes receiving the other treatment level. The similarity between subjects was based on a weighted function of the covariates for each observation. The Average Treatment Effect (ATE) was computed by averaging the difference between the observed and imputed potential outcomes for each subject, described as follows.

$$ATE = E(Y1 - Y0/Gi = 1) = E(Y1/Gi = 1) - E(Y0/Gi = 1) \quad (3)$$

*Y1* represented the outcome of the treated condition, *Y0* signified the outcome in the control condition, which referred to the rice production as the outcome variable of *Y*, and the *Gi* indicator variable as the treatment status assigning the farmer group membership.

Matching is a good method when assuming no systematic differences between members and non-members. In other words, matching can only control observational selection biases and thus may be unreliable when unobservable selection biases exist. Therefore, following this approach, this study utilized a regression model to investigate the role of farmer group membership on the rice production function.

To further explore the role of farmer group participation in agricultural practices and productivity, this study modeled the production function, involving farmer group membership as one of the independent variables in the production function. A linear logarithmic production function was estimated using Ordinary Least Square (OLS), defined as Formula 4.

$$Yi = \beta 0 + \beta 1\ Xi1 + .... + \beta n\ Xni + \varepsilon i \quad (4)$$

$Yi$ indicated the rice production, $\beta 0$ was the intercept, $\beta n$ referred to the parameter to be estimated, and $\varepsilon i$ implied the error term of the model. Accordingly, all variables were transformed into logarithmic form except the dummy ones. Table 1 displays the details of the variables.

## RESULTS AND DISCUSSION

### The Role of Farmer Group Membership on Agricultural Practices and Productivity

TABLE 1. VARIABLE DEFINITIONS AND DESCRIPTIVE STATISTICS FOR ALL RESPONDENTS

| Variable | Definition | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Member | 1 if the farmer was a member of a farmer group, 0 otherwise | | | 0 | 1 |
| Production | Production of rice in kilograms | 1,695.814 | 1,964.823 | 20 | 80,000 |
| Fertilizer | The use of fertilizer in kilograms | 193.9809 | 252.2324 | 0.9 | 8,300 |
| Seed | The use of seed in kilograms | 1.73919 | 25.79161 | 0.3 | 500 |
| Labor | Total working hours for paid labor | 30.58974 | 28.99726 | 0.5 | 841 |
| Gender | 1 if male, 0 if female | | | | |
| Age | Age of respondents in years | 49.989 | 12.012 | 11 | 99 |
| Edu | Education of respondents (Categorical 1-8)<br>1 = unschooled<br>2 = primary school<br>3 = junior high school<br>4 = senior high school<br>5 = D1/D2<br>6 = D3<br>7 = bachelor<br>8 = master/doctor | 2.241 | 1.179 | 1 | 8 |
| Farm size | Total harvested land ($m^2$) | 4,385.112 | 4,695.881 | 50 | 100,000 |
| Irrigation | 1 if the farmer had access to irrigation, 0 otherwise | | | 0 | 1 |
| Land status | 1 if the farmer owned the land, 0 otherwise | | | 0 | 1 |
| Monoculture | 1 if the farmer applied monoculture, 0 otherwise | | | 0 | 1 |

This study involved 53,537 rice farmers as the respondents; 28,526 (53%) joined farmer groups. Table 1 exhibits the variable definitions and descriptive statistics for each variable, depicting that male farmers dominated the respondents; they aged 50 years on average and had low formal education. Meanwhile, most farms applied a monoculture system under the same harvest time, i.e., rainy season in 2013, with an average farm size of around 0.43 hectares. Furthermore, the use of input demonstrated a relative variation among the respondents. For instance, the most considerable amount of fertilizer used was 8,300 kilograms, whereas the average amount utilized was only 190 kilograms. The use of labor and seed was another area where these differences became apparent.

The empirical findings disclosed the significance of farmer group membership in agricultural practices and production. Table 2 portrays the PSM results, revealing a statistical difference in the Average Treatment Effect (ATE) between the production of members and non-members. PSM was applied to evaluate the effect of any treatment for the respective variables. In conclusion, farmer group participation likely impacted rice production in Indonesia.

**TABLE 2. THE RESULTS OF PROPENSITY SCORE MATCHING (PSM) FOR FARMER GROUP MEMBERSHIP**

| Production | Coefficient | Robust Standard Error | z | $>\|z\|$ | Confidence interval | |
|---|---|---|---|---|---|---|
| ATE member (1 VS 0) | 61.35 | 14.59 | 4.21 | 0.000 | 32.76 | 89.95 |

Table 3 displays the empirical results from the PSM, confirming significant differences in productivity and farming practices between rice farmers participating in farmer groups and those who did not. The average productivity of members was higher than that of non-members. Fertilizer, seed, and labor were production inputs depicting differences. The members utilized more fertilizer and labor (working hours). Moreover, Blekking, Gatti, Waldman, Evans, & Baylis (2021) discovered that cooperative membership allowed farmers to obtain better access to fertilizer both in quantity and price, particularly regarding government subsidy. Therefore, the members of farmer groups applied more fertilizer than non-members.

**TABLE 3. THE MEAN OF PRODUCTIVITY AND FARMING PRACTICES BETWEEN MEMBERS AND NON-MEMBERS**

| Variable | Member | Non-member | Total respondents | t-statistics |
|---|---|---|---|---|
| Productivity (kilogram/hectare) | 4337.70 | 4153.89 | 4251.83 | 10.97*** |
| Fertilizer (kilogram) | 220.03 | 164.28 | 193.98 | 25.67** |
| Seed (kilogram) | 24.51 | 29.13 | 21.74 | 26.74** |
| Labor (hours) | 17.42 | 16.69 | 17.08 | 3.55** |
| Monoculture (1 for monoculture) | 0.98 | 0.97 | 0.98 | 3.39** |
| Irrigation (1 for irrigation) | 0.54 | 0.45 | 0.50 | 20.16** |

Notes: ** statistically significant at 5%, *** statistically significant at 1 % level of significance

Nevertheless, the converse was true with seeds; non-members consumed more seeds than members. Musilah, Putri, & Utami (2021) disclosed that the program was not adequately implemented, despite the government seed subsidies to farmer groups. However, it also unveiled the higher seed efficiency of farmer members than non-members, using less seed while producing more outstanding output.

**TABLE 4. THE RESULTS OF REGRESSION ON PRODUCTION FUNCTION**

| Dependent: rice production | Coefficient | Robust standard error | t-statistics |
|---|---|---|---|
| Farm size | 0.60 | 0.007 | 83.79*** |
| Fertilizer | 0.21 | 0.004 | 53.07*** |
| Labor | 0.06 | 0.003 | 19.30*** |
| Seed | 0.02 | 0.006 | 4.45*** |
| Irrigation | 0.16 | 0.005 | 33.92*** |
| Monoculture | 0.24 | 0.021 | 11.78*** |
| Membership | 0.03 | 0.005 | 7.22*** |
| Const | 0.60 | 0.04 | 13.80*** |
| R-square | | | 0.6783 |
| F-stats (Prob > F) | | | 12,588.63 (0.0000) |

Notes: All variables were transformed into logarithmic form, except the dummy variables, i.e., irrigation, membership and monoculture,** statistically significant at 5%, *** statistically significant at 1 % level of significance

Table 4 summarizes the production function results estimated using OLS from the linear logarithmic regression model. Given that the Variance Inflation Factor (VIF) for the estimated model was 1.05, implying no multicollinearity among the independent variables, the estimated model appeared relatively robust. To address the issue of heteroscedasticity in the error term, the model applied in this study utilized robust standard error. Furthermore, all parameters fulfilled the expected signs, i.e., positivity in the production function. Concerning the magnitude of the parameters, the variable of farm size acquired the highest value, signifying that land had the most contribution to rice production in Indonesia.

Table 4 exhibits the importance of farmer group membership in rice production in Indonesia, illustrating the statistically significant membership variable with the positive sign of the parameter. These results confirmed the previous findings, unveiling that rice farmers participating in farmer groups demonstrated higher productivity than those who did not participate. Therefore, these findings consistently support the argument of the importance of the farmer groups in enhancing the farmers' productivity, as emphasized by previous studies, such as (Abate et al., 2014; Abdul-Rahaman & Abdulai, 2018; Agarwal, 2018; Gong, Battese, & Villano, 2019; Lin, Wang, Jin, Yang, & Li, 2022; Wanglin Ma, Zheng, & Yuan, 2022; Mojo et al., 2017; Olagunju, Ogunniyi, Oyetunde-Usman, Omotayo, & Awotide, 2021; Qu et al., 2020).

Understanding what factors induce agricultural productivity in Indonesian rice farming, dominated by small farmers, should consider the behavioral aspects of the farmers. Economic and cultural factors may influence farmers' perceptions and decision-making in managing their farming practices. Small farmers with low education usually refer to other farmers in their decisions. Furthermore, how farmers acquire any agricultural information from formal resources often depends on information within their informal social network (Boahene, Snijders, & Folmer, 1999; Lyon, 2000) and transfer their agricultural knowledge through social interactions (Conley & Udry, 2010). As Pratiwi & Suzuki (2017) reported, farmers' social networks affected their knowledge acquisition in several rural areas in Indonesia. By actively participating in farmer groups, farmers will likely have access to or get more informed on any technology development, especially concerning farming practices. In addition, a farmer

group is usually connected to the extension services, providing education or training for farmers.

**Factors Affecting The Decision of Farmer Group Membership**

In many countries, joining a farmer group is generally voluntary. It also applies to farmers in Indonesia contemplating membership. However, many government programs in the agricultural sector require farmers to participate in any organization, including farmer group membership, such as input subsidies, financial aid, and access to extension services. According to Ministry Regulation No. 82 of 2013, a farmer group is formed based on mutual interest, commodity similarity, and geographic proximity. Establishing a farmer group requires the participation of the village leader, community leaders, and agricultural extension officers. Subsequently, the regulation mandates that farmer groups notify agricultural extension officers and the village leader of any changes in their managerial structure.

The probability of participating in a farmer group was estimated using logistic regression, as summarized in Table 5, demonstrating that most of the estimated variables were statistically significant at a 5% significance level, except monoculture, which was significant at a 10% level of significance. Regarding the sign of the parameter, all estimated parameters exhibited positive signs. In short, male rice farmers were likelier to join farmer groups than female rice farmers. It was unsurprising since male farmers have dominated most agricultural practices in Indonesia, especially in the food sector (Utami, 2022). Much literature emphasized gender inequality in the agricultural sector across the world, where most female farmers had limited access to agricultural resources and from institutional aspects (Addison, Ohene-Yankyera, & Fredua-Antoh, 2016; Danso-Abbeam, Baiyegunhi, & Ojo, 2020; Luis, Rola-Rubzen, Paris, & Pede, 2015; Mishra, Khanal, & Mohanty, 2017; Obayelu, Ogbe, & Edewor, 2020; Seymour, 2017).

TABLE 5. LOGISTIC REGRESSION RESULTS ON FAMER GROUP MEMBERSHIP

| | Coefficient | Standard Error | z-statistics | p>\|z\| | Odds-ratio |
|---|---|---|---|---|---|
| Gender | 0.391 | 0.028 | 13.79 | 0.000 | 1.478 |
| Age | 0.008 | 0.001 | 10.39 | 0.000 | 1.008 |
| Education | 0.179 | 0.008 | 21.69 | 0.000 | 1.196 |
| Farm size | 0.00006 | 0.00002 | 26.24 | 0.000 | 1.00006 |
| Land status | 0.066 | 0.019 | 3.4 | 0.001 | 1.069 |
| Irrigation | 0.337 | 0.018 | 18.78 | 0.000 | 1.400 |
| Monoculture | 0.106 | 0.057 | 1.85 | 0.065 | 1.112 |
| Const | -1.594 | 0.079 | -20.20 | 0.000 | 0.203 |

The results also corroborate several previous studies, including those by Wangli Ma & Abdulai, (2016) and Methamontri, Tsusaka, Zulfiqar, Yukongdi, & Datta (2022), discovering that a higher level of formal education among rice farmers was associated with greater participation in a farmer group. In addition, as Abdul-Rahaman & Abdulai (2020) revealed, farmers' age also mattered in farmer group membership. This study discovered that older rice farmers seemed more willing to join farmer groups than younger rice farmers. It might be due to their average age being over 50 years old. Older farmers might have more experience in

agricultural practices than the younger ones, thus having more access and networking with the other farmers. Therefore, it does not necessarily imply that younger farmers were not interested in joining farmer groups, given their low proportion in the agricultural sector.

Farmer group membership was affected not only by the characteristics of farmers but also by farming characteristics and practices. Table 5 demonstrates that farmers with a greater farm size were more likely to join farmer groups, as also consistent with the influence of the land status. The landowner farmers were more likely to join farmer groups than the renter farmers. As disclosed in other cases, wealthier farmers were likely to join farmer groups, including poor farmers as well (Bernard & Spielman, 2009; Chagwiza, Muradian, & Ruben, 2016; Fischer & Qaim, 2012; Spielman, Kelemwork, & Alemu, 2011). However, having easy access to irrigation significantly influenced the decision to participate in a farmer group. Farmers with access to irrigation were more willing to join farmer groups. In Indonesia, more than 70% of freshwater has been utilized for irrigation to support the agricultural sector, occupying almost 30% of the total land area.

However, as the Ministry of Public Works and Housing reported in 2018, around 46% of public irrigation infrastructure was heavily damaged. Given the probability of future freshwater scarcity, farmer groups' role is more critical in developing public water management, especially regarding irrigation infrastructure (Tirtalistyani, Murtiningrum, & Kanwar, 2022). Subsequently, there was not enough empirical evidence in this study on whether farmers practicing monoculture farming were more likely to join farmer groups since the variable of monoculture was not statistically significant at a 5% level of significance. It might be related to the fact that most of the respondents in this study practiced monoculture farming in rice production, both for members and non-members.

**Policy Implication**

Several policy implications were drawn from the empirical findings of this study. Generally, the findings revealed the importance of farmer group participation in enhancing the productivity of small farmers in Indonesia. Improving agriculture productivity could be pursued not only by relying solely on improving agriculture production factors. The interventions on an institutional aspect, such as by promoting farmer groups or any other farmers' collective action, could support any product development project. In practice, the government could exploit the role of the farmer groups in implementing or introducing a new production technology. It is also possible to reduce the transaction costs in the agricultural project implementation, thus, leading to a more effective and efficient agricultural policy. Therefore, it requires increasing and continuous support from various stakeholders involving government, private companies, and other development agencies in farmer group formation and development when implementing any project in the agricultural sector. Despite the common assumption that the farmer groups can only be a political tool for the government to deliver their interest, especially in Indonesia, the role of the farmer groups in enhancing farmers' productivity should not be neglected.

Understanding the determinants of farmer group participation in a more specific context considering the variations of commodities, regional disparities, type of organizations, and the development of farmer groups in organizational management is critical to developing farmer collective action across the country. As reported by Ibnu, Offermans, & Glasbergen (2018), the farmers' willingness to actively participate in a farmer group depended on their perceived benefit, which organized farmers perceived as a higher benefit than unorganized smallholders. This perception has relied on the type of farmer organization development. Even though many empirical findings have revealed the positive effect of farmer groups in pursuing agricultural productivity, for the long run development, it also requires a study on how farmer groups are sustainable. In the short run, the government may develop farmer groups through several programs, but if the organization cannot benefit farmers, it may demotivate farmers to participate or even lead to negative perception actively.

## CONCLUSION

The agricultural sector productivity is critical in pursuing sustainable development in developing economies with a large and growing population, such as Indonesia. This paper examined the role of farmer group membership on agricultural practices and productivity in the Indonesian rice sector by employing data from the National Agricultural Survey of Indonesian rice farmers in 2014. The empirical findings confirmed the positive relations between farmer group participation and productivity in the Indonesian rice sector. Rice farmers participating in farmer groups depicted higher productivity than those who did not participate. Therefore, these results consistently support the argument of the importance of farmer groups in enhancing the farmers' productivity, as emphasized in several previous works of literature.

Moreover, the rice yield in Indonesia was positively and significantly influenced by the farm size, fertilizer, labor, seed, irrigation, monoculture, and the farmer group membership. Furthermore, in the Indonesian rice sector, the farmer group participation was influenced by farmers' characteristics, covering age, gender, and education level, and farming practices, such as land status, access to irrigation, and monoculture. These factors positively affected the probability of participating as a farmer group member.

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