CarakaTani
Journal of Sustainable Agriculture
ISSN 2613-9456 (Print) 2599-2570 (Online)

Caraka Tani: Journal of Sustainable Agriculture, 36(2), 340-354, 2021
URL: https://jurnal.uns.ac.id/carakatani/article/view/46817
DOI: http://dx.doi.org/10.20961/carakatani.v36i2.46817

Factors Affecting the Participation of Sugarcane and Tobacco Farmers in Farmer Groups, Associations and Cooperatives in Indonesia

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Abstract

The revitalization of farmer organizations has become the central paradigm in agricultural development. In Indonesia, increasing farmer participation in farmer groups, associations and cooperatives is the strategy to revitalize farmer organizations. This study aimed to determine the factors influencing farmers' participation in farmer groups, associations and cooperatives. This study employed data from the Sugarcane and Tobacco Plantation Farm Household Survey in 2014, consisting of 8,831 (70.73%) sugarcane farmers and 3,645 (29.27%) tobacco farmers. Logistic regression analysis was used to identify the factors contributing to farmers' participation in each organization. The results showed that harvest area, access to extension and contract farming positively affect farmers' participation in organizations. Farmers' age and education positively affect their participation in associations and cooperatives but do not significantly affect their group participation. Land tenure has an ununiform effect on farmer participation in each organization. Tenant farmers are less likely to participate in farmer groups and cooperatives, but they tend to participate in associations. Meanwhile, the owner farmers are less likely to join cooperatives. Government support positively influences farmer group participation, shows a negative effect on participation in associations and has a non-significant effect on participation in cooperatives. Finally, farmers' wealth gives a positive effect on their participation in cooperatives, a negative effect on their participation in associations and a non-significant effect on farmer groups. These results depict that farmer groups are more inclusive than cooperatives and associations.

Keywords: agricultural development; farmer association; farmer cooperatives; farmer group; farmer organization

Cite this as: Rokhani, Fauziyah, D., Supriono, A., Hariyati, Y., Raharto, S., Hapsari, T. D., Adi, A. H., Khasan, A. F., & Rondhi, M. (2021). Factors Affecting the Participation of Sugarcane and Tobacco Farmers in Farmer Groups, Associations and Cooperatives in Indonesia. *Caraka Tani: Journal of Sustainable Agriculture*, *36*(2), 340-354. doi: http://dx.doi.org/10.20961/carakatani.v36i2.46817

INTRODUCTION

Smallholder agriculture is the foundation for agricultural and rural economic development in developing countries (World Bank, 2007) and farmer empowerment through farmer organizations plays a crucial role in achieving this goal (IFAD, 2011). One essential role of farmer organizations is to increase the commercialization of smallholder farmers (Abdullah et al., 2019), which then increases farm specialization (Yang and Liu, 2012), productivity (Traore, 2020) and farmer income (Bachke, 2019). Furthermore, the Food and

[*] *Received for publication December 19, 2020*
Accepted after corrections August 4, 2021

Agricultural Organization (FAO) states that farmer organizations can facilitate farmer participation in supporting the development process (FAO, 2009). The leading farmer-level institutions that can support agricultural development are farmer groups, farmer associations and cooperatives (Lopulisa et al., 2018). In line with this, farmer organization is an essential part of the Indonesian Ministry of Agriculture's (*Kementerian Pertanian Republik Indonesia, Kementan*) Strategic Plan from 2020 to 2024 (Kementan, 2020). Thus, identifying the factors contributing to the participation of farmers in farmer organizations is essential to agricultural development, particularly in strengthening farmer institutions.

An extensive strand of literature has shown that participation in farmer organizations provides significant benefits to farmers. There are two essential roles of farmers' organizations: facilitate farm production and assist farmers in marketing agricultural products (Shiferaw et al., 2008). By acting collectively as an organization, farmers can obtain a large number of farm inputs at low cost and of good quality (Liverpool-Tasie, 2014). Also, farmer organizations act as a channel for the latest agricultural information and technologies (Zhou et al., 2019).

Access to recent agricultural information and technology is crucial to the adoption of good farming practices (Ji et al., 2019). Thus, the combined effect of quality farm inputs and good farming practices will improve farm productivity. Furthermore, in the marketing of agricultural products, farmer organizations increase farmer's bargaining power against buyers and intermediaries. Moreover, by acting collectively, farmers reduce marketing risks and transaction costs (Ncube, 2020) and have greater access to market information (Abu et al., 2016). These features will increase farmers' gains from selling their products and improve their welfare (Courtois and Subervie, 2014). Therefore, participation in farmer organizations will improve access to quality inputs, the latest agricultural information and technology, and bargaining power that contribute to increased farm productivity and profitability (Shiferaw et al., 2011).

Membership in a farmer organization promotes collective action, improving agriculture's economic, social and environmental sustainability (dos Santos et al., 2020). Collective action among farmers also catalyzes optimal resource sharing, increasing crop income and equal access to resources (Pradhan and Ranjan, 2016). Furthermore, conventional agriculture creates environmental externalities that cannot be solved through conventional instruments, such as markets and regulations. In that case, collective action is a viable tool to mitigate agricultural externalities on public goods (Willy and Ngare, 2021). Also, collective action combines the benefits of small and large-scale farming, which is key to the sustainability and inclusiveness of agriculture (Jelsma et al., 2017). Hence, identifying factors affecting farmer participation in farmer organizations is crucial to improving collective action and agriculture sustainability.

Empirically, several studies reveal farmer organization has a positive impact on farm performance. For example, Utaranakorn and Yasunobu (2016) explain that organic vegetable farmer groups in Thailand strengthen social networks between farmers. In line with this, Ainembabazi et al. (2017) have reported that membership in farmer groups increases the adoption of the latest technology. Moreover, the participation of rice farmers in farmer groups in Ghana significantly increases farm productivity and efficiency (Abdul-Rahaman and Abdulai, 2018). The positive impact was also shown by the participation of farmers in farmer associations and cooperatives. Smith (2013) states that farmer association in Malawi facilitates market access and provision of financial capital. In line with that, Matchaya (2010) has uncovered that farmer associations can provide access to credit and market access. Furthermore, in apple farming in China, farming cooperatives become a collective means of reducing agricultural risk (Jin et al., 2020). Farming cooperatives also impact the welfare of member farmers (Yu and Huang, 2020) and become a forum for branding for member farmers (Grashuis, 2017).

In Indonesia, sugarcane and tobacco are two commodities where farmer collective action is intensive, whether as farmer group, association or cooperative. Collective action is crucial to facilitate both the production and marketing of sugarcane and tobacco farming. For example, sugar mill companies distribute farm inputs and credit through farmer groups and cooperatives (Rondhi et al., 2020). Similarly, membership

in a farmer group is required to obtain farm inputs provision and market access through a contract arrangement with a tobacco leaf supplier (Rondhi et al., 2020). Farmer association plays a vital role for sugarcane and tobacco farmers. In the sugarcane case, the APTRI, i.e., Association of Indonesian Sugarcane Smallholder Farmers, acts as the representative body for sugarcane farmers in sugarcane price negotiation with the sugar mill companies (Suwandari et al., 2020) and the formulation of national sugar floor price with the government (Samadikoen, 2015). Similarly, the APTI, i.e., Association of Indonesian Tobacco Farmers, plays a vital role as the front group to revoke tobacco Excise Tax, which harms tobacco farmers (Bigwanto, 2019).

Meanwhile, international studies of sugarcane and tobacco farmer organizations are limited and do not distinguish the type of organization. These studies define farmer organizations as the institution for collective action, such as for sugarcane farmer organizations in Tanzania (Isager et al., 2018) and tobacco farmer organizations in Zimbabwe (Scoones et al., 2018). Thus, analyzing sugarcane and tobacco farmers' participation in farmer organizations is relevant since both groups share similar characteristics.

Currently, 30.51% of Indonesian sugarcane farmers participate in farmer groups, 15.25% in associations and 5.28% in cooperatives. Meanwhile, 23.75% of tobacco farmers join farmer groups, 3.12% associations and 0.52% cooperatives (BPS-Statistics Indonesia, 2016). Studies on farmer participation in each organization have been conducted extensively. The first group focused on researching farmer groups, for example, studies on sugarcane farmer groups in Malang, East Java (Anam, 2013) and tobacco farmer groups in Wonosobo, Central Java (Cahyono, 2014). Both studies show that social capital underlies farmer participation in farmer groups. The second group centered on farmer association, for example, the studies on sugarcane farmer association in Situbondo, East Java (Yuniati et al., 2017) and tobacco farmer association in Cirebon, West Java (Baga and Setiadi, 2008; Hakim and Wibisono, 2017). The studies depict that participation in farmer associations solves farmers' problems, as well as improves their welfare and bargaining position. The third group concentrated on farmer cooperatives, for example, the studies on sugarcane farmer cooperatives in Sleman, Yogyakarta (Saputra et al., 2017) and tobacco farmer cooperatives in Sumedang, West Java (Santoso et al., 2017). These studies indicate that farmer participation in cooperatives is determined by the cooperative's internal and external factors and its role for farmers.

Unlike previous studies that studied each organization separately, this study aims to identify the determinants of sugarcane and tobacco farmers' participation in farmer groups, farmer associations and farming cooperatives. This study is essential because each farmer organization has different fundamental principles. A farmer group is formed by the government, while farmers establish associations and cooperatives independently. Therefore, the farmers' participation motive in each organization is different. Hence, it is crucial to analyze all types of the organization simultaneously. Farmer organization is the frame-work for collective action, which increases farmer income and promote the good farming practice. Thus, participation in farmer organizations is essential to achieve sustainable farming practice. Furthermore, this study used nationally representative data of sugarcane and tobacco farmers in Indonesia, and contributes to policy-making at the national level.

MATERIALS AND METHOD

This study employed data from the 2014 Indonesian Plantation Farm Household Survey (SKB14) for sugarcane and tobacco. SKB14 is a part of the 2013 Agricultural Census (ST13), covering various plantation crops. Based on the economic importance, the plantation crops are grouped into national and provincial primary crops, and both sugarcane and tobacco belong to provincial primary crops (BPS-Statistics Indonesia, 2016). SKB14 applied a two-stage stratified sampling method. The first stage was the selection of sample census blocks using a systematic probability proportional to size method. The eligible census blocks were those having at least ten farm households. The second stage was the selection of plantation farm households. The eligible farm households were those with a cropping area of at least 650 m^2 (Rokhani et al., 2020). Table 1 describes the sampling procedure of SKB14.

Table 1. The two-stage stratified sampling procedure of SKB14

Stage	Selection target	Sampling framework	Selection method	Selection criteria
1	Sample blocks	Census block	Systematic proportional to the size	Census blocks with at least ten farm household
2	Sample farm households	List of farm households in the sample blocks	Systematic sampling	Farm households with a crop area of at least 650 m^2

Table 2 presents the descriptive statistics of the data. The data show that from 12,485 farmers, 8,831 are sugarcane farmers (70.7%) and 3,654 are tobacco farmers (29.2%). The majority of sugarcane and tobacco farmers in Indonesia are in Java. The percentage of sugarcane and tobacco farmers in Java is 96.8% and 61.5%, respectively. Meanwhile, 37.7% of tobacco farmer is in Bali and Nusa Tenggara, and no sugarcane farmer is in this region. The percentage of sugarcane and tobacco farmers in Kalimantan and Sulawesi is relatively small, only 2.1% and 0.6%, respectively. A similar situation is found in Sumatra, where sugarcane and tobacco farmers are only 1.03% and 0.03% of the total farmers, respectively. On average, sugarcane farmers are four years older than tobacco farmers. However, the majority of farmers in each group have primary education. In general, sugarcane and tobacco farm households in Indonesia are male-headed, but the percentage of wealthy farm households is higher in the former than the latter.

Table 2. Descriptive statistics of data

Variable	Description	Mean dan frequency (%)	
		Sugarcane	Tobacco
Dependent variable			
Farmer group	1 = Participate	1 = 2,694 (30.5)	1 = 868 (23.7)
	0 = Not participate	0 = 6,137 (69.4)	0 = 2,786 (76.2)
Association	1 = Participate	1 = 1,347 (15.2)	1 = 114 (3.1)
	0 = Not participate	0 = 7,484 (84.7)	0 = 3,540 (96.8)
Cooperative	1 = Participate	1 = 466 (5.2)	1 = 19 (0.5)
	0 = Not participate	0 = 8,365 (94.7)	0 = 3,635 (99.4)
Independent variable			
Crop	1 = Tobacco	1 = 8,831 (70.7)	1 = 3,654 (29.2)
	2 = Sugarcane	2 = 0 (0)	2 = 0 (0)
Harvest area	The harvest area of each crop (ha)	0.68	1.29
Land tenure	The ownership of cultivated land		
	1 = Owned land	1 = 7,163 (81.1)	1 = 2,967 (81.2)
	2 = Leased land	2 = 1,098 (12.4)	2 = 633 (17.3)
	3 = Sharecropping	3 = 570 (6.4)	3 = 54 (1.4)
Age	Age of head of farm household (yr)	51.59	47.62
Education	Formal education of the head of farm household		
	1 = Elementary education (SD)	1 = 6,288 (71.2)	1 = 2,898 (79.3)
	2 = Middle education (SMP-SMA)	2 = 2,251 (25.4)	2 = 648 (17.7)
	3 = Higher education (D1-S3	3 = 292 (3.3)	3 = 108 (2.9)
Gender	The sex of head of farm household		
	1 = Male	1 = 7,974 (90.3)	1 = 3,419 (93.5)
	0 = Female	0 = 857 (9.7)	0 = 235 (6.4)
Extension	1 = Receive	1 = 1,383 (15.6)	1 = 665 (18.2)
	0 = Not receive	0 = 7,448 (84.3)	0 = 2,989 (81.8)
Government support	1 = Receive	1 = 4,004 (45.3)	1 = 2,311 (63.2)
	0 = Not receive	0 = 4,827 (54.6)	0 = 1,343 (36.7)

Table 2. Continued

Variable	Description	Mean dan frequency (%)	
		Sugarcane	Tobacco
Contract farming	1 = Participate	1 = 3,036 (34.3)	1 = 594 (16.2)
	0 = Not participate	0 = 5,795 (65.6)	0 = 3,060 (83.7)
Wealth	1 = Wealthy	1 = 6,290 (71.2)	1 = 2,166 (59.2)
	0 = Poor	0 = 2,541 (28.7)	0 = 1,488 (40.7)
Region	1 = Java	1 = 8,550 (96.8)	1 = 2,248 (61.5)
	2 = Sumatera	2 = 91 (1.03)	2 = 1 (0.03)
	3 = Bali and Nusa Tenggara	3 = 0 (0)	3 = 1,381 (37.7)
	4 = Kalimantan and Sulawesi	4 = 190 (2.1)	4 = 24 (0.6)
	5 = Maluku and Papua	5 = 0 (0)	5 = 0 (0)

Source: Indonesian Plantation Farm Household Survey 2014

In general, most sugarcane and tobacco farmers cultivate their land, with a total of 81.1% and 81.2%, respectively. Meanwhile, the percentage of tobacco farmers cultivating leased land is higher, with a total of 17.3%, compared to a sugarcane farmer that is only 12.4%. In contrast, the number of sugarcane farmers who cultivate sharecropping land is higher, with a total of 6.4%, compared to a tobacco farmer that is only 1.4%. The harvest area of tobacco farmers is higher than that of sugarcane farmers. The average harvest area for tobacco and sugarcane farmers is 1.29 ha and 0.68 ha, respectively. Sugarcane farmer participation in all types of farmer organizations is higher than that of tobacco farmers. The percentage of sugarcane farmers participating in farmer groups, associations and cooperatives is 30.5%, 15.2%, and 5.2%, while the percentage of tobacco farmers joining those groups is 23.7%, 3.1% and 0.5%, respectively. The number of sugarcane and tobacco farmer receiving extension service is relatively the same at 15.6% and 18.2%, respectively. However, more tobacco farmers receive government assistance (63.2%) than sugarcane farmers (45.3%). In contrast, the number of sugarcane farmers involving in contract farming (34.3%) is twice higher than that of tobacco farmers (16.2%).

This study applied a logistic regression model to estimate the determinants of sugarcane and tobacco farmer participation in farmer groups, associations and cooperatives. Logistic regression is used to estimate the effect of independent variables on a binary dependent variable (Abonazel and Ibrahim, 2018). The dependent variable in this study is farmer participation in farmer groups, associations and cooperatives. Equation 1 formulates the logistic regression model in this study.

$$Y_i = ln\left(\frac{p_i}{1-p_i}\right) = \frac{e^{b_0+\sum_{i=0}^{13} b_i x_i}}{1+e^{b_0+\sum_{i=0}^{13} b_i x_i}}, \quad i = 1,2,\dots,11$$

Y_i represents farmer participation in farmer organization, $X_{1\text{-}11}$ are the independent variables, b_0 is the constant and $b_{1\text{-}11}$ is the coefficient of each independent variable. Omnibus Test of Model Coefficient, Pseudo $R^{2,}$ and *-2 log-likelihood* was used to evaluate the fitness of logistic regression. Omnibus Test of Model Coefficient and Pseudo R^2 values were used to explain the effect of independent variables on the dependent variable. Meanwhile, the *-2 log-likelihood* value was used to evaluate the overall relationship between the dependent and independent variables. Finally, the effect of each independent variable was estimated using the regression coefficient.

RESULTS AND DISCUSSION

Estimation results

This study aimed to identify the driving factors of farmer participation in farmer groups, associations and cooperatives. Analyzing each organization is crucial since each organization has a different motive and purpose. A farmer group is an organization initiated by the government. It acts as a channel for the government to distribute and implement agricultural-related programs and policies. Meanwhile, both association and cooperative are organizations initiated by farmers. However, the motive of each organization is different. Farmers establish associations to

increase bargaining power against buyers and influence policymaking. On the other hand, farmers establish cooperatives to pool resources to increase economies of scale and operational efficiency. Since each organization has a distinct role for farmers, the farmer's participation motive in each organization is different. Thus, it is crucial to analyze factors affecting farmer participation in each organization.

The estimation procedure was grouped into two: sugarcane and tobacco. Each group contains three estimations corresponding to each farmer organization. The estimation results show that the model for sugarcane (Table 3) and tobacco (Table 4) are robust. For sugarcane farmers, seven variables (land tenure, education, gender, extension, government support, contract farming and region) significantly affect the participation in the farmer group, eight variables (harvest area, land tenure, age, education, extension, contract farming, wealth and region) motivate their contribution in farmer associations and eight variables (harvest area, land tenure, age, education, extension, contract farming, wealth and region) encourage them to join the cooperatives. The results of the Omnibus Test of Model Coefficient value for farmer group, association and cooperative are 8,646; 5,815 and 2,815, respectively.

Meanwhile, eight variables (harvest area, land tenure, education, extension, government support, contract farming, wealth and region) significantly influence tobacco farmer participation in farmer groups and eight variables (harvest area, age, education, extension, government support, contract farming, wealth and region) support their involvement in farmer associations. However, no variable has a significant effect on farmer participation in cooperatives. Each regression model has a significant Omnibus Test of Model Coefficient value at the 1% level. It exemplifies that the independent variables significantly explain the variance of farmer decision to participate in farmer organizations. The effect of each variable will be discussed as follow.

Table 3. Estimation results of sugarcane farmer participation in farmer groups, associations and cooperatives

Variable	Farmer group		Association		Cooperative	
	β	Exp(B)	β	Exp(B)	β	Exp(B)
Intercept	–1.874***	0.154	–3.735***	0.024	–5.546***	0.004
Harvest area	0.015ns	1.015	0.076***	1.079	0.052***	1.054
Land tenure						
Lease	–0.243***	0.785	0.290***	1.336	–0.057ns	0.944
Sharecropping	–0.183ns	0.833	–0.131ns	0.878	0.977***	2.656
Age	0.000ns	1.000	0.014**	1.014	0.008*	1.008
Education						
Middle education	0.249***	1.283	0.357***	1.429	0.440***	1.552
Higher education	0.229ns	1.257	0.276ns	1.318	0.626***	1.871
Gender	–0.159*	0.853	0.105ns	1.111	–0.147ns	0.863
Extension	1.621***	5.058	1.241***	3.457	1.241***	3.458
Government support	0.108**	1.114	–0.069ns	0.933	0.120ns	1.128
Contract farming	1.613***	5.016	1.741***	5.705	2.274***	9.719
Wealth	–0.042ns	0.959	–0.159**	0.853	0.226**	1.254
Region						
Sumatera	3.275***	26.433	–20.391ns	0.000	–19.157ns	0.000
Bali and Nusa Tenggara						
Kalimantan and Sulawesi	0.068ns	1.070	1.314***	3.720	–0.563**	0.569
Maluku and Papua						
Model Robustness						
Omnibus Test	8,646***		5,815***		2,815***	
Cox and Snell R2	0.222		0.178		0.090	
Nagelkerke R2	0.314		0.309		0.266	
N	8,831		8,831		8,831	

Note: *** = significant at 1%; ** = significant at 5%; * = significant at 10%; ns = not significant

Table 4. Estimation results of tobacco farmer participation in farmer groups, associations and cooperatives

Variable	Farmer group		Association		Cooperative	
	β	Exp(B)	β	Exp(B)	β	Exp(B)
Intercept	–2.317***	0.099	–5.598***	0.004	–6.493***	0.002
Harvest area	0.094***	1.099	0.173**	1.189	0.039ns	1.040
Land tenure						
Lease	–0.584***	0.558	0.227ns	1.255	0.152ns	1.164
Sharecropping	0.935***	2.547	–17.856ns	0.000	–15.755ns	0.000
Age	–0.004ns	0.996	0.036***	1.037	0.015ns	1.015
Education						
Middle education	0.228**	1.257	0.738***	2.091	1.048*	2.851
Higher education	–0.195ns	0.823	1.274***	3.574	0.517ns	1.677
Gender	0.005ns	1.005	0.071ns	1.074	–15.646ns	0.000
Extension	2.237***	9.367	1.538***	4.657	0.737ns	2.090
Government support	0.299***	1.348	–0.808***	0.446	–0.168ns	0.846
Contract farming	–0.311**	0.733	0.522*	1.686	0.378ns	1.459
Wealth	0.360***	1.433	0.124ns	1.132	–0.017ns	0.984
Region						
Sumatera	–20.943ns	0.000	–19.240ns	0.000	–16.326ns	0.000
Bali and Nusa Tenggara	0.783***	2.188	–1.073***	0.342	–0.039ns	0.962
Kalimantan and Sulawesi	1.843***	6.313	–17.591ns	0.000	–15.545ns	0.000
Maluku and Papua						
Model Robustness						
Omnibus Test	3,348***		876***		223***	
Cox and Snell R2	0.165		0.037		0.004	
Nagelkerke R2	0.247		0.154		0.062	
N	3,654		3,654		3,654	

Note: *** = significant at 1%; ** = significant at 5%; * = significant at 10%; ns = not significant

Harvest area

Harvest area is the area of sugarcane and tobacco harvested during the period of the survey. Harvest area has a different effect on sugarcane and tobacco farmer participation in each organization. For the sugarcane case, a 1 ha increase in harvest area proliferates the probability of a farmer participating in association and cooperative by 7.9% and 5.4%, respectively. However, this condition does not put any significant effect on participation in farmer groups. Meanwhile, a 1 ha increase in harvest area of tobacco farmers increases the probability of a farmer participating in farmer group and association by 9.9% and 18.9%, respectively. Still, it has no significant effect on participation in the cooperative. These findings suggest that the harvest area, which represents farm size, is crucial for farmer participation in a farm organization. However, the effect is more significant in tobacco than that in sugarcane. This finding is in line with those of previous studies. For example, in Middle Guinea, potato farmers with a large harvest area tend to participate in farmer groups to obtain farm input and capital (Tolno et al., 2015). Similarly, a large harvest area in Mozambique increases farmer participation in obtaining farm technology (Sitoe and Sitole, 2019). Also, in Rwanda, the coffee farmers with large tracts of land tend to join cooperatives (Issa and Chrysostome, 2015). On the other hand, a large harvest area increases farm risk for sugarcane and tobacco farmers. The primary farm risks are crop failure and low selling prices. Participation in farm organizations helps farmers mitigate these risks by obtaining quality input, new farm technologies and increased bargaining power.

Land tenure

Land tenure is a categorical variable consisting of three types of tenure: owned land (owner farmer), leased land (tenant farmer) and sharecropping (sharecropper). The reference category is owned land. Land tenure significantly

affects sugarcane farmer participation in each organization. For sugarcane farmers, the results demonstrate that tenant farmers are 21.5% and 5.6% less likely to participate in farmer groups and cooperatives but 33.6% are more likely to participate in association than the owner farmer. Then, the result proves that sharecropper is 2.3% less likely to participate in cooperative than owner farmer, but this condition does not have any significant effect on participation in farmer group and association. For tobacco farmers, land tenure significantly affects farmer participation in farmer groups, but it has no significant effect on association and cooperation. The results demonstrate that tenant farmers are 44.2% less likely to participate in farmer groups than owner farmers. In contrast, sharecropper is 154.7% more likely to participate in farmer group than owner farmer. The result indicates that land tenure security increases the probability of a farmer participating in a farm organization.

Previous studies reported that land tenure is crucial for farming decisions, such as participation in a farm organization. Tenant farmers usually lease farmland for a short period; since it helps avoid the expected risk of agricultural production (Li and Shen, 2021), the tenant farmers prioritize mitigating short-term risk. In addition, participation in association increases farmer's bargaining power over the buyer of their product. Thus, tenant farmer mitigates the short term marketing risk through participation in the association. In contrast, participation in farmer groups and cooperatives is a long-term investment in access to training and education services (Jitmun et al., 2020). Therefore, the tenant farmer chooses not to participate in farmer groups and cooperatives.

Age

This variable represents the age of the head of the farm household. Farmer age does not show any significant effect on both sugarcane and tobacco farmer participation in farmer groups. In contrast, farmer age has a positive and significant effect on sugarcane and tobacco farmer participation in farmer association. A 1 yr increase in farmer age rises the probability of sugarcane and tobacco farmer joining an association by 1.4% and 3.7%, respectively. This factor has a positive and significant effect on sugarcane farmer participation in a cooperative, but not significant on tobacco farmer participation. A 1 yr increase in age increases the probability of sugarcane farmers joining a cooperative by 0.8%. The result indicates that the farmer group is more inclusive than association and cooperative. Moreover, it suggests that older farmer controls association and cooperative. This result is in line with the findings of the studies by Asante et al. (2011) and Mwaura (2014) on Farmer Based organizations (FBO) in Uganda. They found that old farmer tends to participate in an organization that increases their bargaining power. In Indonesia, association and cooperative are means to consolidate farmers to increase their bargaining power.

Education and gender

We grouped farmer education into three categories: elementary, middle and higher education. The reference category for this variable is elementary education. Education increases the probability of a sugarcane farmer participating in a farmer group, association and cooperative. It significantly affects participation in farmer groups and associations, but not in cooperatives. The results demonstrate that sugarcane farmers with a middle-level education are 28.3%, 42.9% and 55.2% more likely to partake in farmer groups, associations and cooperatives than those with elementary-level education. Similarly, sugarcane farmers with middle-level education have a higher probability of joining farmer groups, associations and cooperatives than those with elementary-level education by 25.7%, 209.1% and 285.1%, respectively. However, higher-level education significantly affects farmer participation in cooperatives (for sugarcane farmers) and associations (for tobacco farmers).

The results show that the majority of farmers who participate in association and cooperative have high formal education. Association and cooperative require a managerial ability obtained from formal education (Issa and Chrysostome, 2015). The skill and knowledge of educated farmers also play a crucial role in improving cooperative marketing capacity in Ethiopia (Francesconi and Heerink, 2011). In contrast, education has no significant effect on participation in farmer groups because farmer groups are inclusive for all farmers. In contrast to education, gender has no significant effect on farmer participation in each organization for tobacco farmers and in association and

cooperative for sugarcane farmers. The result only shows a significant effect of gender on participation in farmer groups for sugarcane farmers. On average, female sugarcane farmers are 14.7% less likely to participate in a farmer group than male farmers. These results signify no gender discrimination in the Indonesian farmer organization.

Extension

Access to agricultural extension increases farmer participation in farmer groups and associations in the sugarcane and tobacco groups. However, access to agricultural extension increases participation in cooperatives only for sugarcane farmers. Farmer with access to extension services is more likely to participate in farmer group by 505.8% (sugarcane) and 936.7% (tobacco), in association by 42.9% (sugarcane) and 465.7% (tobacco) and in cooperative by 345.8% (sugarcane). Previous studies have associated access to extension services with participation in farmer organizations. For example, in Cameroon, an extension service is a facility obtained by a member of a farmer organization (Guillaume and Kenette, 2017). A similar result was found in Mozambique, where participation in the association is closely related to the access to the extension because the extension officers promote microcredit and farmer training through association (Sitoe and Sitole, 2019).

Government support

Government support positively and significantly affects participation in farmer groups (for sugarcane and tobacco farmer). However, it decreases the probability of tobacco farmers joining an association. However, government support decreases participation in the association and is not significant in the cooperative. Government support has no significant effect on farmer participation in association (sugarcane) and cooperative (sugarcane and tobacco). Farmer receiving government support is 11.4% (sugarcane) and 34.8% (tobacco) more likely to participate in farmer group. Nevertheless, receiving government support decreases tobacco farmer participation in an association by 55.4%. Farmer group is a government-promoted farm organization, and the government uses a farmer group as a channel to distribute support to the farmer (Msuta and Urassa, 2015). Hence, the farmer who receives government support is likely a member of the farmer group. Meanwhile, the farmer formed the association to increase political and bargaining power (Smith, 2013). Therefore, the government is less likely to distribute support to the farmer through association. In contrast, the cooperative is an organization established by the farmer for economic purposes. Furthermore, farmers use cooperatives for commercial branding and obtaining farm credit (Grashuis, 2017).

Contract farming

Contract farming positively affects sugarcane farmer participation in farmer groups, associations and cooperatives. This factor has a positive and significant effect on association but a negative effect on tobacco farmers. Participation in contract farming increases sugarcane farmer participation in farmer groups, associations and cooperatives by 501.6%, 570.5% and 971.9%, respectively. Similarly, contract farming increases tobacco farmer participation in an association by 68.6%, but it decreases participation in farmer groups by 26.7%. The contracting firm usually does not contract directly to the farmer; instead, the firm uses farm organizations to coordinate farmers. Thus, the majority of contract farmers are members of farm organizations. The result also demonstrates that the contract farming effect is highest on cooperative participation. In some cases, cooperative also acts as the contracting firm, such as in the Vietnamese rice sector (Ba et al., 2019) and pineapple farming in Ghana (Wuepper and Sauer, 2016). Furthermore, the success in contract farming is determined by self-efficacy and social capital, both of which can be obtained from participation in farmer organizations.

Wealth

Farmer wealth significantly affects participation in cooperatives and associations but not farmer groups for sugarcane farmers. Meanwhile, for tobacco farmers, farmer wealth has a significant effect only on farmer group participation. This factor decreases sugarcane farmer participation in associations by 14.7% but increases participation in cooperatives by 25.4%. Meanwhile, farmer wealth increases tobacco farmer participation in a farmer group by 43.3%. Participation in cooperative requires capital participation from the farmer. Thus, only a wealthy farmer can afford participation in

the cooperative. For example, cooperative in Greece requires a farmer to make capital participation to strengthen cooperative marketing and extension capacity (Kontogeorgos et al., 2014). Meanwhile, farmers participate in the association to increase their bargaining power by cooperating than acting individually. As a consequence, poor farmers are more likely to participate in associations. For example, farmers in Malawi join associations to obtain market access and price guarantee (Matchaya, 2010; Smith, 2013). In contrast, farmer wealth has no significant effect on participation in farmer groups because the farmer group is a government-promoted organization, which aims to be inclusive to all farmers regardless of their wealth.

Policy implications

Increasing farmer participation in a farm organization is fundamental to agricultural development. Participation in a farm organization increases farmer access to resources, technologies and information that improve farm productivity. Participation in a farm organization also increases farmer bargaining power both in the economic and political settings. In the economic setting, farmers can negotiate a better price for their products and receive a higher income from their sales. In the political setting, farmers can negotiate for better regulation that supports them. Thus, identifying factors contributing to farmer participation in a farm organization is crucial to agricultural development. The information obtained in this study can be used to formulate a policy to increase farmer participation in farm organizations. Table 5 summarizes the effect of several socio-economic variables on sugarcane and tobacco farmer participation in farm organizations.

Table 5. The summary of variable effect on farmer participation in the farm organization

Variable	Farmer group	Association	Cooperative
Harvest	ns/+	+/+	+/ns
Land tenure	s/s	s/ns	s/ns
Tenant farmer	–/–	+/ns	ns/ns
Sharecropper	ns/+	ns/ns	ns/ns
Age	ns/ns	+/+	+/ns
Education	s/s	s/s	s/ns
Elementary education	+/+	+/+	+/ns
Higher education	ns/ns	ns/+	+/ns
Gender	–/ns	ns/ns	ns/ns
Extension	+/+	+/+	+/ns
Government support	+/+	ns/–	ns/ns
Contract farming	+/+	+/+	+/ns
Wealth	ns/+	–/–	+/ns
Region	s/s	s/s	s/ns

Note: + = indicates significant positive effect; – = indicates significant negative effect; s = indicates significant effect; ns = indicates a non-significant effect; the sign before"/" is for sugarcane and after "/" is for tobacco

This study focuses on three farm organizations: farmer group, farmer association and farm cooperative. This study indicates that the farmer group is more inclusive than farmer association and farm cooperative, both in the sugarcane and tobacco cases. Farmer group membership does not require a large farm size (farm size-neutral) nor does discriminate based on farmer age (age-neutral) and gender (gender-neutral). Also, membership in a farmer group is closely related to farmers receiving an extension, government support and participation in contract farming, all of which improve farm productivity. Thus, increasing the number of registered farmer groups will likely improve farmer participation in farmer groups. Furthermore, targeting educated farmers who are not currently in a farmer group is vital because they have a higher probability of joining a farmer group.

In contrast, farmer associations and cooperatives are less inclusive than farmer groups. Sugarcane farmers tend to participate in cooperatives and associations, but tobacco farmers tend to participate in associations.

Participation in association seems to benefit farmers with large farm sizes and is dominated by older farmers. Similarly, participation in cooperatives is dominated by farmers with large farm sizes and older farmers. These suggest that both associations and cooperatives are critical to support larger farmers. Therefore, strengthening farmer association and cooperation is needed to increase the economy of scale of sugarcane and tobacco farming.

CONCLUSIONS

This study aimed to identify sugarcane and tobacco farmer participation in farmer groups, associations and cooperatives. This study concludes that the farmer group is more inclusive than association and cooperative. Farmer group participation is farm size-, age- and gender-neutral. In contrast, both association and cooperative are dominated by large size and older farmers. Increasing registered sugarcane and tobacco farmer group is crucial to improve farmer participation in it. Then, strengthening association and cooperative is fundamental to increase the economy of scale of sugarcane and tobacco farming.

ACKNOWLEDGEMENT

We wish to acknowledge LP2M of Universitas Jember for supporting this study. This study was funded under the 2020 Research Group grant with the grant number: 11872/ON25/LT/2020.

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