ESPOUSAL DETERMINANTS AND PROFITABILITY OF MAIZE PRODUCTION TECHNOLOGIES AMONG SMALLHOLDER FARMERS IN IGABI LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

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ABSTRACT
This study was conducted to analyze the determinant of adoption of maize production technologies among smallholder maize farmers in Igabi Local Government Area, Kaduna State, Nigeria. Multi-stage sampling method was used to select sixty (60) maize farmers used for the study. Descriptive statistics such as frequency distribution, percentages and means and gross margin analysis were used to analyze the data collected. The result of the analysis indicated that maize production in the study area was not gender specific. The age distribution showed that the farmers were relatively young, with a mean age of 41.35 years. Literacy level was high, farmers were well experienced and household size was large. The farmers used both traditional and modern technologies in the production process. This implied that maize production in the study area was not fully mechanized. The major reasons for adopting traditional technologies were its low cost and ease of operation. The reasons for adopting improved technology were that it was faster and easier. The result also affirmed that maize production in the study area was profitable with a return on investment of 0.26. Some of the recommendations were: a public-private partnership in developing policies, programmes and strategies that will encourage the free flow of credit facilities to desired and unpretentious farmer was necessary and provision of soft loans with little or no bottleneck was imperative to enhance their production level
Keywords: Espousal determinants, maize, production, Technologies, smallholder farmers

INTRODUCTION
Agriculture is the largest employer of labour, providing over seventy percent (70%) of the workforce and sustaining over eighty percent (80%) of rural households. The domestic food consumed in both rural and urban economies is largely derived from agriculture. Over forty-six percent (46%) of Nigeria's Gross Domestic Product (GDP) is contributed by this vital sector. It serves as a vehicle for poverty reduction, and a driver of economic growth and development (Kaine et al., 2024; Kaine & Ochiaka, 2024; Fabunmi & Agbonlahor, 2012). Maize (*Zea mays*) is a significant cereal crop cultivated widely across the world. It is known as corn or mielie/mealie in many English-speaking countries (Kaine, 2016). The crop has been a staple in Nigerian households for centuries and is increasingly important to agro-based industries as a source of raw materials.

It is regarded as the third most important crop globally and holds significant socio-economic importance among Sub-Saharan African countries (Adesinya, 2015; Kaine et al., 2015; Food and Agricultural Organization [FAO], 2003). Maize can be grown on a small scale in gardens where it may not thrive on larger farms, and also around homes where it makes use of otherwise unused land.

Research has shown that maize performs exceptionally well in Nigeria and other African countries. This performance is attributed to the fact that over ninety percent (90%) of maize production in these regions is carried out on a micro-agricultural basis. This system is characterized by traditional farming methods, crude implements, low capitalization, and low output per hectare (Adesinya, 2015). Maize production technology in Nigeria is similar to what is obtainable in other developing countries and is largely peasant-based. According to Ogunsumi et al. (2005), micro-level maize production by smallholder farmers has the potential to significantly reduce household hunger, with a multiplier effect on food production across Africa.

Maize is primarily consumed by humans, with about fifty to seventy percent (50%–70%) of the total production also used as livestock feed. It is a rich source of carbohydrates, income, employment, and vitamins A and C (Kaine et al., 2015). Although various studies have been conducted on different aspects of maize production and marketing in the study area, it is uncertain whether any have specifically examined the determinants of adoption and the profitability of maize production technologies among micro-farming households in Igabi Local Government Area of Kaduna State, Nigeria. It is against this background that this study was conducted. Specifically, it examined the socio-economic characteristics of the farmers, their credit access, the production technologies adopted, and the profitability of maize production in the study area.

METHODOLOGY

This study was conducted in Igabi Local Government Area (LGA) of Kaduna State. The LGA covers an area of 3,727 km² and had a population of 430,753 according to the 2006 census, making it the most populous LGA in Kaduna State. The inhabitants are predominantly farmers engaged in the production of food crops and livestock at both commercial and subsistence levels. Major crops cultivated include maize, rice, guinea corn, beans, sugarcane, and vegetables.

A multi-stage sampling technique was employed to collect the necessary information for the study. In the first stage, six (6) communities were randomly selected. The second stage involved the random selection of ten (10) maize farmers from each of the selected communities, resulting in a total sample size of sixty (60) maize farmers.

Primary data were used for the study and were collected directly from respondents. Structured questionnaires were administered to the 60 maize farmers by trained enumerators. The data collected addressed the specific objectives of the study, including the socio-economic characteristics of the farmers, access to credit, production technologies adopted, and the profitability of maize production in the area. In addition to the questionnaires, oral interviews and personal observations were conducted to complement and validate the information gathered. The data collected were coded and analyzed using descriptive statistics and gross margin analysis.

Model Specification

Gross Margin Analysis

GM = TR – TVC; TC = TVC + TFC; NPM = GM – Depreciation

Where

GM = Gross Margin; TR = Total Revenue (₦); VC = Variable Cost (₦); NPM = Net Profit Margin

RESULTS AND DISCUSSION

Socio-Economic Demography of the Respondents

The demographic structure of the farmers was examined, and the results are presented in Table 1. The age distribution of the farmers showed a mean age of 41 years, indicating that the farmers were relatively young and economically active. This suggests that they are likely to be energetic, viable, and receptive to agricultural innovations. Similar findings were reported by Kaine and Abojei (2024), Kaine and Ochiaka (2024), and Kaine et al. (2023) among micro agro-ecological groundnut farmers in Ezza North Local Government Area, Ebonyi State, and pig farmers in Southeast Nigeria. Likewise, Kaine and Ume (2021) and Kaine et al. (2021) also found that farmers in similar studies were relatively young.

The gender distribution revealed that 48 (80%) of the respondents were male, while 12 (20%) were female, indicating that maize production in the study area is not gender-exclusive. Regarding marital status, 48 respondents (80%) were married, while 12 (20%) were single, widowed, or divorced. The household size variable revealed that the respondents had relatively large families, with a mean household size of six (6) persons. According to Ochiaka and Ogbonna (2023), a mean household size of nine (9) was observed in a similar study. Ochiaka and Kaine (2022) and Ume et al. (2020) noted that large household sizes serve as a valuable source of farm labour. A more detailed breakdown showed that 2 respondents (3.30%) had a household size of 1–3 persons, 10 (16.70%) had 4–6 persons, 34 (56.70%) had 7–9 persons, and 14 (23.30%) had 10–12 persons.

The educational attainment of the respondents is also shown in Table 1. The average number of years spent in school was 11, suggesting a relatively high literacy level among the farmers. According to Oyesola and Oladeji, education plays a crucial role in the adoption of new and improved agricultural technologies. Simonyan et al. (2010) also emphasized that education enhances innovation and the adoption of new techniques, making it easier for farmers to understand and implement improved practices.

Regarding production experience, the results showed that the farmers were well-experienced, with an average of 15 years of farming experience. Further analysis revealed that 8 respondents (13.30%) had between 6–10 years of experience, 16 (26.70%) had 11–15 years, 8 (13.30%) had 16–20 years, and 28 (46.70%) had between 21–25 years of farming experience. The analysis of farm size revealed that the respondents were smallholder farmers, with an average farm size of 2.75 hectares. A detailed breakdown showed that 26 respondents (43.30%) had farm sizes ranging from 0.5–1.0 hectares, 8 (13.30%) had between 1.5–2.0 hectares, 6 (10.00%) had 2.5–3.0 hectares, 16 (26.70%) had 3.5–4.0 hectares, and only 4 respondents (6.70%) had between 4.5–5.0 hectares.

Credit characteristics of the respondent

The credit-related characteristics of the respondents were examined, and the results are presented in Table 2. The findings revealed that 34 respondents (60.00%) had no access to credit, while 26 respondents (36.70%) had access to credit facilities. An analysis of the volume of credit accessed showed that the majority—26 respondents (43.33%)—received credit within the range of ₦150,000 to ₦200,000. Additionally, 17 respondents (28.33%) received credit between ₦100,000 and ₦150,000, while another 17 respondents (28.33%) accessed between ₦50,000 and ₦100,000. The mean volume of credit accessed was ₦125,000.00. findings on credit access show that 32 respondents (52.33%) obtained credit through cooperative societies, while 28 respondents (46.70%) sourced credit from family members.

Maize production technology characteristics

Maize production technologies adopted by the respondents in the study area were analyzed and are presented in Table 3. The results showed that maize producers in the area used both traditional and modern production technologies. Specifically, 24 respondents (40.00%) adopted improved technology, 16 respondents (26.70%) used traditional methods, and 20 respondents (33.30%) combined both improved and traditional technologies. Further analysis revealed that the majority—44 respondents (73.30%)—adopted improved technology, while 16 respondents (26.70%) relied solely on traditional methods. The reasons for adopting improved technology were also examined. The results revealed that 32 respondents (53.30%) adopted improved technologies because they were faster, while 10 respondents (16.70%) noted that improved technologies provided better quality.

On the other hand, the analysis of reasons for using traditional technology showed that 25 respondents (41.67%) used it because it was cheaper, and 27 respondents (45.00%) stated that it required no specialized skills. The types of traditional technologies used were also analyzed. Results showed that 10 respondents (16.70%) used hoes and cutlasses, 8 respondents (13.30%) used farmer-saved seeds, and 42 respondents (70.00%) utilized manure. Regarding modern technologies, 9 respondents (15.00%) used fertilizer, 12 respondents (20.00%) used improved seeds, and 39 respondents (83.33%) applied herbicides and insecticides.

Table 1: Socioeconomic demography of farmers'

Variable	Frequency (n = 60)	Percentage	Mean
Age			
20 – 30	09	15.00	
31 – 40	21	35.00	
41 – 50	18	30.00	41.35 years
Above 50	12	20.00	
Gender			
Male	48	80.00	
Female	12	20.00	
Martial Status			
Single	02	3.30	
Married	48	80.00	
Widow	04	6.70	
Widower	06	10.00	
Household Size			
1 – 3	02	3.30	
4 – 6	10	16.70	7 members
7 – 9	34	56.70	
10 – 12	14	23.30	
Educational Attainment (years)			
0 – 6	04	6.70	
7 – 12	16	26.67	
13 – 19	28	46.70	
20 and above	12	20.00	
Farming Experience			
6 – 10	08	13.30	
11 – 15	16	26.70	15.50 years
16 – 20	08	13.30	
21 – 25	28	46.70	
Farm Size			
0.5 – 1.0	26	43.30	
1.1 – 2.0	08	13.30	2.75
2.1 – 3.0	06	10.00	hectares
3.1 – 4.0	16	26.70	
4.1 – 5.0	04	6.70	

Source: computed from field survey 2024

Table 2: Credit characteristics of the respondent

Variable	Frequency	Percentage (%)	Mean
Access to Credit			
No	34	60.00	
Yes	26	43.33	
Volume of Credit			
50,000 – 100,000	17	28.33	
100,001 – 150,000	17	28.33	**₦125,000**
150,001 – 200,000	26	43.33	
Sources of Credit			
Family members	28	46.70	
Cooperatives	32	53.33	

Source: computed from field survey 2024.

Table 3: Maize production technology characteristics

Variable	Frequency	Percentage (%)
Production Technology		
Improved technologies	24	40.00
Traditional technologies	16	26.70
Both	20	33.30
Technologies Adopted		
Did not adopt improve tech	16	26.70
Adopted improved technologies	44	73.30
Reason for adoption of improved Tech	18	30.00
No response	32	53.00
It is faster	10	16.70
It provide better quality		
Reason for using tradition tech.		
It is cheaper	25	41.67
Availability	08	13.33
Requires no skill	27	45.00
Traditional tech. used		
Hoes and cutlass	10	16.70
Farmer's saved seed	8	13.30
Manure	42	70.00
Modern Tech Used		
Fertilizer	09	10.00
Improved seed	12	06.70
Herbicides/Insecticides	39	83.33

Source: computed from field survey 2024

Profitability analysis of maize production

The cost and return of maize production in the study area were assessed, discussed, and presented in Table 4. To determine the profitability of maize production, an average yield of 26 bags (equivalent to 2,600 kg) was used. The results indicated that the total variable cost amounted to ₦537,310.00, accounting for 71.01% of the total production cost. This finding aligns with the observations made by Ubokudom et al. (2021), Kaine (2021), and Enimu et al. (2016), who also reported that variable costs constitute a major component of overall production expenses.

The total fixed cost was estimated at ₦169,000.00, representing approximately 22.33% of the total production cost. Further analysis of the profit margin, as shown in Table 4, revealed a positive annual profit of ₦1,143,090.00 with a return on investment (ROI) of 0.26. This suggests that maize production in the study area yields a positive and viable return, with the investment generating profits greater than one-quarter of its initial value. The ROI of 0.26 implies that for every ₦1.00 invested in maize production, there was a return of 26 kobo. This result indicates that maize production in the study area is a profitable venture.

Table 4: Profitability analysis of maize production

Items	Cost
Average quantity of maize produced: 26 bags (2600kg)	
Profit (Sales – Total Cost)	1,193,390.00
Labour Cost	217,500.00
Fertilizer	143,500.00
Planting materials (maize seeds)	101,250.00
Rent on land	13,500.00
Herbicides	61,550.00
Total Variable Cost (TVC)	**537,310.00**
Total Fixed Cost (TFC)	**169,000.00**
Depreciation on TFC	50,000.00
Total Cost (TV)	**756,610.00**
Net Profit Margin (NPM)	**1,143,090.00**
Average Profit Margin (APM)	19,051.50
Return on Investment (ROI)	**0.26**

Source: computed from field survey 2024

CONCLUSION AND RECOMMENDATIONS

The study implied that maize production in the area was not gender-specific. The farmers were relatively young, with a mean age of 41.35 years, and had large household sizes, averaging seven people per household. The farmers also possessed substantial experience in maize production. It was further established that maize producers in the area were predominantly low-income, small-scale farmers, with an average monthly income of one hundred and twenty-five thousand naira (₦125,000).

A majority of the farmers lacked access to credit. In terms of production techniques, both traditional and improved technologies were adopted. The preference for traditional technologies was primarily due to their low cost and simplicity, while improved technologies were adopted mainly because they were more efficient and time-saving. The profitability analysis revealed that variable costs formed the major portion of the total production cost. However, maize production was found to be profitable, with a return on investment of 0.26, indicating that for every ₦1.00 invested, farmers earned a profit of 26 kobo.

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

1. I**mprove Access to Credit**
   Since the majority of the farmers had no access to credit, a public-private partnership is recommended to formulate and implement policies, programs, and strategies that will facilitate the free flow of credit facilities to genuine and small-scale farmers. These efforts should prioritize transparency, accessibility, and inclusiveness.
2. **Provision of Soft Loans**
   Given that the farmers in the study area are predominantly smallholder farmers, there is a pressing need to provide soft loans with minimal bureaucratic hurdles. This will help enhance their production capacity and overall output.
3. **Encourage Cooperative Participation**
   Farmers should be encouraged to pool their resources by actively participating in cooperative societies. This will enable them to benefit from economies of scale, improve bargaining power, and increase their income levels.
4. **Promote Mechanization**
   The adoption of both traditional and improved technologies indicates that maize production in the area is not yet fully mechanized. Therefore, government and private sector interventions are needed to supply affordable and accessible mechanized farming equipment to boost productivity.
5. **Economic Sensitization on Maize Production**
   As maize production was found to be profitable, targeted awareness campaigns should be organized to educate farmers on the economic benefits of maize production. These campaigns should also promote best practices in input use, cost management, and market access to further maximize profitability.

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