Universal Journal of Agricultural Research 12(2): 391-402, 2024
DOI: 10.13189/ujar.2024.120218

Smallholder Technical Efficiency and Farmers' Satisfaction on Broiler Contract Farming in East Java, Indonesia

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Received November 27, 2023; Revised April 3, 2024; Accepted April 22, 2024

Cite This Paper in the Following Citation Styles

(a): *[1] Nanang Febrianto, Puji Akhiroh, Muhammad Helmi, Nur Silviyah Rahmi, Dewi Masyithoh, Budi Hartono , "Smallholder Technical Efficiency and Farmers' Satisfaction on Broiler Contract Farming in East Java, Indonesia," Universal Journal of Agricultural Research, Vol. 12, No. 2, pp. 391 - 402, 2024. DOI: 10.13189/ujar.2024.120218.*

(b): *Nanang Febrianto, Puji Akhiroh, Muhammad Helmi, Nur Silviyah Rahmi, Dewi Masyithoh, Budi Hartono (2024). Smallholder Technical Efficiency and Farmers' Satisfaction on Broiler Contract Farming in East Java, Indonesia. Universal Journal of Agricultural Research, 12(2), 391 - 402. DOI: 10.13189/ujar.2024.120218.*

Abstract This study delves into the technical efficiency and satisfaction levels of broiler chicken farmers engaged in contract farming in Malang Regency, East Java, Indonesia. With the region being a significant contributor to broiler production, particularly through partnership schemes, the research focuses on a purposive sample of 70 plasma farmers with a minimum two-year or seven-rearing period partnership experience, each managing a minimum of 3,000 birds. The study employs a stochastic production function frontier analysis by utilizing a combination of primary data, encompassing production costs, revenue, and production factors, along with secondary data from authoritative sources. The findings reveal a notably high average technical efficiency of around 95%, indicating a commendable level of productivity among farmers. The nuanced examination of socio-economic factors highlights the contrasting effects of age and experience on efficiency, underscoring the positive impact of formal education and land area. The study also unveils a generally high satisfaction index of 88.84 among farmers, with facilities and field agents garnering the highest praise. While opportunities for improvement exist, particularly in enhancing competitiveness and specific aspects of product reliability and endurance, the findings collectively advocate for a holistic approach, including scaling up operations and adopting best-practice farming techniques through contract farming, to further advance regional production and income.

Keywords Broiler, Contract Farming, Farmer Satisfaction, Frontier, Technical Efficiency

1. Introduction

In Indonesia, the broiler chicken farming industry plays a pivotal role in supplying the nation's meat. This is evident from the accelerating demand for this chicken commodity. In 2021, Indonesians consumed an average of 7.28 kg of chicken meat per person per year, which was the highest meat consumption in the country. During the same year, Indonesia produced a total of 3.42 million tons of chicken meat with national consumption of around 1.56 million tons [1, 2]. According to data from the National Socioeconomic Survey (SUSENAS), the consumption of broiler chicken per capita has shown a consistent upward trend by the Indonesian population over the past 10 years (2012-2022), increasing at a rate of 7.39% per year [2]. Although it has promising prospects, it faces significant risks, primarily driven by price volatility and input cost fluctuations, leading to income instability for farmers [3-6].

The contract farming approach, involving companies (core) with advantages in capital and technology, can enhance the scale of operations for farmers (plasma). Despite these advantages, there are also inherent weaknesses in this approach [7].

The advantage of contract farming lies in its medium-scale production and marketing system, where the burden of production and marketing risks are shared between agribusiness participants and small-scale farmers. This system can be viewed as an innovative approach to providing essential production resources (inputs) required by farmers (or livestock producers), such as credit, insurance, information, infrastructure, and other production factors, as well as marketing [8-11].

Contract farming in agriculture may also have adverse effects on small-scale farmers, including issues related to contract determination, manipulation of inputs, unprofitable contract terms, under-weighing of poultry, incorrect indexing or ranking, and grading problems [12]. In order to mitigate the negative impacts of contract farming implementation, core companies should execute more organized vertical integration, and farmers should be actively involved in the contract development process, particularly in contract design and the enhancement of contract terms that can benefit farmers [13].

The current situation among independent small-scale broiler chicken farmers is that they are unable to conduct their operations optimally due to the high operational costs, which include the expenses for day-old chicks (DOC), concentrated feed, vaccines, and medications [14]. Therefore, the participation of farmers in contract farming is of paramount importance and warrants investigation for the development of broiler chicken farming. The presence of contract farming significantly assists broiler chicken farmers by providing inputs, enhancing access to production and marketing, and regulating price determination to reduce uncertainties [15]. This is further emphasized in a contract design whose primary goal is to protect the farmers [8]. However, the contract design is determined by the core company, potentially leading to conflicts of interest.

The participation of both companies and farmers in contract farming programs results in varied contract implementations due to the motivation to fulfill the contracts. Therefore, this aspect is highly important for examinations. It is assumed that a high level of contract implementation will enhance technical efficiency through guidance and extension services, as well as the benefits in terms of income and accessibility or the ease of operations obtained by farmers [16]. Both these aspects offer solutions to the challenges faced by both companies and farmers, creating a synergistic relationship that increases farmer income. To achieve this, farmers are expected to participate in contract farming programs.

Furthermore, the sustainable success of the agriculture industry hinges significantly on the imperative of ensuring farmer satisfaction within the framework of contract farming, particularly in the context of broiler production. Moving beyond transactional engagements, the contentment of farmers becomes a pivotal metric in gauging the overall efficacy of their relationships with contractual entities [17]. A contented farmer is more likely to exhibit motivation, engagement, and unwavering commitment to the implementation and adherence to best practices in broiler farming [18]. Consequently, this enhances productivity and the generation of superior-quality poultry. Moreover, farmers who are satisfied with their contractual agreements are more likely to establish long-term relationships with the companies, which promotes stability and dependability in the agricultural supply chain [19]. Robust relationships, grounded in mutual satisfaction, cultivate an environment conducive to open communication, reciprocal trust, and a favorable atmosphere for the exchange of knowledge [20]. This, in turn, empowers farmers to adeptly navigate emerging challenges and advancements within the agricultural sector. Ultimately, the satisfaction of farmers emerges as a key to the individual prosperity of farmers and the overarching resilience and sustainability of contract farming within the broiler production industry.

Farmer participation in contract farming programs has been well-known in many regions of Indonesia [21]. One of them is Malang Regency, a region located in East Java. In this region, broiler farming is carried out through contract farming and independent systems, mainly by small to medium-sized businesses [22, 23]. In 2021, the broiler population in this region reached 25,591,600 heads, positioning it as the third-largest broiler producer in East Java [24]. No empirical study has yet been carried out on broiler contract farms in Malang to justify whether the broiler farms of this region are technically efficient in the broiler production and whether farmers are satisfied with the contract farming. Therefore, there is an intense need to undertake a study to estimate and examine the efficiency and satisfaction levels of broiler farmers in Indonesia, particularly in Malang Regency.

2. Materials and Method

2.1. Study Area

The research was conducted in Malang Regency. The selection of the location was purposive, considering that Malang Regency is one of the regencies with the highest broiler chicken population in East Java Province in 2021, with a population of 25,591,600 heads [24]. It is also a central hub for broiler production, where a significant number of farmers engage in broiler farming, through partnership schemes in East Java [25].

2.2. Respondent Criteria

Respondent selection was carried out using purposive

sampling, a method of sample determination based on specific criteria [26]. The number of partnership plasma farmers in Malang Regency is 580 farmers [27] with a population distribution ranging from 5,000 to 62,000 heads. The sample is determined to be 70 farmers or 10 percent of the population, following [28] that if the number of subjects is large, a sample of 10-15 percent can be taken. Sampling of farmers is done using a purposive sampling method with the requirement of having raised broiler chickens in a partnership pattern for a minimum of two years or 7 production periods. Based on the population of chickens, the respondent farmers are then divided into three scales: 50 farmers/respondents with livestock populations < 15,000 heads/production cycle (small scale), 20 farmers with livestock populations of 16,000-30,000 heads/production cycle (medium scale), and 10 farmers with livestock populations > 31,000 heads/production cycle (large scale). The sample of Manufacturer Partnerships is determined using a purposive sampling method with 5 companies from 13 partnership companies in Malang Regency [27] with considerations of having been in business for more than five years and having partnerships with plasma farmers.

2.3. Source of Data

The data collection method utilizes the survey method. The survey method involves sampling from a population using questionnaires as tools for collecting primary and secondary data [29]. The use of the survey method aims to obtain an accurate picture of a specific event or situation occurring in a particular location within a large population using sampling methods with the goal of understanding behaviors, characteristics, and creating descriptions and generalizations within that population.

The data utilized in the study comprised both primary and secondary data. Primary data encompassed production cost elements, revenue, and production factors used (day-old chicks, feed, medicines and vaccines, electricity, fuel, and labor). Additionally, supporting data included the identity characteristics of farmers and technical aspects of broiler chicken farming. Meanwhile, secondary data were obtained from relevant institutions such as the Central Statistics Agency/*Badan Pusat Statistik* (BPS) of Indonesia, the Department of Livestock, and other pertinent literature. The secondary data includes broiler chicken population, trends in input and output prices of broiler chickens, and broiler chicken production and consumption of broiler meat.

2.3. Data Analysis

2.3.1. The Stochastic Frontier Production Function Analysis

The Stochastic Frontier Production Function model was employed to examine the factors influencing broiler chicken farming production in Malang Regency. The production factors considered are those directly affecting the production of a commodity. A natural logarithm model is utilized to estimate the factors influencing technical efficiency, with household farmers as the unit of analysis. Stochastic Frontier Analysis (SFA), developed by Aigner, Lovell and Schmidt [30], is employed to calculate the technical efficiency of a farming unit or company and identify its technical inefficiency factors. The software used for calculating technical efficiency values through the SFA method is Frontier 4.1 [31].

The selection of the Stochastic Frontier Analysis (SFA) production function form as an approach is based on considerations such as its ability to reduce multicollinearity, homogeneity, suitability for deriving the dual cost function from the production function, simplicity in calculations, adaptability to linear function forms [32]. According to Farrell [33] and Coelli, Rao, O'Donnell and Battese [34], efficiency consists of three components: technical efficiency, allocative efficiency, and economic efficiency. This study focuses on technical efficiency analysis, which refers to a farming unit's ability to produce the isoquant curve, achieving optimal output with a specific combination of inputs and technology. Farming activity is deemed technically efficient when it operates on the production function frontier.

The mathematical expression of the stochastic frontier production function model for broiler farming can be written as follows:

$$\mathrm{Y}_1 = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + \beta_6 \ln X_{6i} + \alpha D \quad (1)$$

Where, Y_1 is production (kg/month), X_1 is Day-Old Chicks (DOC) (head/month), X_2 is feed (kg/month), X_3 is medicines and vaccines (g/month), X_4 is labor (human workdays/month), X_5 is electricity costs (Indonesian Rupiah (IDR)/month), X_6 is fuel costs (IDR/month), D is dummy (scale of operation), β_0 is intercept or constant, i is respondent farmer index (i =1,….,70), and β_1 is estimated parameter coefficient (β_1 >0).

2.3.2. Technical Efficiency and Technical Inefficiency

The stochastic frontier approach yields two simultaneous conditions: factors influencing efficiency and, concurrently, the inefficiency of farmers. Technical efficiency for each farmer-i in terms of output is obtained by comparing the observed output to its stochastic frontier output. Technical efficiency analysis can be measured using the ratio between the output level of the farmer-i, the observed outcome (y_i), and the potential output (y_i^*) generated at a specific input usage

level (x_i). Mathematically, the equation is as follows:

$$TE_i = \frac{y_i}{y_i^*} = \frac{\exp(x_i\beta - u_i)}{\exp(x_i\beta)} = \exp(-u_i) \text{ so that } 0 \le TE_I \le 1 \quad (2)$$

Where, TE_i is the technical efficiency of farmer-i, $\exp(-u_i)$ is the expected mean value of u_i given ε_i.

The technical efficiency (TE_i) is a measure ranging between 0 and 1, representing the inverse relationship with the influence of technical inefficiency. It is specifically used for functions with a specific quantity of output and input (cross-sectional data). A farmer is considered sufficiently efficient if $TE_i \geq 0.7$ and inefficient if $TE_i < 0.7$ [34].

In addition to technical efficiency, the study also examines technical inefficiency. The method used for technical inefficiency refers to the model developed by Coelli, Rao, O'Donnell and Battese [34]. The variable u_i is a random variable depicting technical inefficiency in production, associated with internal factors. A larger value indicates greater inefficiency in the farming operation. The random variable u_i should not take negative values, and its distribution is assumed to be half-normal with a distribution value of $N(u_i\sigma 2u)$. The determination of the parameter value for the technical inefficiency effect in broiler chicken farming in this study is determined using the following formula:

$$U_i = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} + \delta_5 Z_{5i} + \delta_6 D_{1i} + \delta_7 Z_{2i} + e \quad (3)$$

Where, U_i is technical inefficiency effect, Z_1 is the age of the farmer (years), Z_2 is the farming experience (years), Z_3 is education (years), Z_4 is land area (hectares), Z_5 is number of family members (person), Z_6 is business status dummy, Z_7 is partnership dummy, δ_0 is constant, and δ_i is parameters to be estimated (δ_i < 0).

2.3.3. Contract Partner Satisfaction Index

To analyze the satisfaction index of contract partners, a regression model with qualitative data on the independent variable (logit function) is employed. In the logit function, the dependent variable is qualitative (dummy), where the variable is assumed to take a value of 1 and others 0. The logit function model used takes the form of the following equation:

$$P(Y=1)\frac{1}{1+e^{(a+\beta_j X_j)}} \quad (4)$$

In logarithmic form, the equation can be written as follows:

$$Ln\left(\frac{P}{1-p}\right) = a + \beta_j X_j \quad (5)$$

Where, Y refers to 1 for contract farming (CF) farmers and 0 for others, $P(Y=1)$ is the probability of farmers participating in CF, X_j is for variables suspected to influence farmers' decisions to participate in CF, and α, β are estimated parameters.

3. Results and Discussion

3.1. Technical Efficiency of Contract Farming Livestock Business

The technical efficiency of broiler contract farming refers to the ability of a broiler business to produce the maximum output with the minimum input [21]. In other words, it is the ratio of the actual output to the potential output of a livestock business, given the same level of inputs [35]. In this case, contract farming may increase farmers' income and improve their technical efficiency in agricultural production [35]. For example, in many developing nations, there are market flaws that can be addressed by contract farming, which can help farmers boost their income by giving them access to new markets and opportunities [21, 36]. Farmers can also lower transaction costs and lower market risks by using contract farming [37]. Furthermore, contract farming is able to provide farmers access to input, training, and technical support that will increase their technical productivity in their production [38].

With regard to this study, the results of the estimation of the stochastic production function frontier are presented in Table 1. From Table 1, F_{count} of 583.756 and R^2 of 0.982 were obtained, which are significant. The value of F_{count} of 583.756 indicates that all technical efficiency variables simultaneously or together at a 95% confidence level have a significant effect on the difference in broiler production by farmers in Malang Regency. Then the value of R^2 of 0.982 means that the six technical efficiency variables are able to explain the diversity of production values produced by broiler chicken farmers in Malang Regency by 98.2%, and the remaining 1.8% is explained by other variables that have not been included in this study.

Table 1. Results of Technical Efficiency Analysis in Broiler Chicken Contract Farming in Malang Regency

Variable	Coefficient (Std. Error)	t-ratio
Constant	0.399*** 0.000	-25.900
X1 (DOC)	0.029*** 0.003	3.061
X2 (Feed)	0.038*** 0.000	20.036
X3 (Medicines and Vaccines)	0.034** 0.010	2.638
X4 (Labor)	0.002tn 0.184	1.344
X5 (Electricity)	0.022tn 0.224	1.228
X6 (Fuel Costs)	0.015* 0.085	1.748
R^2	0.982	
F_{count}	583.756	

Note: Explanation: *** significantly influences at a confidence level of 99% and ** significantly influences at a confidence level of 95%.

The t-ratio values for each variable indicate that out of the six technical efficiency variables, two variables, namely labor and electricity, do not have a significant impact on broiler chicken production by farmers. On the other hand, the remaining four variables, which include breed, feed, medicine & vaccines, and feed ingredients, have a significant influence on the production output of broiler farmers in Malang Regency.

Furthermore, the analysis of technical efficiency in the use of production factors for broiler chickens in Malang Regency is divided into three intervals: 0.56–0.70, 0.71–0.85, and 0.86–0.99. The frequency distribution of the levels of technical efficiency achieved by the respondents in the research location is presented in Table 2.

Table 2 explains that the highest level of technical efficiency achieved by broiler chicken farmers is 0.9994. This means that farmers can attain at least 99% of the potential production based on the combination of inputs used in their broiler chicken farming activities. The estimation of these efficiency levels indicates that there is still a 1% opportunity for farmers to increase their production. On the other hand, the lowest efficiency level is 0.8405, which implies that farmers achieve a technical efficiency level of 84% with the combination of production factors used and still have the opportunity to increase broiler chicken production by 16%. The average technical efficiency level of broiler chicken farmers is 0.9547 or 95%. The estimation of the average efficiency level shows that there is a 5% opportunity for the average farmer to improve their production.

Table 2. Frequency Distribution of Technical Efficiency of Broiler Farmers in Malang Regency

Technical Efficiency Index	Total	Percentage (%)
<0.9870	47	67.14
0.9871-0.9880	1	1.43
0.9881-0.9890	1	1.43
0.9891-0.9900	1	1.43
0.9901-0.9910	2	2.86
>0.9910	18	25.71
Total	70	100.00
Maximum	0.9994	
Minimum	0.8405	
Average	0.9547	

Moreover, it can be observed that 67.14% of farmers, or 47 individuals, have a technical efficiency index of less than 0.9870. Additionally, the number of farmers with an efficiency index in the range of 0.9871–0.9900 is 4.29%, and in the range of 0.9901–0.9910 is 2.86%. Meanwhile, the number of farmers with an efficiency index greater than 0.9910 is 18 individuals or 25.71%.

Gelan and Muriithi [39] categorize farmers as efficient if they have an efficiency level above 0.7. In this study, all farmers have efficiency levels above 0.7. With a technical efficiency level that is close to 1 achieved by broiler chicken farmers in Malang Regency, this indicates that the opportunity to further increase this already very high level of productivity is minimal. The gap between the productivity level achieved by broiler chicken farmers and the maximum productivity achievable through the best-practice broiler farming techniques is almost non-existent. Therefore, increasing production and income for contract farmers can be done by expanding the scale of their operations (growth development), along with improving land requirements, time management, securing funds, and minimizing other input costs. Additionally, strategies such as enhancing the utilization of high genetic materials, reducing mortality rates, and minimizing wastage are crucial for maximizing efficiency. For example, the findings of Zhang, Razzaq, Qin, Feng, Ye and Xiao [40], suggest that increasing farmer income is achieved by expanding the scale of operations. This is further emphasized by Al-Nasser, Al-Khalaifah, Al-Mansour, Ahmad and Ragheb [41] who state that the most profitable scale of operation is 10,000 birds per production cycle. Increasing the scale of broiler chicken farming at the farmer level is made more manageable with the implementation of contract farming.

According to Table 3, the age of farmers has a positive but not significantly strong impact on technical efficiency. This lack of significance is indicated by the statistical calculation showing that the t-ratio value is smaller than the

critical t-table value of 1.99 at a 5% significance level. The age of farmers is related to their physical condition and risk-taking abilities. As farmers get older, their willingness to take risks decreases, and their physical condition may weaken. This, in turn, affects the farmers' working capacity, which can lead to a decrease in technical efficiency.

Table 3. Factors Influencing Technical Efficiency in Broiler Farming Among Contract Farming Models in Malang Regency

Variable	Coefficient	Standard Error	t-ratio
Intercept	0.953	0.036	26.125*
Age	0.000	0.001	-0.591
Experience	-0.001	0.001	-1.331***
Education	0.008	0.007	1.096
Land area	0.178	0.000	1.756***
The number of family members	0.000	0.005	-0.099

Note: * significant at a 1% confidence level (2.65360), ** significant at a 5% confidence level (1.99713), and *** significant at a 20% confidence level (1.29471).

Experience in the farming business has a negative and significant impact on technical inefficiency. The coefficient for the experience factor, which is -0.001, indicates that for each additional year of experience, the respondent who has technical inefficiency decreases by 0.001, all else being equal. This is considered significant because the statistical calculation reveals that the t-ratio value is greater than the critical t-table value at a 20% significance level. With extensive experience in farming, farmers gain knowledge and insights into broiler chicken farming activities, as this type of business is often passed down through generations. The more business experiences a farmer has, the more they learn from previous farming efforts, which they can apply in subsequent seasons.

Formal education represents the number of years a farmer has spent on their formal education. These variables measure a farmer's managerial capability. The higher the formal education a farmer possesses, the better their ability to implement new technologies and allocate resources optimally. In the technical efficiency model, formal education has a positive but not significantly strong impact on broiler chicken farming efficiency. The coefficient for formal education is 0.008, indicating that for each additional year of formal education that a respondent farmer has, technical efficiency increases by 0.008, all else being equal. This lack of significance is because the statistical calculation shows that the t-ratio value is smaller than the critical t-table value at a 20% significance level.

The land area controlled by farmers has a positive and significant impact on technical efficiency. The coefficient for land area is 0.178, meaning that for each additional square meter of land controlled by a respondent farmer, technical efficiency increases by 0.178, all else being equal. This is considered significant because the statistical calculation shows that the t-ratio value is greater than the critical t-table value at a 20% significance level.

The number of family members has a positive but not significantly strong impact on the technical efficiency of broiler chicken farming. This lack of significance is indicated by the statistical calculation showing that the t-ratio value is greater than the critical t-table value at a 20% significance level.

3.2. Contract Partner Satisfaction Index

The Contract Partner Satisfaction Index is measured to find out the level of farmer satisfaction with the contract partner's contract program. Likert scale is an effective way to measure satisfaction with a contract partner’s. Likert scale, an assessment scale made in matrix form, is given to respondents so that they can assess their contract farming experience. The Satisfaction Index is obtained by calculating the average value and then postulating it into a percentage. In this research, the satisfaction index is measured by a Likert scale from 4 elements which are measured through 57 indicator items (statements). The scale Likert used around 1-5 is described in Table 4.

Table 4. Satisfaction Index Score

Score	Value of Likert Scale
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

The satisfaction index for each assessment element in the satisfaction of broiler chicken farmers regarding the broiler contract in Malang Regency is elaborated in the following Figure 1.

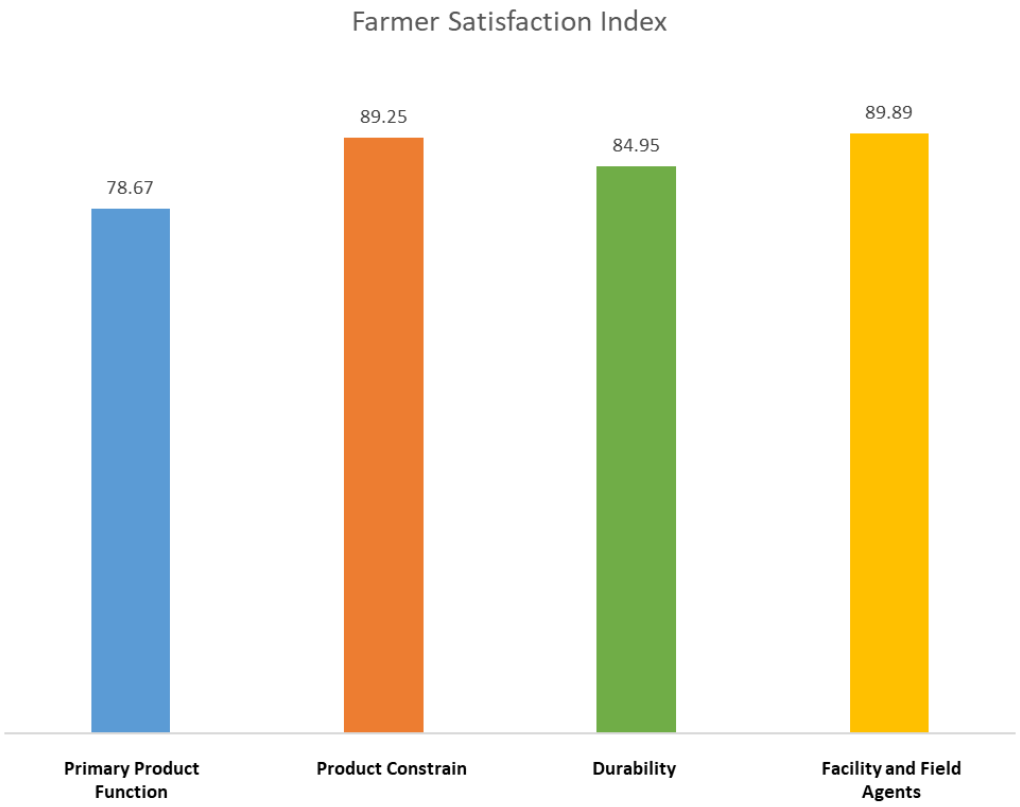

Figure 1. Satisfaction Index for Each Element

The satisfaction index values for all elements scored higher than 75.00. The element that received the highest satisfaction score was the facilities and field agents with a score of 89.89. Positive feedback was received for both facilities and field agents, highlighting factors such as effective communication skills, suitability of working facilities to on-field conditions, Core Company's awareness of partner farmers' needs, proper storage of rearing records, and evaluation by the Core Company. The reliability and trustworthiness of the Core Company, timely sharing of rearing result summaries with partner farmers within 7 working days after the final harvest, and partner farmers' confidence in Field Agents as representatives of the Core Company were also noted as strengths.

On the other hand, the element of main product function received a satisfaction index score of 78.67, indicating that farmers are reasonably satisfied with the primary product functions, which are measured by factors such as normal and healthy live bird growth, the profitability of the partnership contract scheme for partner farmers, and the competitiveness of the contract scheme compared to competitors.

Furthermore, the total Satisfaction Index score for the farmer participating in the broiler chicken contract program in Malang Regency was 88.84, based on satisfaction measurements. Table 5 represents the details of the farmer satisfaction index scores regarding the broiler chicken contract program in Malang Regency, divided into several elements and variables.

Table 5. Calculation of Satisfaction Index

	Aspect Assessed	Average Satisfaction	Value of Likert Scale	Percentage of Satisfaction Index
	Primary Product Function			
1	Normal and healthy live bird growth	3.99	Neutral	79.71
2	Contract partnership scheme benefits for partner farmers	3.93	Neutral	78.57
3	Contract scheme competes with competitor schemes	3.89	Neutral	77.71
	Reliability of Product			
4	Mortality of DOC is less than 5% during the rearing period	4.73	Strongly Agree	94.57
5	The Feed Conversion Ratio (FCR) is in line with the growth of broiler chicken weight being cultivated	4.54	Strongly Agree	90.86
6	The average weight of broiler chickens harvested is at least 1.7 kg/head within 35 days of rearing	4.76	Strongly Agree	95.14
7	The healthcare program owned by the core company is capable of preventing diseases	4.50	Strongly Agree	90.00
8	Medications supplied by the core company for treating sick chickens are effective in restoring the health of broiler chickens	4.46	Strongly Agree	89.14
9	The core company provides DOC supply with an initial weight of > 37 grams	4.54	Strongly Agree	90.86
10	The core company provides DOC supply with uniformity ≥ 80%	4.37	Strongly Agree	87.43
11	The core company provides DOC supply that is not dehydrated	3.78	Neutral	75.65
12	The number of DOC sent by the core company matches the quantity stated in the agreement letter	4.67	Strongly Agree	93.43
13	The number of DOC per box sent is 100 chickens	4.80	Strongly Agree	96.00
14	Additional bonus DOC, 2% per box, to anticipate mortality during transportation	3.73	Neutral	74.57
15	The amount of feed sent by the core company matches the quantity of DOC being cultivated	4.57	Strongly Agree	91.43
16	The kilograms of feed per sack match the weight stated on the packaging	4.73	Strongly Agree	94.57
17	Types of medications sent by the core company match the health program	4.30	Strongly Agree	86.00
18	The condition of DOC received by partner farmers is free from abnormalities (crooked legs, defective heads, twisted necks, and crossed beaks)	4.00	Strongly Agree	80.00
19	The feed received is in good packaging and free from lumps	4.73	Strongly Agree	94.57
20	The core company provides feed supply with an aroma and texture suitable for the growth period of broiler chickens	4.79	Strongly Agree	95.71
21	The core company provides DOC supply with dry and clean feathers	4.33	Strongly Agree	86.57
	Durability			
22	Feed supplied by the core company should not expire during the rearing period	4.80	Strongly Agree	96.00
23	Medications supplied by the core company should not expire during the rearing period	4.74	Strongly Agree	94.86
24	There are no broiler chickens culled during the rearing period	3.20	Neutral	64.00
	Facilities and Infrastructure			
25	Supporting work facilities for Field Agents (phone, vehicle, agenda, and stationery) used by Field Agents are adequate	4.51	Strongly Agree	90.29
26	Work facilities for Field Agents are adjusted to field conditions	4.29	Strongly Agree	85.71
27	Field Agents have an attractive and neat appearance	4.46	Strongly Agree	89.14

Table 5 continued

28	Field Agents are equipped with adequate and up-to-date work equipment, especially for technical poultry farming (scales, electronic thermometer, humidity meter, and surgical scissors)	4.53	Strongly Agree	90.57
29	Contract farming agreements are provided and approved by partner farmers 1 week before rearing the animals	4.41	Strongly Agree	88.29
30	The core company is expected to provide personal attention to partner farmers	4.50	Strongly Agree	90.00
31	Field Agents can be relied upon to pay attention to partner farmers	4.66	Strongly Agree	93.14
32	The Core Company is aware of the needs of its partner farmers	4.49	Strongly Agree	89.71
33	Field Agents can be contacted and are available to be contacted by partner farmers	4.69	Strongly Agree	93.71
34	Field Agents have good communication skills	4.63	Strongly Agree	92.57
35	The core company stores rearing records and evaluations of partner farmers well	4.73	Strongly Agree	94.57
36	When partner farmers encounter problems, the core company responds sympathetically and reassures partner farmers	4.37	Strongly Agree	87.43
37	Harvesting and selling live birds is fast and on time	3.74	Neutral	74.86
38	The core company is reliable and trustworthy	4.60	Strongly Agree	92.00
39	Feed from the core company is received one day before the arrival of DOC	4.63	Strongly Agree	92.57
40	Subsequent feed deliveries (second and third) are in accordance with the needs of broiler chicken farming	4.63	Strongly Agree	92.57
41	Medications are received a maximum of 7 days before the arrival of DOC	4.14	Strongly Agree	82.86
42	Partner farmers receive a summary of rearing results within a maximum of 7 working days after the final harvest	4.37	Strongly Agree	87.43
43	Payment for rearing results is made in less than 10 days	4.56	Strongly Agree	91.14
44	Incentives (FCR efficiency and market price difference) are provided according to the agreed agribusiness operational contract at the beginning	4.79	Strongly Agree	95.71
45	Calculation of rearing results is done according to the agreed agribusiness operational contract at the beginning	4.63	Strongly Agree	92.57
46	Field Agents make a minimum of two visits per week during the rearing period to provide technical guidance	4.07	Strongly Agree	81.43
47	Field Agents check the preparation of the coop carried out by partner farmers a maximum of one week before DOC chick-in	4.40	Strongly Agree	88.00
48	If there are complaints about the quality of DOC and feed, the core company responds quickly	4.19	Strongly Agree	83.71
49	Partner farmers can trust Field Agents as representatives of the core company	4.73	Strongly Agree	94.57
50	The health team arrives after partner farmers report complaints of disease occurrence	4.54	Strongly Agree	90.86
51	The core company provides fast and accurate service	4.47	Strongly Agree	89.43
52	Field Agents' responses to partner farmers are fast and on time	4.50	Strongly Agree	90.00
53	Field Agents provide technical assistance to partner farmers when needed	4.53	Strongly Agree	90.57
54	Partner farmers feel safe collaborating with Field Agents of Core Companies	4.68	Strongly Agree	93.62
55	Field Agents are friendly and polite	4.81	Strongly Agree	96.29
56	Field Agents receive adequate support from the core company to carry out their work in the field	4.60	Strongly Agree	92.00
57	Field Agents have good knowledge of contract schemes and broiler chicken farming technique	4.46	Strongly Agree	89.14

Based on Table 5, it can be observed that the indicator receiving the highest satisfaction index score in the Primary Product Function category is the normal and healthy growth of live birds, with a score of 79.71. Conversely, the indicator with the lowest satisfaction index score in the Primary Product Function category is the competitiveness of the contract scheme with competitors, scoring 77.71.

Moving on, the indicator achieving the highest satisfaction index score in the Product Reliability category is the number of day-old chicks (DOC) sent per box, totaling 100 chicks, with a score of 96.00. On the other hand, the indicator with the lowest satisfaction index score in the Product Reliability category is the additional bonus of 2% DOC per box to anticipate mortality during transportation, scoring 74.57.

Within the Endurance category, the indicator attaining the highest satisfaction index score is that the core company's feed should not expire during the rearing period, scoring 96.00. Conversely, the indicator with the lowest satisfaction index score in the Endurance category is the absence of broiler chickens being culled during the rearing period, scoring 64.00.

Furthermore, in the Facilities and Field Agents category, the indicator with the highest satisfaction index score is the friendliness and politeness of Field Agents, scoring 96.29. Meanwhile, the indicator with the lowest satisfaction index score in the Facilities and Field Agents category is the prompt and timely harvesting and sale of live birds, scoring 74.86.

4. Conclusions

In conclusion, the comprehensive study on broiler chicken production in Malang Regency provides valuable insights into both the technical efficiency of farmers and their satisfaction with the contract program. The analysis of the stochastic production function frontier reveals a commendably high level of technical efficiency, with the majority of farmers achieving levels close to 95%. While opportunities for improvement exist, particularly among those with lower efficiency levels, the study suggests that further enhancements may be constrained by the already high levels attained. Scaling up operations and embracing best-practice farming techniques, notably through contract farming, emerge as a potential avenue for further improving production and income in the region. Simultaneously, the satisfaction assessment of broiler chicken farmers participating in the contract program underscores a generally high level of contentment, with facilities and field agents receiving the highest satisfaction score of 89.89. While overall satisfaction is robust at 88.84, the study identifies areas for potential improvement, notably in enhancing the competitiveness of the contract scheme and addressing specific aspects of product reliability and endurance. These findings collectively emphasize the need for a holistic approach to enhance both technical efficiency and farmer satisfaction for sustained progress in broiler chicken farming in Malang Regency. Eventually, there is an opportunity for future research by conducting a comparative analysis of broiler chicken production and technical efficiency in Malang Regency with other regions in Indonesia or similar agricultural contexts. This could provide valuable insights into the unique factors contributing to success or challenges in this sector.

Acknowledgements

The authors express their gratitude to the University of Brawijaya for providing financing for the research and to the reviewers for their insightful comments that enhanced the quality of this paper.

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