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).

In actual conditions, 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 reducing 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](image-url)
Table 1. Description of variables used in the quantitative phase (Phase 1)

| Factors used in the quantitative phase (Phase 1) | 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 | +             |

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:

\[
Y_i = \ln \left( \frac{p_i}{1 - p_i} \right) = \sum_{k=1}^{13} b_k x_{ik} + \ln \left( \frac{h_{13} - \sum_{k=1}^{12} b_k x_{ik}}{h_{13} + \sum_{k=1}^{12} b_k x_{ik}} \right), i = 1, 2, ..., 13
\]

Where \( Y \) is the farmer’s decision to participate in CF (1=participate; 0=non-participate), and \( X_{13} \) are the independent variables, \( b_k \) is the constant, and \( b_{1,13} \) 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 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 occurred 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

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

| Code | Variables                  | Contract farmer | Independent farmer |
|------|----------------------------|-----------------|--------------------|
| Y    | Participation in CF        | Mean  | S.D.  | Freq¹ | Mean  | S.D.  | Freq¹ |
| X1   | Age (year)                 | 44.82 | 10.55 | 513 (44.9%) | 44.94 | 10.88 | 629 (5611%) |
| 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. For the categorical variable, the value represents the number of the farmer for each category in each group;¹Household size is the number of household member (including farmer) in a particular farm household.
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 m² 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), Fregun-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 feed 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 likelihood 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. Arema 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.

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