p-ISSN 2615-787X e-ISSN 2615-790X

Trop. Anim. Sci. J.
Vol. 43 No. 2: 95-190, June 2020

Tropical Animal Science Journal

Published by Faculty of Animal Science, IPB University (Bogor Agricultural University), associated with Animal Scientist's Society of Indonesia

p-ISSN 2615-787X e-ISSN 2615-790X

Tropical Animal Science Journal

Accredited by Directorate General of Strengthening for Research and Development,
Ministry of Research, Technology and Higher Education of the Republic of Indonesia
No: 30/E/KPT/2018

Vol. 43 No. 2, June 2020

PUBLISHER
Faculty of Animal Science, IPB University (Bogor Agricultural University) associated with Animal Scientist's Society of Indonesia

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Tropical Animal Scince Journal (Trop. Anim. Sci. J.) previously Media Peternakan is a scientific journal covering broad aspects of tropical animal sciences. Started from 2018, the title is changed from Media Peternakan in order to develop and expand the distribution as well as increase the visibility of the journal. The journal is published FOUR times a year in March, June, September, and December by Faculty of Animal Science, IPB University (Bogor Agricultural University), associated with Animal Scientist's Society of Indonesia. Tropical Animal Scince Journal is a peer reviewed journal that has been indexed and abstracted in Elsevier products (Scopus, Reaxys), Clarivate Analytics product (Emerging Sources Citation Index), Scimago Journal Rank, ASEAN Citation Index, DOAJ, Dimensions-Digital Science, CABI, EBSCO, Science and Technology Index (SINTA), Google Scholar, and other scientific databases. The journal also uses Similarity Check to prevent any suspected plagiarism in the manuscripts.

SECRETARIAT OF TROPICAL ANIMAL SCIENCE JOURNAL
Faculty of Animal Science Building, IPB University (Bogor Agricultural University)
Jalan Agatis, Kampus IPB Dramaga, Bogor 16680, Indonesia
Phone/Fax: +62-251-8421692
e-mail: mediapeternakan@apps.ipb.ac.id; mediapeternakan@yahoo.co.id
website: http://journal.ipb.ac.id/index.php/tasj

Subscription Rate (Not including shipping and handling):
IDR 100.000/ edition and IDR 350.000/ year (Indonesian subscribers); 50 US$ (Foreign subscribers)
Bank account: BRI KCP KAMPUS IPB No. 0595-01-005208-53-3, o.b. Media Peternakan, SWIFT CODE: BRINIDJA

p-ISSN 2615-787X e-ISSN 2615-790X

Tropical Animal Science *Journal*

Accredited by Directorate General of Strengthening for Research and Development,
Ministry of Research, Technology and Higher Education of the Republic of Indonesia
No: 30/E/KPT/2018

HISTORY

Tropical Animal Science Journal (Trop. Anim. Sci. J.) (p-ISSN 2615-787X and e-ISSN 2615-790X) previ- ously Media Peternakan (published from 1967-2017 with p-ISSN 0126-0476 and e-ISSN 2087-4634) is a scientific journal covering broad aspects of tropical animal sciences. Started from 2018, the title is changed from Media Peternakan in order to develop and expand the distribution as well as increase the visibility of the journal. The journal is published three times a year in April, August, and December by Faculty of Animal Science, IPB University (Bogor Agricultural University), associated with Animal Scientist's Society of Indonesia. The journal is published FOUR times a year in March, June, September, and December started from the year 2020.

The first edition with the new title was published in April 2018 edition (Vol 41 No 1 2018), while the previ- ous edition (up to 2017 edition) still use Media Peternakan as the title. The online version of Tropical Animal Scince Journal could be accessed in the new website (http://journal.ipb.ac.id/index.php/tasj) and the previous editions are available in the old website (http://medpet.journal.ipb.ac.id/).

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p-ISSN 2615-787X e-ISSN 2615-790X

Tropical Animal Science *Journal*

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Ministry of Research, Technology and Higher Education of the Republic of Indonesia
No: 30/E/KPT/2018

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p-ISSN 2615-787X e-ISSN 2615-790X
Accredited by Directorate General of Strengthening for Research and Development No: 30/E/KPT/2018

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DOI: https://doi.org/10.5398/tasj.2020.43.2.183
Available online at http://journal.ipb.ac.id/index.php/tasj

Factors Affecting Farmers' Participation in Contract Farming: The Case of Broiler Sector in Indonesia

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(Received 04-11-2019; Revised 21-02-2020; Accepted 06-03-2020)

ABSTRACT

Contract farming (CF) has been used extensively to integrate broiler value chain both in the developed and developing countries. Participation in CF is associated with the increased farm productivity and farmer income. Therefore, the purpose of this study was to analyze factors affecting Indonesian broiler farmers' participation in CF. This study used the nationally-representative data of smallholder broiler farmers in Indonesia. The data were the results of the 2014 Indonesian Livestock Farm Household Survey (ILFHS) and consisted of 1,142 farmers distributed in 20 provinces. Logistic regression was used to analyze thirteen factors that potentially affected farmers' decision to participate in CF. Those factors were age, gender, education, household size, farming experience, farm area, broiler population, cooperative membership, cooperative service, farmer group membership, farmer group service, farmer association, and agricultural extension. The results showed that six factors had statistically significant effects on farmers' decision to participate in CF. Education, land size, population, farmer group, and agricultural extension have a positive influence on farmers' decisions. Meanwhile, cooperative service has a negative effect. Farmer group and agricultural extension service have the strongest effect on participation in CF. The results suggest that farmer groups and extension services to small scale farmers are promising to improve their participation in CF.

Keywords: broiler farming; contract farming; logistic regression

INTRODUCTION

Contract farming (CF) has attracted considerable attention over the past decades. Several studies show that CF increases farm productivity, profitability, farmers' income, and food security (Barrett *et al*., 2012; Bellemare & Novak, 2017; Wang *et al*., 2014). Moreover, CF has a risk-shifting feature, the transfer of risk from farmer to the company, especially the risk of the market price. The company provides a fixed purchase price to farmers, and the farmers solely concern about maximizing production. These successful examples raised hope that this could be a private sector-led strategy for inclusive and sustainable economic growth and poverty reduction in less developed countries (Lambrecht & Ragasa, 2018).

The actual conditions in the field are that independent broiler farmers are struggling to operate optimally due to the high operational costs (DOC, concentrate, vaccines, and medicines) and lack of modern farming technologies, as was stated in the study of Murthy & Bindu Madhuri (2013). On the other hand, farmers who choose not to participate in CF have a logical reason. Generally, these farmers have a thorough knowledge of the market and access to that market. It makes the farmer to able to set their strategies independently to maximize the farm income. However, not all farmers have that ability and access. Therefore, farmers' participation in CF is crucial to improve broiler farm performance. The presence of CF helps broiler farmers in providing inputs, increasing access to production technology, and reduces price uncertainty.

Several international studies have been conducted to assess the importance of contract farming (Bellemare & Bloem, 2018; Narayanan, 2014; Reardon & Timmer, 2014) and factors that affect the farmer decision to participate in CF (Bellemare & Lim, 2018; Khan *et al*., 2019; Mishra, *et al*., 2018; Odunze *et al*., 2015). A particular study, such as Ntaganira *et al*. (2017), discussed the effects of access to farm service on contracted and non-contracted dairy farmers in Rwanda. However, the paper did not further discuss its effect on farmer's decision to participate in CF. To the extent of our knowledge, no previous studies have included comprehensive institutional variables, such as farmer group, cooperative, farmer association, and agricultural extension as predictors of farmers' participation in CF.

Similarly, the study of broiler CF in Indonesia has been conducted extensively since 1990s. Several studies have assessed the importance of broiler CF from industrial and policy perspectives. Such as Daryanto (2016),

who discussed CF as an instrument to link smallholder farmers to output market, and also Fitriani *et al*. (2014), who assessed the structural change of the Indonesian broiler industry, which became more concentrated because of vertical coordination through contracting. However, these studies were conducted on a community or regional level. To date, there is no study has been conducted to assess the topic at the national level. Consequently, the results of previous studies do not represent the national conditions.

Therefore, the purpose of this study is to analyze factors affecting farmer's decision to participate in CF. The topic is of importance for policymaking purposes. Currently, the CF participation rate in the Indonesian broiler sector is 56.69 percent (BPS, 2014). This figure is relatively low compared to those in developed countries such as the United States of America, where the participation rate in broiler CF reaches 97 percent (Macdonald, 2014). The study of CF is crucial since it is the precursor of agricultural transformation in developing countries. The contribution of this study is twofold. First, it includes institutional variables as predictors of farmers' participation in CF, which is essential to identify key institutions that promote CF. Second, this study uses a nationally-representative data of the broiler sector in Indonesia. Therefore, the findings of this study are appropriate to be used as references in policy-making at the national level.

METHODS

Research Design

A mixed-method of sequential explanatory approach was employed to identify factors affecting farmers' participation in broiler CF in Indonesia (Creswell, 2013). This method consisted of quantitative (Phase 1) and qualitative (Phase 2). In the quantitative phase, we estimated thirteen factors that potentially affected farmer decision to participate in CF. This study used a nation-wide survey data consisting of 1,142 broiler farmers distributed in 20 provinces in Indonesia. The data were part of the 2013 Agricultural Census conducted by the Indonesian Bureau of Statistics (BPS) and was a representative of Indonesian conditions. Figure 1 shows the distribution of broiler farmers in the survey.

In the qualitative phase, two in-depth interviews with independent farmers and contract farmers were conducted. The interview was conducted in May and July 2019 in Kalisat and Sukowono District, Jember Regency, in the Province of East Java. The primary purpose of Phase 2 was to explain and clarify the different effects of each factor obtained from Phase 1. Also, Phase 2 provided a thorough understanding of the rationale behind the farmer's decision to participate in broiler CF. The next section provided a comprehensive explanation of the data used for each phase.

Data

This study used both quantitative and qualitative data. The quantitative data were the results of a nation-wide survey to Indonesia broiler farmer. Therefore, the result of the quantitative analysis can be generalized to Indonesian conditions. The quantitative analysis estimated the effect of thirteen factors on farmers' decision to participate in broiler CF. These factors were categorized into four categories: farmers' characteristics (age, education, gender), household characteristic (household size), farm characteristics (land size, population, farming experience), and institutional characteristics (cooperative, cooperative service, farmer group, farmer group service, farmer association, and agricultural extension). Table 1 presents the description of each thirteen factors along with the expected sign.

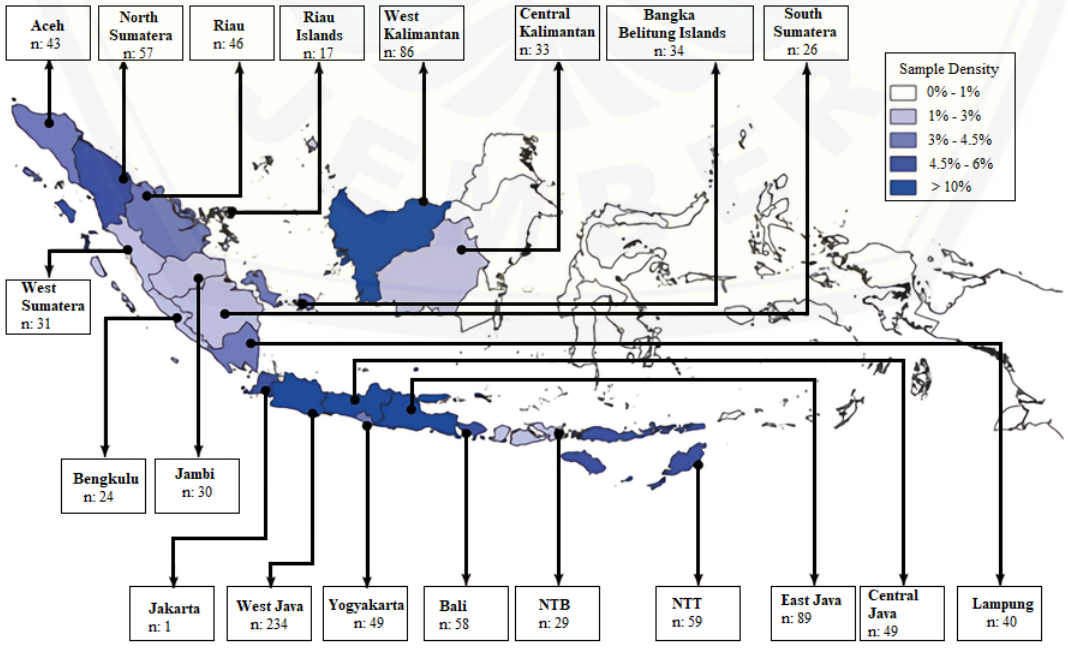

Figure 1. Distribution of Indonesian broiler farm households in Indonesia

The expected sign was the hypothesis of the effect of each predictor on the outcome variables. The hypothesis was based on the descriptive statistics of each variable, which was presented in Table 2. Both contract and independent farmers had the same characteristics in household size and age. The majority of farmers were male, both in the contract and independent groups. Contract farmer had a higher education level, land size, and broiler population. The farming experience was not significantly different between the two groups. In average, the number of contract farmer who became the member of cooperative, farmer group and association or those who received services from these institutions is higher than the independent farmer. Moreover, the number of contract farmers who received agricultural extension was higher than those of independent farmers.

The qualitative data were the result of in-depth interviews to contract and independent broiler farmers. The qualitative data were used to confirm or disconfirm the results obtained from quantitative analysis. The in-depth interview focused on the rationale behind the decision to participate or not to participate in CF. Then, the interviews went further on exploring the characteristics of broiler farming under contract and independent production. The characteristics explored consisted of market price, length of production, feed usage, labor usage, the timing of production, and the status of broiler farming in overall household income.

Data Analysis

This study used a logistic regression model to estimate the effect of each factor on farmers' decision to participate in CF. Logistic regression is appropriate if the dependent variable is in a dichotomous form. In this study, the dependent variable was in a dichotomous (participate and not participate) form. Logistic regression was commonly used in studies attempting to identify the determinants of farmers' participation in CF (Wang *et al*., 2014). Equation below specifies the model:

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

Where Y is the farmer's decision to participate in CF (1=participant; 0=non-participant), and $X_{1\text{-}13}$ are the independent variables, b_0 is the constant, $b_{1\text{-}13}$ are the coefficient of each independent variable. The robustness of the model was tested using the *Omnibus Test of Model Coefficients* and *-2 log-likelihood*. A significant value of the Omnibus Test of Model Coefficients and decreased -2LL value from block 0 to block 1 indicate that the model is robust (Field, 2005).

RESULTS

Table 3 summarizes the estimation stages of logistic analysis, which requires two trials before getting accurate estimation results. The initial model consisted of thirteen variables and had 1,142 number of observations. The observations were divided into 513 farmers that participated in contract farming and 629 farmers that were not. The first trial with entering method resulted in a good logistic model statistical test value (Table 3), with a significant omnibus test value (chi-square) and a decreased likelihood ratio value from block 0 to block

Table 1. Description of variables used in the quantitative phase (Phase 1)

	Factors	Description	Units	Measure	Expected sign
Y	Participation in broiler CF	Farmer decision to participate in contract farming (1=participate, 0=does not participate)	-	Nominal	
X1	Age	The age of farmer	Year	Scale	–
X2	Education	Farmer's formal education	Year	Scale	+
X3	Gender	The gender of a farmer (1=male, 2=female)	-	Nominal	+
X4	Household size	The number of family members in each household.	Person	Scale	–
X5	Land size	The size of land used for broiler house	100 M²	Scale	+
X6	Population	The population of broiler owned by each farmer	In hundred birds	Scale	+
X7	Farming experience	Farmer experience in broiler farming	Year	Scale	+
X8	Cooperative	Membership in farm cooperative (1=member, 0=not member)	-	Nominal	+
X9	Farmer group	Membership in farmer group (1=member, 0=not member)	-	Nominal	+
X10	Farmer association	Membership in farmer association (1=member, 0=not member)	-	Nominal	+
X11	Cooperative service	Recipient of cooperative services (1=receive, 0=not receive)	-	Nominal	+
X12	Farmer group service	Recipient of farmer group services (1=receive, 0=not receive)	-	Nominal	+
X13	Agricultural extension	Recipient of agricultural extension services (1=receive, 0=not receive)	-	Nominal	+

Table 2. Descriptive statistics of variables used in the quantitative phase

Code	Variables	Contract farmer			Independent farmer		
		Mean	S.D.	Freq[1]	Mean	S.D.	Freq[1]
Y	Participation in CF			513 (44.9%)			629 (5611%)
X1	Age (year)	44.82	10.55		44.94	10.88	
X2	Education (year)	9.6	4.13		8.66	4.39	
X3	Gender						
	Male			488 (95.1%)			576 (91.5%)
	Female			25 (4.9%)			53 (8.5%)
X4	Household size (person)	4.4	2.27		4.41	1.64	
X5	Land size (100m2)	8.14	12.7		3.15	8.66	
X6	Population (hundred birds)	33.66	47.11		13.63	41.33	
X7	Farming experience						
	1 (< 1 year)			33 (6.4%)			69 (10.9%)
	2 (1 - < 5 year)			271 (52.8%)			334 (53.1%)
	3 (5 - < 10 year)			118 (23%)			138 (21.9%)
	4 (≥ 10 year)			91 (17.8%)			88 (14,1%)
X8	Cooperative membership						
	Member			54 (10.5%)			64 (10.2%)
	Not member			459 (89.5%)			565 (89.8%)
X9	Farmer group						
	Member			81 (15.8%)			40 (6.4%)
	Not member			432 (84.2%)			589 (93.6%)
X10	Farmer association						
	Member			34 (6.6%)			9 (1.5%)
	Not member			479 (93.4%)			620 (98.5%)
X11	Cooperative service						
	Receive			27 (5.3%)			33 (5.2%)
	Not receive			486 (94.7%)			596 (94.8%)
X12	Farmer group service						
	Receive			66 (12.9%)			32 (5.2%)
	Not receive			447 (87.1%)			597 (94.8%)
X13	Agricultural extension						
	Receive			191 (37.2%)			63 (10.3%)
	Not receive			322 (62.8%)			566 (89.7%)

Note: Source: ILFHS, 2014. [1]For the categorical variable, the value represents the number of the farmer for each category in each group; [2]Household size is the number of household member (including farmer) in a particular farm household.

1. However, nine variables were not significant in the model. Therefore, the analysis proceeded to the second trial and excluded the household size, gender, age, farming experience, cooperative membership, farmer group services, and associations. The second logistic regression estimation with forwarding stepwise (wald) method produced a robust result, and all of the input variables had a statistically significant effect at the 95% confidence level.

The value of the omnibus test of model coefficients or Chi-Square was statistically significant ($p<0.01$). It means that with a confidence level of 99%, there is at least one independent variable that influences the dependent variable. The overall percentage value indicated the regression model was robust and able to correctly estimate 71% of the conditions that occured in the study area. There was a decrease in the Likelihood value from block number 0 to block number 1. It implied that the regression model was better at predicting farmers' decision to participate in CF; in other words, the addition of independent variables to the model significantly improved the robustness of the model.

Finally, of the 13 factors estimated in the logistic regression model, six factors had a statistically significant effect, and seven factors were insignificant to farmers' decision to participate in CF. Out of 6 significant factors, 5 had the expected sign (education, land size, population, farmer group, and agricultural extension). Only cooperative services differed from the expected sign. There were six independent factors in the final model, namely education, land use, number of livestock, cooperative services, farmer group, and agricultural extension. All of these factors had a positive sign except for cooperative services.

DISCUSSION

The primary purpose of this study was to identify factors affecting farmers' decision to participate in CF. The analysis found that only 6 out of 13 factors that have

Table 3. Estimation results of logistic regression

Variables	1st Trial			2nd Trial			Odds ratio
	β	S.E.	t-value	β	S.E.	t-value	
Age	-0.002	0.007	0.814	*Removed*			
Education	-0.034	0.016	0.040**	0.032	0.015	0.041**	1.032
Gender	-0.311	0.271	0.252	*Removed*			
Household size	0.007	0.034	0.846	*Removed*			
Land size	0.049	0.011	0.00***	0.050	0.011	0.00***	1.051
Population	0.010	0.002	0.00***	0.010	0.002	0.00***	1.010
Farming experience	0.019	0.079	0.813	*Removed*			
Cooperative membership	-0.159	0.277	0.565	*Removed*			
Farmer group	0.318	0.316	0.313	0.571	0.232	0.014**	1.771
Farmer Association	0.561	0.425	0.187	*Removed*			
Cooperative service	-0.613	0.385	0.111	-0.651	0.309	0.035**	0.521
Famer group service	0.320	0.349	0.359	*Removed*			
Agricultural extension	1.379	0.178	0.00***	1.437	0.173	0.00***	4.209
Constant	-2.048	1.140	0.072	-1.273	0.703	0.011	0.280
Omnibus Test	0.00***			0.00***			
Overall Percentage	70.6			71.0			
Nagelkerke R2	0.240			0.235			
Likelihood (block 0)	1571.345			1571.345			
Likelihood (block 1)	1346.074			1350.497			

Source: Data analysis, 2019
Note: ***= significant at 99% confidence level, **= significant at 95% confidence level, *= significant at 90% confidence level.

a statistically significant effect. This section will discuss the findings of this study based on the category of each factor.

Farmers' Characteristics

There were three factors in this category: age, education, and gender of participant farmers. The result of the logistic regression analysis showed that only education had a statistically significant effect. Meanwhile, age and gender were insignificant to farmers' decision to participate in broiler CF. Many previous studies included age, education, and gender as the predictors of farmers' participation in CF. However, there was still no consensus about the significance and sign of these factors.

Katchova & Miranda (2004) found that age increased participation in CF for soybean farmers in the United States. In contrast, Bellemare (2012) found that young farmers had a higher probability of participating in CF. A similar result was also found for seed corn farmers in Indonesia (Simmons *et al*., 2005). In a similar study, Simmons *et al*. (2005) found that age had an insignificant effect on the decision to participate in CF for broiler and seed rice farmers in Indonesia, which confirmed the finding of this study. These findings suggested that the effect of farmers' age was commodity and location-specific.

The estimation result showed that education had a significant positive effect on the CF participation of broiler farmers in Indonesia. Education had an odds ratio of 1.032, suggesting that, on average, an increase in one year in formal education increased the probability of farmers to participate in CF by 3.2%. The finding of this study was in agreement with those of Arumugam *et al*. (2011), who studied fresh fruits and vegetables CF in Malaysia. Recent studies also confirmed the finding of this study, such as Mishra *et al*. (2016), Pandey (2016), and (Ito *et al*., 2012). However, some studies found that farmer with higher education was less likely to participate in CF, such as those for small farmers who contracted with supermarkets in China (Miyata *et al*., 2009). Moreover, other studies found that education had no significant effect (Bellemare, 2012; Ito *et al*., 2012). These findings implied that the education effect was also a commodity- and location-specific.

Gender is insignificant in affecting farmers' decision to participate in CF. This finding was in accordance with the findings of Setboonsarng *et al*. (2008) who studied rice CF in Lao PDR, Arumugam *et al*. (2011) in Malaysia, Freguin-Gresh *et al*. (2012) in South Africa, and Holly Wang *et al*. (2011) in China. In contrast, some studies found that women were less likely to participate in CF, such as in Madagascar (Bellemare, 2012) and Kenya (Wainaina *et al*., 2012). The possible explanation for this difference is that in less developed countries, women receive a huge institutional pressure that prohibits them from participating in CF. Meanwhile, in emerging countries such as Indonesia, the institutional constraints that prohibit women from participating in CF have been greatly diminished.

Household Characteristics

This category consists only of one factor, household size. This study found no significant effect of household size. Several studies, such as Bellemare (2012) and Swain (2012), had estimated the effect of household size on

farmers' participation in CF. Bellemare (2012) found an insignificant effect of household size, while Swain (2012) found a significant positive effect. Swain (2012) argued that CF was labor-intensive, and farm households with more members tended to participate in CF due to their available family labor. Our in-depth interview showed that CF was labor-intensive, but the farmer tended to use hired labor instead of family labor. Hence, we conclude that household size is not a significant predictor of CF participation.

Farm Characteristics

There were three factors in this category, i.e., land size, population, and farming experience. Land size and population had a significant positive effect, while the farming experience was insignificant. Land size had an odds ratio of 1.051, indicating that an increase of 100 m^2 in land size increased the probability of farmer to participate by 5.1%. The odds ratio of population was 1.010, indicating that an increase in 100 birds in the broiler population increased the probability of participating in CF by 10%. Land size and population were used to represent farm size. Land size represents the area of land used for broiler houses while the population describes the number of broilers that a farmer produces. In essence, these two factors are the measure of farm size.

A large number of studies had found a significant positive effect of farm size on farmers' participation in CF, such as Arumugam *et al*. (2011), Bellemare (2012), Freguin-Gresh *et al*. (2012), Holly Wang *et al*. (2011), Issa & Chrysostome (2015), and Holly Wang *et al*. (2017). Larger farms are more likely to participate in CF is consistent with the common belief that they are more likely to be offered a contract for the transaction cost-saving benefit of the processor (Wang et al., 2014). In line with that, Barrett *et al*. (2012) state that contracting with larger, better-off farmers may reduce company transaction costs. Odunze *et al.* (2015) found that large scale farming had seven times more likely to increase viability than small scale farming for a farmer, and contracting a large-scale farmer increased the viability by six times for a contractor. In addition, land is a proxy for wealth both for rural and peri-urban farmers in Indonesia (Rondhi *et al*., 2019b).

Capital requirements and farm transaction costs increase with the increase in farm size. Participation in CF helps the farmer to reduce these costs, especially in broiler farming. Table 2 showed that, on average, contract farmers managed 3,366 broilers in one production cycle, much higher than the independent farmer who managed only 1,363 broilers. Our in-depth interview showed that broiler farming required large capital for feed and DOC. The contract farmer received these inputs from the company, and the cost would be deducted at harvest. In contrast, the independent farmer tended to manage only a small population of broilers. Also, an independent farmer tended to use a varying feed to reduce farm costs.

The literature also has not found an agreement on the effect of farming experience. Bellemare (2012) found a positive and significant effect of farming experience. In contrast, Arumugam *et al*. (2011) found that farming experience was insignificant to farmers' participation in CF. These findings suggested that farming experience might have a nonlinear relationship with farmers' participation in CF.

Institutional Factors

There were six factors in this category: membership in a cooperative, farmer group, and association, as well as services from cooperative, farmer group, and agricultural extension. The result showed that only membership in farmer groups increased participation in CF. Membership in farmer groups had an odds ratio of 1.771, indicating that the member of the farmer group had 77.1% higher probability of participating CF than a non-member. The agricultural extension also had a significant positive effect, with an odds ratio of 4.029. It showed that farmers who received agricultural extension had 302.9% higher probability of participating in CF than farmers who had not to receive extension services. Meanwhile, a farmer who received farm services from cooperative had 47.9% (Odds ratio of 0.521) lower probability of participating in CF than those who did not receive cooperative services. The other three factors (membership in a cooperative, farmer association, and farmer group service) were insignificant to farmers' participation in CF.

Participation in a farmer group facilitates farmers to obtain farm-related information. Farmer group also acts as a channel of distribution for government support such as farm subsidies, farm machinery, and training program (Rondhi *et al*., 2018). Farmers have a higher bargaining position by acting in a group. In the case of a small broiler farmer, farmer group helps farmer to gain access to CF due to the increased broiler population. Moreover, the company prefers to deal with farmers who are members of a farmer group because it is easier to manage. This finding is in line with Odunze *et al*. (2015), which states that being a member of a farmer group increases the chance of CF viability by about seven times. The statement was supported by Bellemare & Lim (2018) research which stated that households, where the head was a member of a farmer group, were more likely to participate in CF. Consequently, services from farmer groups also increase farmer likeliness to participate in CF. In contrast, participation in farmer association and cooperative are insignificant to involvement in CF.

The result showed that a farmer who received agricultural extension was more likely to participate in CF. Aremu *et al*. (2015) state that agricultural extension is the process to transfer knowledge to farmers and help farmers to implement that knowledge to improve their farming. CF can be a new method for farmers to cope with risk. Giving farmers more information about CF through agricultural extension can increase the chance for the farmer to participate in it. Altalb *et al.* (2015) also found out that agricultural extension workers had an effective and important role in helping farmers to solve

agricultural problems and adopted new methods or technologies. Agricultural extension is shown to be an effective institution in Indonesia, such as to mitigate the effect of climate change (Rondhi *et al.*, 2019).

Cooperative services have a significant negative effect on a farmer's decision to participate in CF. Better cooperative services will affect the willingness and comfort of farmers to continue to work with the cooperative. The cooperative has two functions, both as a supplier of livestock business inputs and helping farmers to distribute or sell their farming products with profit-sharing systems. Issa & Chrysostome (2015) stated that strengthening cooperatives could give farmers access to extension services, farm inputs, credit, markets, and other services. Good cooperative services will provide alternative options for farmers in facing risks, so this will reduce the selection of agricultural contracts from companies by farmers.

CONCLUSION

Six factors significantly influence the participation of Indonesian farmers in broiler CF. Education, land size, population, farmer group, and agricultural extension have a positive influence on farmers' decisions. Meanwhile, cooperative service has a negative effect. Farmer group and agricultural extension service have the strongest effect on participation in CF. The result implies that CF was less inclusive to small scale farmers (those with an average population of <1500 birds). Uniting small scale farmers in farmer group is promising to increase farmer participation in broiler CF since they can meet the minimum scale set by the company

CONFLICT OF INTEREST

We certify that there is no conflict of interest with any financial, personal, or other relationships with other people or organizations related to the material discussed in the manuscript.

ACKNOWLEDGEMENT

This research was supported by Indonesian Ministry of Research, Technology, and Higher Education, Grant Number: 7/E/KPT/2019. We thank two anonymous reviewers and the journal editor for their constructive comments and suggestions which significantly improve the initial version of the manuscript. Finally, all errors are ours.

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