Research Article

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Economic performance of smallholder soya bean production in Kwara State, Nigeria

https://doi.org/10.1515/opag-2022-0100
received August 31, 2021; accepted April 22, 2022

Abstract: Soya bean occupies a crucial space in solving the problem of poverty and food insecurity in sub-Saharan Africa (SSA), given the status of the crop as a multipurpose crop. Despite the enormous importance of this crop, the production is still very low in SSA, particularly in Nigeria. This study, therefore, examines the performance of soya bean production using technical efficiency as a yardstick for measuring performance. Primary data were collected with the aid of a structured questionnaire and scheduled interview from 100 soya bean farmers selected using a purposive sampling technique. The data were analysed using descriptive statistics, profitability analysis, and stochastic frontier analysis. The results reveal that the average age was about 45 years with close to 5 years of farming experience. The average household size in the study area was 5 with a mean farm size of 1.8 hectares. The net farm income was ₦37753.92k, while the average rate of return to investment (return per naira invested) was 1.49. The overall mean technical efficiency score was about 56%. This suggests that farmers are relatively efficient in general. There is, however, a gap to improve their farming operations through adequate training on seeds and agrochemical use because both contribute to their inefficiencies.

Keywords: economic performance, stochastic frontier analysis, soya beans, Kwara State

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1 Introduction

Agriculture in African countries has become the primary means of stimulating economic development, addressing food shortages, and reducing poverty. Most livelihoods in Africa depend on agriculture because aside from the provision of food for both humans and animals, it provides raw materials for industries. It also employs about 55% of the population in rural and urban settings [1]. With about 70% of the populace engaged in agricultural activities, the agriculture sector contributed 25.13% to Nigeria's gross domestic product (GDP) in 2018 [2].

The crop subsector is the highest and most important component of the agricultural sector, accounting for approximately 23% of the agricultural sector's 25% contribution to Nigeria's GDP in 2018 [2]. The crop sector is noted for food crops (such as yam, groundnut, and soya beans) and tree crops (such as cocoa and cashew). Soya bean is used in the formulation of poultry feed due to its high protein content, which is more than 40% [3]. It is also a significant source of income and grown for its oil and protein contents.

Soya bean is one of the most important crops for oil and protein; it contains 40% protein, while beans and peas contain only about 20% protein [4]. It accounts for 339 metric tons of the 578.7 metric tons of the total world oilseed production, which is approximately 59% of the total world oilseed production [5]. Soya beans constitute about 70% of total protein meal and 28% of total vegetable oil consumption behind oil palm [5]. Soya bean is used as medicinal food: to lower bad cholesterol and triglycerides, which are related to heart diseases. In addition, other studies have shown that the crop aids in blood glucose regulation and weight loss, and cures malnutrition [6,7]. Soya beans are rich in protein and fibre and have low cholesterol levels [8].

Soya bean-based foods are becoming increasingly common in sub-Saharan Africa (SSA), Nigeria inclusive [7]. Soya bean has been described as a crop with the potential to increase SSA household food and nutrition security. Soya bean was introduced to Nigeria in 1908, which is the second-largest producer of the crop in SSA, right behind South Africa [9]. Its production, which has steadily increased since 1987 from 40,000 tons to 680,000 tons in 2016, may be attributed to a better knowledge of the crop's potential to blend protein with carbohydrate sources as a suitable raw material replacement for vegetable oil, both as a concentrate complement for poultry and other livestock, and more recently as a bioenergy source [6,10].

Similarly, the development of home-level and small-scale processing technology for soya bean-based foods; the training of technical and extension staff, local farmers, and village leaders; the delivery of food processing technologies; and public and private sector investment have all resulted in increased use and consumption of soya-based food products [6]. Within the crop subdivision in Nigeria, soya bean is a major alternative to animal protein whose consumption is dwindling because of its unaffordability, given the fact that there is a deficiency in protein consumption in almost all the geopolitical zones of Nigeria.

Soya bean is grown in almost every state in Nigeria, with a higher concentration in the northern states, especially the north-central region. It grows well in Nigeria at a variety of planting dates if moisture is available [11]. Its output is predicted to produce more tonnage every year; however, the average yield per hectare remains below 1,000 kg despite significant public and commercial interest in the crop [12]. Nigeria's low soya bean yield can be attributed to the use of low-yielding varieties, the sparing use of fertilizers, and inconsistent government policies to subsidize the production of this crop [6]. In Nigeria, the potential of this crop, which is rich in both oil and protein, has not been fully maximized in the production of various forms of food products [13]. To blossom the production and productivity of this crop, the Kwara State Government launched an intervention programme known as Off-Takers Demand Driven Agriculture (ODDA). For many years, several intervention programmes have been implemented to reduce food poverty in Nigeria [14]; these laudable programmes have not achieved much as the Nigerian agricultural sector has not fared better than in pre-independence days when agriculture was the engine room of the Nigerian economy. There is, therefore, a need to investigate the performance of agricultural production under government intervention programme; this is necessary to unravel the factors that drive low productivity and inefficiency that characterizes Nigeria's agricultural production, particularly the crop subsector. This study chooses soya bean from the crop subsector because of its importance to food security and poverty alleviation attributes.

A plan for accelerating soya bean production efficiency in Nigeria should investigate the crop's potential by increasing farmer productivity, which will result not only in improved soya bean production and profitability but also in the country's long-term food stability [9]. Efficiency is an indicator of the economic performance of a business as it helps to recognize inputs that are responsible for the high efficiency of a business [15]. It has remained an important empirical topic, especially in developing countries where the majority of farmers are resource-poor [9].

Efficiency is affected by a considerable portion of the labour and input costs. As a result, there is a need to examine the technical efficiency and profitability of soya bean production.

Studies on the efficiency of a crop as important as soya beans are few in the literature: previous studies [10,15–20] assessed the technical efficiency of soya bean production; however, to the best of authors' knowledge, no study has provided empirical evidence of the efficiency of soya beans under any government intervention programme. This research, therefore, seeks to close this gap in knowledge by assessing the performance of soya bean production using profitability and technical efficiency as a yardstick for measuring the performance of soya bean farmers that benefited from the ODDA scheme in Kwara State, Nigeria. This study is therefore apt and seeks to provide answers to the following research questions:

i. Are farmers under the scheme profitable?
ii. What is the technical efficiency of the soya bean farmers' beneficiaries of this programme?
iii. What are the productive inputs driving farmers' efficiency or inefficiency?

Hence, this study examines the following specific objectives that are borne out of the questions raised above; the specific objectives are to:

i. Estimate the profitability of soya bean beneficiaries,
ii. Assess the level of technical efficiency of soya bean beneficiaries, and
iii. Investigate the drivers of technical efficiency of soya bean farmers under this scheme.

This study is relevant and novel as the implications from this study will go a long way in formulating workable and sustainable agricultural policy in Nigeria by identifying soya bean production inputs that are needed to improve the productivity of soya bean production.

1.1 ODDA scheme

ODDA is an intervention programme of the Kwara State established in 2017. It is formulated to drive employment in agriculture, boost food production, alleviate poverty, and improve standards of living while also diversifying the state's economy. The scheme provides seedlings, fertilizers, chemicals, and other farming tools and also matches farmers with off-takers. The programme is targeted at farmers who engage in the production of soya bean, cassava, rice, and maize. ODDA aims to make farming attractive to the youths, and it has disbursed about N1billion to over 1,000 farmers in the state and provided access to 2,550 hectares of land across the state.

1.2 Theoretical framework

In economic theory, the term "production efficiency" refers to the highest output that may be achieved given a combination of inputs and available technologies. The ratio of actual output to stochastic frontier output is regarded as production efficiency. A producer can produce the highest output (at the frontier) with a set of factors and technology [21]. However, individual production may differ due to personal, environmental, or institutional attributes, which may fall below the frontier.

Production efficiency could be assessed using either the parametric technique of stochastic frontier analysis (SFA) or the nonparametric approach of data envelopment analysis (DEA) from a theoretical and empirical standpoint. SFA accounts for random shocks in production activities [22]. DEA method, on the other hand, ignores measurement flaws and other types of statistical noise. Owing to this intrinsic advantage, and also taking into cognisance, smallholder farmers' production is prone to numerous random errors arising from factor use [23]. Furthermore, SFA is based on the unpredictable nature of agricultural production, which allows factors driving farmer technical inefficiency to be included in the model; hence, SFA was chosen for this study.

A general SFA form is as follows:

The output (y_i) by an ith producer is a function of input factor, vector of the associated coefficients (β), and the error term (ε_i), which is expressed as follows:

$$y_i = f(x_i\,;\beta)^{\varepsilon_i}. \tag{1}$$

ε_i is further discomposed into v_i and u_i .

$$\varepsilon_i = v_i + u_i, \tag{2}$$

where v_i is the symmetric random error accounting that controls for noise effects, and u_i is expressed as a function of external factors Z_i that influence the production efficiency.

$$v_i \sim N(0, \sigma_v^2), \tag{3}$$

$$u_i \sim F, \tag{4}$$

where v_i is independent and uniformly distributed across observations with a mean of zero and variance σ_v^2. Also, u_i is independent and identically distributed with truncation at zero ($N + (\mu, \sigma^2\mu)$). The non-negativity assumption of μ_i implies that the observations cannot be above the production possibility frontier and u_i follows the distribution F.

Equation (1) can be further expanded as:

$$\text{In}\, y_i = \beta_0 + \sum_{j=1}^{n}\beta_j x_{ij} + v_i + u_i, \tag{5}$$

where i = 1, 2, 3 … n and j = 1, 2, 3 … n are the number of producers, In is the natural logarithm, y_i is the output, and x_i is the vector of factors of production.

Equation (6) depicts the functional form of technical inefficiency, which is influenced by a variety of socioeconomic and farm-specific factors:

$$u_i = f(z_{ji}), \tag{6}$$

where $u_i = (1 - \text{TE}_i)$, which is the technical inefficiency of the ith producer, and z_{ji} is the set of exogenous factors, which are vector inefficiencies such as age, sex access to credit, education level, and household size.

SFA is estimated using equation (5) and the maximum-likelihood estimation (MLE) technique, where the likelihood function is expressed in terms of the variance parameter [24–26]:

$$\sigma^2 s = \sigma^2\varepsilon + \sigma^2 u;\ y = \frac{\sigma^2 u}{\sigma^2 s} \text{ and } 0 \le y \ge 1, \tag{7}$$

where $\sigma^2 s$ represents the output variance owing to changes in random shock and inefficiency. If the value of y = 1, there is complete inefficiency, and if the value of y = 0, there is no technical inefficiency [26].

2 Research methodology

2.1 Area of study

This research was conducted in Kwara State, Nigeria. Kwara State is located in Nigeria's north-central geopolitical region. It covers approximately 32,500 km^2 and has a population of 2,371,089 inhabitants [27]. The state is bordered by Niger State to the north, Osun and Ondo States to the south, Kogi State to the east, and Oyo State to the west. Kwara State shares an internal boundary with the Republic of Benin [28]. More than 80% of its population is engaged in farming. The state's main mineral resources are limestone, feldspar, kaolin, clay, granite, quartz, and tantalite [29].

2.2 Sampling procedure and sample size

The study respondents were chosen using a purposive sampling methodology, which involved the selection of two local government areas (LGAs) from Zone C agricultural development project zones based on the predominance of soya bean farmers in the two LGAs. The two LGAs chosen are Moro and Ilorin East LGAs. Five villages were selected each from the two LGAs: Oke-Ose, Onikoko, Onimomo, okeoyi, and Oshin from Ilorin East LGA, while Logun, Malete, Marafa, Obalaja, and Obale from Moro LGA. Finally, ten farmers that benefited from the intervention were selected at random from each village, giving a total of 100 respondents.

2.3 Data collection

Primary data were used for this study. The data were obtained by administering a well-structured questionnaire coupled with a scheduled interview to collect requisite information from the respondent. Farmers' socioeconomic characteristics (age, household size, educational status, amount of credit received, number of extension contacts, and number of years spent as cooperative members) and production characteristics data (level of inputs and output) among others were collected.

2.4 Analytical techniques

The data gathered were analysed using descriptive statistics, profitability analysis, and SFA.

2.5 Profitability analysis

Following previous studies [30–35], the net farm income (NFI) was used to estimate the profitability of soya bean farmers. Below is the formula for net farm profits:

$$\text{NFI} = \text{TR} - \text{TC}, \tag{8}$$

where NFI is the net farm income (₦), TR is the total revenue (₦), and TC is the total cost of production (₦).

$$\text{TC} = \text{TVC} - \text{TFC}, \tag{9}$$

where TVC is the total variable cost (₦), and TFC is the total fixed cost (₦).

$$\text{RI} = \frac{\text{TR}}{\text{TC}}, \tag{10}$$

where RI is the return to investment.

Decision rules:

When RI > 1, it implies farmers are making profit.
When RI = 1, the farmers are at breakeven.
When RI < 1, the farmers are at a loss.

2.6 The SFA model

To assess the technical efficiency of soya bean farmers, the MLE technique was used to calculate the Cobb–Douglas output frontier function. SFA is defined as follows:

$$\begin{aligned} \text{In } y_i &= \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 \\ &\quad + \beta_5 x_5 + \varepsilon_i , \end{aligned} \tag{11}$$

where ln represents the natural logarithm, y_i indicates the output of soya beans (kg), β_0 is the constant, β_1–β_5 are the regression coefficients, x_1 indicates the farm size (hectares), x_2 represents the quantity of seeds (kg), x_3 represents the fertilizer (kg), x_4 indicates the total labour employed (man hours), x_5 indicates the agrochemical volume (litres), and ε_i is the composed error term.

To estimate the determinants of technical efficiency, socioeconomic characteristics were incorporated into equation (6) to estimate the determinants of the farmers' technical inefficiency.

$$U_i = \partial_0 + \partial_1 Z_1 + \partial_2 Z_2 + \partial_3 Z_3 + \partial_4 Z_4 + \partial_5 Z_5, \tag{12}$$

where U_i is the ith farm's technical inefficiency, Z_1 represents the farmer's educational level in years, Z_2 represents the household size (number), Z_3 indicates the farmer's age in years, Z_4 represents the years of farming experience, Z_5 represents the membership in cooperative society, ∂_0 is the constant, and ∂_1–∂_5 are the parameters to be estimated.

3 Results and discussion

The data in Table 1 present the socioeconomic characteristics of soya bean farmers. About 77% of the sampled farmers are male. This may be because women are more into processing and marketing than production. Following Ilona et al. [36], women dominate (75%) the food processing and marketing sector. The average age is about 45 years, which implies that the farmers are still in their active years and are physically fit: they can actively cope with rigours associated with farming activities. This result agrees with the findings of previous studies [15,37,38] that the mean age of Nigerian farmers ranges between 45 and 48 years and that this age group forms the active work life. Most of the farmers are educated; this finding follows the study by Yegon et al. [15] and Ochepo [39] but negates the study by Shaib et al. [40], who reported that low literacy level of farmers limits agricultural revolution in Central Nigeria. The farmers have about 5 years of farming experience. Chewaka et al. [41] reported that the average years of farming experience related to soya bean production was 5 years. The average household size in the study area is 5, which suggests that soya bean farmers can leverage the relatively large family to use as labour on their farms. Okoro et al. [42] affirmed that many farm families take advantage of their household sizes as farm labour to increase production and maximize profits. The average farm size is 1.8 hectares, indicating that the majority of farmers in this study area cultivate a small area of land, which qualifies them as smallholder farmers [43,44]. This result is in tandem with that of the study by Moses [17], who affirmed that farm size plays a huge role in the output of the farmer.

3.1 Costs and returns analysis

The survival of a business is a function of the amount of profit realized at a given time. Profit is calculated as the difference between the economic value of goods produced and the expense incurred on the resources utilized to make them. The sum of revenue generated and the running costs of a business enterprise determine how much profit or loss the enterprise can make over time. The profitability analysis, which was used to evaluate the profitability of soya bean production, is presented in Table 2.

The average cost of soya bean seeds used per hectare is ₦5,750, accounting for about 8% of the overall production costs. The estimated cost of fertilizer used is ₦10848.49, which stands at 15% of the overall production costs. The average cost of agrochemicals constitutes 8% of the total cost of production. The labour costs consist of the cost of land preparation, planting, fertilizer and insecticide application, weeding, harvesting, and processing. Labour is obtained from both relatives and employed sources. The average labour cost per hectare is ₦46985.96, accounting for 65% of overall production costs, while the total cost of fixed inputs (land rental and tool depreciation) incurred on soya bean production is ₦2,256, accounting for 3% of total costs. Labour cost constitutes the largest chunk of the cost of production, while fixed input cost accounts for just a meagre part of the total cost of production. This result corroborates the findings of Ogunjinmi et al. [44] that soya bean production requires a lot of labour.

NFI is calculated by the product of average yield (kg) and the selling price in naira, which is 130/kg.

Table 1: Respondents' socioeconomic characteristics

Socioeconomic characteristics	Frequency	Socioeconomic characteristics	Mean and standard deviation
Gender		Experience	5.230 (±7.400)
Female	23	Farm size	1.820 (±0.845)
Male	77	Household size	5.440 (±3.013)
Level of education		Age	44.80 (±8.119)
No formal education	4		
Primary education	7		
Secondary education	41	Number of observations (*n*)	100
Tertiary education	48		
Association			
Yes	42		
No	58		

Table 2: Average costs and returns per hectare of soya bean production

Variables	Values/ha (₦)	% Cost
Variable cost		
Seed (kg)	5750.00	7.97
Fertilizer (kg)	10848.49	15.03
Agrochemical (L)	6073.76	8.42
Labour (man/day)		
Land clearing and preparation	6329.56	8.77
Planting	4546.25	6.30
Weeding	6404.97	8.86
Fertilizer application	2655.20	3.68
Agrochemical application	2100.67	2.91
Harvesting and processing	24949.32	34.57
Marketing cost	251.27	0.35
Total variable cost	**69909.48**	
Fixed costs		
Cost of renting land	2000.00	
Depreciation of tools	256.00	
Total fixed cost	**2256.00**	
Total cost	**72165.48**	**100**
Average yield (kg)	**828.180**	
Total revenue	**107663.40**	
Net farm income	**37753.92**	
Return to investment	**1.49**	

Table 3: Maximum probability estimates of the determinants of technical efficiency in soya bean production in Kwara State

Variables	Coefficient	Standard error	*T*-ratio
Constant (β_o)	5.4798	1.4437	3.7956***
Size of farm (X_1)	0.9972	0.2664	3.7424***
Quantity of seed (X_2)	−0.3300	0.0953	−3.4633***
Fertilizer quantity (X_3)	0.1452	0.1573	0.9236
Labour used (X_4)	0.3386	0.0103	32.974***
Volume of agrochemicals (X_5)	−0.0117	0.1064	−0.1097
Inefficiency model			
Constant (δ_0)	0.1003	0.1427	0.7029
Educational level (Z_1)	−0.0169	0.0090	1.8601*
Household size (Z_2)	−0.0120	0.0062	−1.9118**
Age (Z_3)	0.0059	0.0021	2.8985***
Farming experience (Z_4)	0.0011	0.0027	0.3905
Cooperative society (Z_5)	0.1050	0.03826	2.7450***
Variance sigma-squared (σ^2)	0.05191	0.0061	8.4663***
Gamma (γ)	0.9999	0.0028	354.064***
Log-likelihood function	7.5050		
LR test	12.9215		

n = 100; ***, **, * mean significant at 1, 5, and 10% levels, respectively.

3.2 Return on investment in soya bean production

The total revenue is ₦107663.40k, while the total cost (TVC + TFC) is ₦72165.48k, according to the results in Table 2. As a result, the NFI is ₦37753.92k. The average rate of return on investment (return on investment per naira invested) is 1.49, which means that for every ₦1 invested in soya bean production in the study zone, a profit of 49 kobo was made. Consequently, it can be inferred that soya bean production is lucrative in the study region with a return of 49 kobo for every naira invested. The results concur with the findings of previous studies [16,44–47]; these studies were undertaken in Nigeria and other West African countries. Their results revealed that soya bean production by smallholder producers was a profitable enterprise.

3.3 Technical efficiency

Table 3 shows the MLE of the Cobb–Douglas stochastic frontier production function of soya bean farmers in the study area. Results in the table show that the estimated sigma-squared (σ^2) is 0.052 and is statistically significant and different from zero at 0.01 level. This indicates a good fit of the model and the correctness of the specified distributional assumptions of the composite error term. The estimated gamma (γ) is 0.99 and is significant at 1% range, which means that inefficiency effects exist. The results suggest that about 99% of the variation in soya bean output among the farmers in the study area is due to the differences in their technical efficiencies.

3.4 Determinants of technical efficiency

The determinants of technical efficiency (factors influencing technical efficiency) as shown in Table 3 are discussed in the following paragraphs.

Farm size (X_1): The estimated coefficient of farm size is positive and significant at 1%, which implies that there is a positive relationship between the farm size and technical efficiency. It follows that a 1% improvement in farm size results in a 99% increase in soya bean output. This may be because larger farm sizes promote the adoption of innovations that can result in higher yields. This result supports the findings of previous studies [15,17,44,27,48,49] that farm size has a positive and significant relationship with soya bean yield, but contradicts with those of previous studies [10,45,50,51].

Quantity of seed (X_2): The coefficient of the quantity of seed is negative and significant at 1%. This implies that the quantity of seed used has an inverse relationship with the technical efficiency of production; this also means that the greater the number of seeds used by the farmers, the lower the output as presented in Table 3. This may be due to inappropriate use of seed per hole, spacing, and quality seeds among other factors. The output will be poor even if other inputs are in sufficient or adequate proportions, while the quality of the seeds is poor. This is supported by Yegon et al. [15]; however, the quantity of seed was not significant in their study. This finding is not in agreement with those of previous studies [17,45,46,52,53], which reported seed as a booster of soya bean efficiency.

Labour used (X_4): The coefficient of labour used is positive and significant at 1%. This shows that the quantity of labour used has a positive impact on soya bean performance. As the quantity of labour used in soya bean farming increases, so does the output of soya beans. This finding is in tandem with the findings of previous studies [18,19,44] that a positive significant relationship existed between labour and the output of soya beans. However, it contradicts with findings of previous studies [15,49], which showed that labour used to lessen the technical efficiency of soya bean farmers.

Technical inefficiency: As seen in Table 3, the coefficients of age and cooperative membership are positive and statistically significant at the 1% level. The aforementioned findings show that the increase in age and cooperative membership tend to result in a corresponding decrease in soya beans farmers' performance. This could be because the older a farmer becomes, the less productive the farmer. Farmers' decisions are also influenced by their age because older farmers tend to be more risk-averse than younger farmers who are risk-takers. Physical strength is essential for the agricultural production process, which is also on the decrease among older farmers. The decline in strength after middle age necessitates a greater investment of labour in the same production activity. According to the study by Guo et al. [54], increasing age is not favourable for improving agricultural output. This is in agreement with the studies by Biam et al. [10] and Yegon et al. [15] but contradicts with the studies by Moses [17], Nyongesa et al. [46], and Shalma [55].

Cooperative membership leading to a decrease in soya bean production could be because being in a cooperative requires some commitment such as time and finance. This could affect farmers' productivity one way or the other. This result agrees with the findings of Moses [17] and Ugbabe et al. [45]; however, this contradicts the findings of previous studies [10,15,18,56] that farmers who are members of a cooperative are more likely to be more efficient. Household size and education level are negative and significant at 5 and 10%, respectively. However, years of farming experience are positive but not significant. The increase in household size and level of education tend to result in a corresponding increase in farmers' technical efficiency. An increase in the number of individuals in a household contributes to an increase in farmer technical production by the use of the family members as labour, thereby cutting on labour and improving productivity. As a result, those with higher household sizes are more technically efficient than those with smaller household sizes. This result is affirmed by that of Asodina et al. [19] but opposed to the results by Biam et al. [10] and Moses [17], who reported that household size limits the level of efficiency of soya bean farmers. An increase in educational level could lead to an increase in technical efficiency. This could be because education creates an edge for an individual by exposing such an individual to knowledge and application of the knowledge. This is consistent with the findings of previous studies [10,15,18,19,44,57] that an increase in years of schooling contributes to the technical efficiency of the farmers because they can easily adapt to innovation and improved technology.

3.5 Efficiency scores

Data in Table 4 revealed that the mean technical efficiency was 56%; according to previous studies [17–19], the mean technical efficiency recorded by soya bean farmers were 66, 73, and 59%, respectively. This suggests

Table 4: Efficiency scores of soya bean farmers

Efficiency scores	Frequency	Percentage
021–040	7	7.00
041–060	65	65.00
061–080	21	21.00
081–100	7	07.00
Total	100	100.00
Maximum	0.990	99.00
Minimum	0.255	26.00
Mean	0.559	56.00

that farmers under this scheme are not as efficient as they ought to be and there is still room to increase their technical performance by 44%. This means that there is an efficiency gap that needs to be filled. This could be bridged by training programmes, effective extension-farmer relationships, and so on.

4 Conclusion

The key issue that is addressed in this article is the economic performance of soya bean farming under the ODDA subsidy programme in Kwara State using profitability and technical efficiency as a measure of economic performance. Soya bean farmers are chosen for this research because of the importance of the crop; it is documented in the literature that the crop can help reduce food and income poverty, which is very high in Nigeria. Moreover, it is pertinent to investigate the impact of government subsidy on the technical efficiency of farmers, considering that many policy programmes have been implemented in Nigeria, which yielded little or no result; therefore, it is necessary to evaluate the technical efficiency of farmers under an intervention programme and to guide future subsidy programme or policy on the areas to improve on to achieve the maximum result. This article contributes to the literature by providing answers to the research questions of the level of technical efficiency and the drivers of technical efficiency of soya bean farmers under a subsidy programme in Nigeria.

According to the findings of this research, soya bean production is a profitable venture with good profit recorded per hectare of land cultivated. The main inputs influencing soya bean production in the study area have been identified as labour, seeds, fertilizer, and agrochemicals. As a result, these supplies must be made available to farmers on time, in sufficient or adequate quantity, and at reasonable prices. Furthermore, the average technical efficiency is calculated to be 0.56, meaning that farmers have a substantial opportunity to improve their efficiencies by 0.44. Farmers' performance can be enhanced by better use of farm size, labour, and seeds. It is also suggested that farmers in the study area receive adequate training on seed per hole, fertilizer application, and agrochemical use.

The implications stemming from this research are detailed in the following paragraphs.

Farmers can be more profitable, if the drivers of efficiency are taken into cognizance in the formulation of future agricultural policy; for example, farm size from the analysis has a positive influence on the efficiency of soya bean farmers, and this suggests that future agricultural policy should be designed in such a way that it will help smallholder farmers to expand their scale of production by increasing their farm size, which will further help to address the issue of food security and income poverty, which are key sustainable development goals.

Quantity of seed is found to be negatively related to technical efficiency; this implies that the seed usage has not been maximized by the farmers probably because it is subsidized; therefore, it is essential to incorporate training of the farmers on maximal input use in input subsidy scheme development.

Also, future agricultural policy programme should look at ways of attracting young people into agricultural production; estimates from the research show that age had a positive influence on technical inefficiency, which suggests that younger farmers are more technically efficient than older farmers.

Some of the limitations encountered during this study were the accessibility of the beneficiaries of the scheme due to the remoteness of their fields; this accounted for the relatively low sample size of the respondents. Furthermore, most farmers were circumspect about inquiries concerning their farm input, assistance received, etc., for fear of the information being exploited and used against them. The study is limited to Kwara State due to funding constraints as the research is not funded by funding agencies; rather, it is funded from the personal income of the researchers. The authors, therefore, recommend that further research should focus on other soybean production on a national or regional scale. It will also be interesting to do a comparative study of the economic performance of soya bean production between beneficiaries and nonbeneficiaries of a subsidy programme.

Funding information: The authors state no funding is involved.

Conflict of interest: The authors state no conflict of interest.

Data availability statement: The datasets generated during and/or analysed during the current study are available from the corresponding author on a reasonable request.

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