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ANALYSIS OF EFFECTS OF TRANSPORTATION COSTS ON SOYABEAN PRODUCTIONAMONG RURAL FARMERS IN MAKURDI LOCAL GOVERNMENT AREA OF BENUE STATE, NIGERIA

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ABSTRACT

The study analyzed effects of transportation costs on soybean production among rural farmers in Makurdi Local Government Area of Benue State, Nigeria. A multi-stage sampling technique was employed to select 100 respondents for the study. Data were collected through structured questionnaire and analyzed using descriptive statistics, farm budgeting model and multiple regression analysis. The results of the socio-economic characteristics of soybean farmers showed that majority (59%) of the respondents were males. Majority (83%) of the respondents were married and 88% largely literate and most (53%) of the respondents had household size of 6-10 members. The result of causes of transportation costs variation revealed that, increasing cost of fuel (14%) was the leading cause of variation in transportation cost variation in the study area. The costs and returns analysis showed that soybean farmers earned an average gross return per hectare was ₦1,540,000. The total variable costs per hectare was ₦571,500, fixed costs per hectare was ₦60,000. The total cost of producing soybean in the study area per hectare was ₦ 631,500. The net farm income and gross margin per hectare were ₦ 908,500 and ₦ 968,500, respectively. The return on investment showed that for each Naira invested, there was a 144 percent rate of return, indicating that for every ₦1 invested in the soybean production, will bring ₦1.44k. The result of the multiple linear regression analysis revealed that distance to the market, prices of seeds and prices of pesticides/herbicides were also significant at (P≤0.10), while fuel prices (P≤0.01) and hired labour were significant (P≤0.05) . The study concluded that increasing cost of fuel was the major cause of variation in transportation costs variations in the study area. It was recommended that government should ensure adequate maintenance of the existing roads as this will reduce the cost of transportation. Also, government should subsidize fuel in order to reduce transport cost and variable costs of production leading

to improved soybean production and farm income.

Keywords: *Analysis, effects, cost, production, soybean, transportation.*

1.0 Introduction

Soybean (*Glycine max*) is a leguminous vegetable crop of the pea family that grows in tropical, subtropical and temperate climates. Soybean was introduced to Nigeria in 1908, but extensive production only began in 1937 using the 'Malayan variety' found suitable in Benue State. Soybean production in Nigeria has attained about 850,000 metric tonns per year, which is still not sufficient to reach and satisfy the high domestic demand of the produce to attenuate soybean importation in the country. The domestic demand for soybean is about 1.275 million metric tonnes: there is a shortfall in production of soybean in Nigeria even though Nigeria was ranked the largest producer of soybean in Africa (Amesimeku and Anang, 2021). Soybean is a multipurpose crop and its importance ranges from its use in milk production, oil processing, livestock feeds, medical, industrial and human consumption and more recently, as a source of bio-energy (Omoigui *et al*., 2020).

Many leguminous crops provide some protein, but soybean is the only available crop that provides an inexpensive and high-quality source of protein comparable to meat, poultry and eggs (IITA, 2024). Ukaoha *et al*. (2022) asserted that every person is expected to consume 71grams of protein daily. Soybean also improves soil fertility by fixing nitrogen from the atmosphere. This is a major benefit in African farming systems, where soils have become exhausted by the need to produce more food for increasing populations, and where fertilizers are hardly available and are expensive for farmers (IITA, 2024). Transportation affects agricultural production including soybean production. Improved transportation reduces travel time, thereby increasing the time

available for other economic and social activities, while also promoting access to basic facilities. Transportation enhances agricultural production in terms of evacuation of food stuff from remote areas to the cities.

The importance of transport arises from its role as one of the principal factors affecting the location and distributions of economic and social activities. Large percentage of farmers trek to and fro farms everyday, even when facilities are available, because many of them barely afford such services because of low income earned. However, some privileged ones among them use bicycles, motorcycles and other public means. Fares for farmers and their produce are considerably high and increasing everyday as reflected by economic trend on oil products. High transportation cost has been found associated with less agricultural production and lower profitability. It reduces the revenue received by farmers in remote areas and increases the cost of inputs such as fertilizer, labor and machinery, resulting in lower than optimal yield (Zhan *et al.,* 2022).

Some research works had been conducted on soybean production in Nigeria and other parts of the world. For instance, Rasaki *et al.* (2020) worked on economics of Soybean production in Ibarapa zone of Oyo State, Nigeria. Samuel and Idris (2021) analyzed the economics of soybeans production in Taraba State, Nigeria. Ukaoha *et al*. (2022) evaluated profit efficiency of soybean production in the Federal Capital Territory, Abuja, Nigeria. However, only little studies were conducted on soybean production among rural farmers in Makurdi Local Government Area of Benue State, Nigeria. Thus, there is still a gap in the literature that must be filled.

2.0 Objectives of the Study

The broad objective of this study was to analyze effects of transportation costs on

soybean production among rural farmers in Makurdi Local Government Area of Benue State, Nigeria. The specific objectives were to:

i. describe the socioeconomic characteristics of soybean farmers in the study area.

ii. ascertain the causes of variation in transportation costs in the study area;

iii. estimate the costs and returns of soybeans production amid variation in transportation costs and

iv. determine effects of variation in transportation costs on soybean production.

3.0 Methodology

3.1 The Study Area

The study was conducted in Makurdi Local Government Area of Benue State, Nigeria. The LGA is situated on the South Bank of the Benue River. It is bordered by Guma LGA in the North and East, Gwer West LGA in the West and Gwer East LGA in the South. Makurdi LGA lies on Latitude 7^0, 44' 1.50" N and Longitude 8^0, 31' 17.00" E. It has a land area of 804km^2 and a population of 300,377 million, which is made up of 237 154,138 male and 146,239 female (NPC, 2006).

Makurdi LGA has annual rainfalls of 1,300 - 1,500mm and average annual temperatures are high, fluctuating between 28^0C and 32^0C. The major ethnic groups in Makurdi LGA are the Tiv, Idoma, Igede and Etulo. Others are Jukun, Agatu, Alagbo, Igbo, Yoruba, Hausa, Fulani and Nupe. The Town is a local trade centre for yams, sorghum, millet, rice, cassava, sesame oil, groundnuts, soybeans and cotton raised by the Tiv, Idoma and Igede people of the surrounding area.

Sampling Technique and Sample Size

A multi-stage sampling technique was employed for the selection of 100 respondents as sample size. In the first stage, five (5) council wards: North Bank I,

Mbalagh, Fiidi, Bar, and Agan were purposively chosen largely due to intensity in soybean production. In the second stage, soybean farmers were randomly selected from

Table 1: Sample Size Selection Procedure

Council wards	Sampling frame	Sample Size (0.5)
Fiidi	38	19
Mbalagh	42	21
North Bank I	40	20
Agan	42	21
Bar	38	19
Total	200	100

Source: Field Survey (2024).

Method of Data Collection

The data for this study were obtained mainly from primary sources. The primary data were collected through structured questionnaire:

Method of Data Analysis

Data for this study were analyzed using both descriptive and inferential statistics. The descriptive statistical tools such as means, frequencies and percentages were used to analyze objectives 1 and 2, budgeting technique was employed to analyze objective 3, while multiple regression model was used to analyze objective 4.

Model Specification:

Multiple regression analysis

The multiple regression analysis was used to determine effects of variation in transportation costs variation on soybean production. The equation is expressed explicitly as:

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + e$$

Where,

Y = Soybean output (Kg)

X_1= Transportation price (N)

X_2 = Price of fertilizer (N)

X_3 = Distance to the market (Km)

X_4= Price of seeds (₦)

X_5 = Price of pesticides/herbicides (₦)

X_6 = Fuel price (₦)

X_7 = Hired labour (loading and off-loading) (₦)

e = error term

b_0 = Intercept

bs = Coefficients to be estimated

Farm Budgeting Model

The profitability of soybeans production was assessed using the gross margin analysis and net farm income. Gross margin analysis was calculated as the difference between Total Revenue (TR) and Total Variable Costs (TVC) of soybeans production amid transportation price variation. The model was expressed as:

GM = TR - TVC … (1)

Where,

GM = Gross margin measured in Naira/hectare

TR = Total revenue or Total value of production (TVP) measured in Naira/hectare

TVC = Total variable cost (Naira/hectare)

Net Farm Income (NFI) represents the difference the total revenue (TR) and total cost (TC) of the soybean's farmers. It was computed as:

NFI = TR – TC … (2)

Where,

NFI = Net farm income

TR = Total revenue (quantity of soybeans harvested x unit price).

TC = Total cost (Total variable cost + total fixed cost)

RRI = NFI/TC X 100 … (3)

Where,

RRI = Rate of return on investment
NFI = Net farm income
TC = Total cost

4.0 Results and Discussion

4.1 Socio-economic Characteristics of Soybean Farmers

Table 2, shows that about 28% of the respondents fell within the age group of 31-40 years. This implies that the respondents were still in their economically working and productive ages. This result is in line with Samuel and Idris (2021) that the soybean farmers were within active and productive years in Taraba State. Majority (59%) of the Soybean farmers were males. This indicates a male dominance in Soybeans production in the study area. The implication of this result is that, Soybeans production is more tasking and rigorous, and is done mostly by males, while the females are probably encumbered with domestic activities which, are less energy-consuming. This result is in line with Ukaoha *et al*. (2022) who stated that majority of the sampled Soybean farmers in the Federal Capital Territory were males.

Majority (83%) of the Soybean farmers were married. This means that the married people in the area used the labour of their children in running the business. This result is in line with the finding of Samuel and Idris (2021) who stated that majority of the soybean farmers in Taraba State were married. The results also showed that most (53%) of the Soybeans farmers had 6-10 household members. This implies the availability of labour for production activities. This result disagrees with the finding of Ukaoha *et al*. (2022) that majority of the sampled Soybean farmers in the Federal Capital Territory had a household size ranged from 1-5 persons. The result revealed that majority (88%) of the respondents had formal education. This implies that majority of the Soybean farmers were largely literate. This result is in line with Ukoha *et al*. (2013) that a better education

through improved extension service would lead to improved access to credit, knowledge and improved farm technologies, farm tools etc. which has strong influence on increased productivity.

About 47% of the respondents had farming as their main occupation. The results on the years of experience of the Soybeans farmers showed that majority (71%) of the Soybeans farmers had a farming experience of not more than 10 years. Experienced farmers can adopt the best production systems to maximize output and reduce costs. The result also revealed that about 41% of the Soybeans farmers had a farm size within the range of 1.1−2 hectares. This result implies that the Soybeans farmers were smallholder farmers. This result is in line with Ukaoha *et al*. (2022) that majority of the sampled soybeans farmers in Federal Capital Territory had a farm size of 1−2 ha.

Table 2: Distribution of Respondents by their Socio -Economic Characteristics (n=100)

Variables	Frequency	Percentage
Age (Years)		
≤ 30	21	21
31 – 40	28	28
41 – 50	27	27
> 51	24	24
Sex		
Male	59	59
Female	41	41
Marital Status		
Single	15	15
Married	83	83
Divorced	1	1
Widowed	1	1
Household Size (Members)		
≤ 5	41	41
6 – 10	53	53
≥11	6	6
Educational Status		
Primary	13	13
Secondary	46	46
Tertiary	31	31
No Formal	12	12
Main occupation		
Farming	47	47
Trading	30	30
civil servant	23	23
Farming Experience (Years)		
≤10	71	71
11-15	15	15
≥16	14	14
Farm size (ha)		
≤ 1	33	33
1.1 – 2	41	41
2.1 – 3	17	17
Above 3	9	9

Source: Field Survey (2024)

4.2 Causes of Variation in Cost of Transportation

The result of the causes of transportation cost variations that affect soybean production in the study area was presented in Table 3. The result revealed that increasing cost of fuel (14.8%) was the leading cause of transportation cost variation in the study area. This result agrees with Savic *et al.* (2020) that transport costs over time have a tendency to grow due to rising fuel costs among others. The result also agrees with Aina *et al*. (2015) that the major negative impacts of fuel price increase are identified as increased transportation cost, double digit inflation, higher price of food and essential services.

Table 3: Causes of variation in Costs of Transportation in the Study Area (n=100)

Variables	*Frequency	Percentage
Increasing cost of fuel	99	14.8
Fuel scarcity	78	11.6
Poor state of the roads	92	13.7
Taxes paid by drivers	89	13.3
Multiple checkpoints	85	12.7
High cost of vehicles spare parts	81	12.1
Increasing employee salaries in transport	77	11.5

Source: Field Survey (2024) *Multiple Responses

4.3 Profitability of Soybean Production amid Variation in Cost

The profitability of soybean production was estimated using costs and returns analysis as shown on Table 4. The total variable cost for soybeans production was N 571,500 per hectare, while the total fixed cost was N 60,000 per hectare, giving a total cost of N 631,500 per hectare. The total revenue stood at N 1,540,000 per hectare. The gross margin and net farm income were N968,500 and N 908,500 per hectare, respectively. It was revealed that soybean production was profitable as depicted by the net farm income of N908,500. The soybean production would have been more profitable in the study area, if the variable costs were not inflated by increase in transportation cost

due to fuel price hike. Also, the return on a naira invested was N 1.44k. This implies that, for every N1 invested, 44k was return and as profit. Moreover, the return to naira invested has a positive sign, indicating profitability of soybean production. This finding aligns with Rasaki *et al.* (2020) that soybean production was profitable in Ibarapa zone of Oyo State, Nigeria.

Table 4: Costs and Returns of Soybean Production amid Variation in Transportation Costs

Variables	Price (₦)/Unit	Quantity used	Amount (₦/ha)
Variable costs			
cost of Seed (kg)	800	150	120,000
cost of Fertilizer (bags)	37,500	4	150,000
cost of Pesticides (Litres)	6,450	10	64,500
cost of Herbicides (Litres)	6,500	10	65,000
cost of Labour (manday)	20,000	2	40,000
cost of Transport (in bags)	6,000	22	132,000
Total Variable Cost (TVC)			571,500
Fixed cost			
Rent on land (₦)	60,000	1 ha	60,000
Total fixed cost (TFC)			60,000
Total Cost (TC)			631,500
Total Revenue (TR)	70,000	22bags (100kg)	1,540,000
Net Farm Income (NFI)			908,500
Gross Margin (GM)			968,500
Rate of Return on Investment (RRI)			144% (₦ 1.44)

Source: Field Survey (2024).

4.4 Effects of Transportation Cost Variations on Soybeans Production

The result of the multiple linear regression analysis for the effects of variation in transportation costs on Soybean production was presented on Table 5. The value of the coefficient of determination (R^2) was estimated at 0.527, which implies that about 52.7% of the variation in the output from Soybean production was explained by the explanatory variables included in the model, while the remaining 47.3% was as a result of omission of important explanatory variables as well as errors in estimation. The F-value of 14.65 (P = 0.000) indicates the overall significance of the model, thus confirming the appropriateness of the relationship between the dependent variable and the independent variables. Table 5 revealed that distance to the market, price of seeds, prices of

pesticides/herbicides, fuel prices and labour were significant.

The coefficient of distance to the market (-2.821) was negative and significant at 10 percent level. This result implies that an increase in the distance to the market, will lead to a decrease in the Soybean output. Transportation cost increases with increase in distance to the factor market. Sanchi *et al*. (2022) reported that high transportation cost increases the cost of inputs, leading to a decrease in input acquisition and low productivity in crop farming. The coefficient of cost of seeds (1.123) was positive and significant at 10 percent level. This result implies that an increase in the cost of seeds, will lead to an increase in the soybean output. This is possible if the seeds are improved, and the economics of scale in use of agrochemicals and machineries. Girei *et al.* (2018) found that an increase in the use of seeds (irrespective of the cost) increased soybean production in Doma Local Government Area of Nasarawa State, Nigeria. The coefficient of cost of pesticides/herbicides (36.39) was positive and significant at 10 percent level. This result implies that an increase in the cost of pesticides/herbicides will lead to an increase in the soybean output. This result agrees with Ukaoha *et al*. (2022) that an increase in chemical application (irrespective of the cost) increased soybeans output in Federal Capital Territory, Abuja, Nigeria.

The coefficient of fuel price (9.106) was positive and statistically significant at 1 percent level. This result implies that an increase in the fuel price will lead to an increase in the soybean output. This result disagrees with Sanchi *et al*. (2022) that high transportation cost increases the cost of inputs, leading to a decrease in input acquisition and low productivity in crop farming. The coefficient of labour (-1.149) was negative and significant at 5 percent level. This result implies that an increase in the labour will lead to a decrease in the Soybean output. The result disagrees with Ukaoha *et al*. (2022) who stated

that an increase in labour supply (both hired and family labour), increased Soybeans output in Federal Capital Territory Abuja, Nigeria.

Table 5: Effects of Transportation Cost Variation on Soyabean Production

Variables	Coefficient.	Standard Error	t-value	p-value
Constant	-44.84	10.41	-4.308	0.000***
Transportation cost	0.489	0.335	1.4627	0.147
Cost of fertilizer	-1.702	1.582	-1.076	0.285
Distance to market	-2.821	1.623	-1.738	0.086*
Cost of seeds	1.123	0.586	1.917	0.058*
Cost of herbicides	36.39	21.31	1.707	0.091*
Fuel price	9.106	2.216	4.109	0.000***
Labour	-1.149	0.576	-1.997	0.049**
R square	0.527			
Adjusted R	0.491			
F-test	14.65			0.000***

Source: Field Survey (2024) *** p<.0.01, ** p<.0.05, * p<.0.10

5.0 Conclusion and Recommendations

5.1 Conclusion

From the findings of this study, it was concluded that increasing costs of fuel was the major cause of variation in transportation cost in the study area. Furthermore, distance to the market, prices of seeds, prices of pesticides/herbicides, fuel prices and hired labour were the significant factors that influenced Soybean production in the study area.

5.2 Recommendations

Based on the findings of the study, the following recommendations were made:

i. Government should ensure adequate maintenance of the existing roads so as to reduce the cost of transportation, thereby increasing soybean production in the study area.

ii. Government should subsidize fuel prices in order to reduce transport costs and

and variable costs of production, leading to improved soybean production and farm income

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