Economic analysis of dry season maize production in Kano and Kaduna States

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Abstract

The need to increase food production in the face of global food insecurity as a result of poor farming methods cannot be over-emphasized. The USAID MARKETS II Dry Season Maize program in Kano and Kaduna States targeted 2000 maize out-growers for increased productivity in the maize value chain in selected locations that was implemented from August 2014 to March 2015 as geared towards attaining food sustainability in the study area. This paper focuses on an economic analysis of the dry season maize project in the two locations. Data was collected with the use of structured questionnaire from a sample of 128 respondents selected from among the networked farmers in four local government areas in the two States and analysed with the use of descriptive statistics. The results show that relatively lower youth participation among the age groups; average farm sizes of between 0.4 hectare and 0.5. From the NPV, IRR and BSR, the project is viable, revealing a mean total cost of production per hectare of N160,800 and N237,400, as well as net profit of N390,255 and N558,600 per hectare in Kano and Kaduna locations respectively.

Keywords: Food insecurity, Dry season Maize program, USAID MARKET II, Kano Kaduna

1. Introduction

Food insecurity as embedded in Thomas Malthus population thesis is a real concern today. While situation is stable for some developed nations, it is a real threat to most LDCs on account of poor farming techniques resulting to poor yields. In a bit to address this problem, the USAID MARKETS II Dry Season Maize program in Kano and Kaduna States targeted 2000 maize out-growers for increased productivity in the maize value chain in selected locations. The project was implemented from August 2014 to March 2015 in Bagwai, Garun Mallam, Sabon Gari and Zaria Local Governments of Kano and Kaduna States respectively. The project employed networking of farmers into groups, training of farmers on recommended improved practices in maize production, establishment of demonstration plots to showcase best practices alongside farmers' plots, linkage to agro-input dealers and produce markets through up-takers schemes to achieve its project objective.

Maize is becoming the miracle seed for Nigeria's agricultural and economic development. It has established itself as a very significant component of the farming system and determines the cropping pattern of the predominantly peasant farmers, especially in the Northern Nigeria, (Ahmed, 1996). Maize has been of great importance in providing food for man, feed for livestock and raw materials for some agro-based industries. Maize constitutes a stable food in many regions of the world. It is a basic stable for large population groups particularly in developing countries, (FAO and ILO, 1997).

Despite the economic importance of maize to the teeming populace in Nigeria, it has not been produced to meet food and industrial needs of the country. This could be attributed to low productivity from maize farms or that farmers have not adopted improved technologies for maize production. To meet the food and industrial demand for maize, USAID MARKETS II has invested resources in building capacities of small holder farmers to adopt recommended best practices for maize value chain in Kano and Kaduna States, as well as other parts of Nigeria.

The economic analyses of the dry season maize projects in Kano and Kaduna is imperative to compare costs with the derived benefits so as to determine their alternative and acceptable return. The return or otherwise of the series of investment made will provide a basis for the

required adjustments hence the costs and benefits of the project must be identified. Once costs and benefits are known, they are priced and their economic values determined.

This paper perceived the benefits and returns as a function of the major objective of farmers' participation in the project which include; maximizing gains to his family, his children education, increase in his income, increase in productivity as a result of mechanization, among others.

The aim of this paper is to examine the significance of dry season maize production among small holder farmers under USAID MARKETS II dry season maize intervention project sites in Kano and Kaduna States. The specific objectives are to: analyse the mean total cost, output, selling price and benefits in cobs per hectare of land; determine the viability, sustainability and continuity of the dry season maize project in the implementation sites; and assess the impact of the project on the farmers' income and livelihood. The analysis that follow will determine if the project has contributed significantly to the development of the economy of the beneficiaries directly and the communities at large and to justify the investment on the project. The rest of the paper is divided into literature review, methodology, data analysis and conclusion.

2. Literature Review

Studies on food insecurity and the need to boost agricultural production worldwide abound. Bello (2009), Nield (2009), Ayantoye, Yusuf, Omonona and Amao (2011), Andohol (2012), Ojo and Adebayo (2012), Abimbola and Adejare (2013), Otaha, (2013), Chinedum (2013), Eme, Onyishi, Uche, and Uche (2014)and Khan (2014) all see the need to improve agricultural productivity as a means of enhancing food security and reducing its threats to human survival. However, appraising the USAID MARKETS II dry season maize production intervention through Sasakawa Global 2000 (SG2000) in Kano and Kaduna States are not visible merely because these are most often sponsored researches. This paper is the outcome of a sponsored report under the mandate of USAID MARKETS II dry season maize production intervention through Sasakawa Global 2000 (SG2000) in Bagwai, Garun Mallam, Sabon Gari and Zaria Local Governments Areas of Kano and Kaduna States respectively.

3. Methodology

From a population of 1000 farmers in the study area, a multi-stage sampling technique was adopted, where 128 networked dry season farmers (respondents) were selected equally from four participating LGAs in the two states (Kano and Kaduna). A systematic sampling based on the sex proportional composition of the population was used to determine respondents to the survey instrument. The sex composition of the population (1000 farmers in each location) is made up of 73% male and 27% female in Kano location, while in Kaduna location, 86% of the 1000 farmers are male and 14% female. A mode of selection was set in each location based on the percentage distribution of the population. In the case of Kano location, the 73% of 1000 farmers is 730 and 27% of 1000 is 270 farmers and also the total required sample of male is 73% of 64 and the value is 47 farmers, while that of female the value is arrived by 27% of 64 making 17 female farmers. To select systematically, the sample size of 64 respondents for Kano State is arrived at by dividing 730/47 and 270/17. The same procedure applies to Kaduna location where based on the proportion, 55 males and 9 females were selected.

Data was collected with the aid of a structured questionnaire that was administered to the respondents by the respective Extension Agents (EAs) in the locations. The questionnaire was constructed using simple language to enable better responses from the respondents.

Descriptive statistics such as percentages, frequency distribution are used to determine the socio-economic parameters of the respondents such as sex, age and farm size, while profitability/viability determination techniques like Net Present Value (NPV), Internal rate of return (IRR) and benefit-cost ratio (BCR) - were used to estimate returns to the project participants and society as a whole.

4. Data Analysis

This analysis begins by taking into account the socio-economic characteristics in terms of the sex, age and farm sizes of the respondents. This is then followed by the economic and production analysis as well as the profitability and viability analysis.

- **Socio-economic Analysis of the respondents**

The gender status of the respondents in the study areas of the project reveals that, 73% and 27% of the respondents are male and female in Kano location, while in Kaduna location, the results indicate 86% of the respondents are male and 14% are female.

Table 1: Sex of the Respondents

Sex	Kano		Kaduna	
	Frequency	**Percent**	**Frequency**	**Percent**
Male	47	73	55	86
Female	17	27	9	14
Total	**64**	**100**	**64**	**100**

Source: Field Survey, 2015.

Though numerically different, the sex consideration avoid gender bias conclusion.

The age of the respondents is reported in three categories as can be seen in the table 2. In Kano location, the youth takes the least of 19% as no response was recorded under the age of 18 years, while the adult category takes the largest of 81% of the sampled respondents. The Kaduna location reports a higher percent of youths compared to Kano with almost 50% difference.

Table 2: Age of the Respondents

Kano			Kaduna		
Age	**Frequency**	**Percent**	**Age**	**Frequency**	**Percent**
Under 18	0	0	Under 18	0	0
Youth	12	19	Youth	26	41
Adult	52	81	Adult	38	59
Total	**64**	**100**	**Total**	**64**	**100**

Source: Field Survey, 2015.

This reveals glaringly that the youths are not actively engaged in agriculture not only in the study area but nationally because of its backwards techniques and limited access to financing.

On the sizes of the farms, as presented on Table 3, it is observed that the mean farm size in hectare used by the respondents during the dry season maize farming in the Kano location was 0.4hectare and 0.5hectare in Kaduna location.

Table 3: Farm Size in Hectare (Ha) of the Respondents

Mean Farm Size (Hectare) in Kano	Mean Farm Size (Hectare) in Kaduna
0.40	0.50

Source: Field Survey, 2015.

Evidently the farm sizes are relatively too small suggesting difficulties in land acquisition, limited access to finance and challenges of employing mechanized farming.

- **Economic and production analysis**

The economic and production analysis of the survey considers the following; production, output and returns parameters such as the Total and Average Cost of Production per hectare (ha); Total Maize Output Produced; Selling Price of Maize per cob Type of Selling Market; Number of Regular Buyers; Total Cost, Total Revenue and Profit Determination; The Net Present Value (NPV) of the Projects; The Internal Rate of Return (IRR) of the Projects and The Benefit-Cost Ratio (BCR).

The breakdown of the mean cost of production per 1ha is presented on can be seen in the table 4. Table 4 reveals that the mean total cost of production (obtained by summing all the costs involved in the dry season maize production starting with the cost of fertilizer, seeds, and labor, watering inclusive) per 1ha is N160,800 for Kano and N237,400 for Kaduna. The Kaduna location had the highest mean total cost of the dry season maize production compared to Kano location with a 58% difference.

Table 4: Components of the Total Cost of Production per Hectare

Item	Description	Quantity		Cost (N)	
		Kano	**Kaduna**	**Kano**	**Kaduna**
Fertilizer	NPK	8	8	46,000	44,000
	UREA	2	4	10,800	20,000
Seed	Yellow	20kg	-	3,000	
	Extra Early		15kg		2,100
Herbicide	-	5kg	5kg	5,000	5,000
Labour	Required for land preparation, planting, hand weeding, fertilizer application, irrigation, harrow & ridging and harvesting	4 – 20 workers	4 – 20 workers	89,000	126,000
Transport & other costs				7,000	8,000
Grand Total				**160,800**	**237,400**

Source: Field Survey, 2015.

From table 4, labour cost for both locations takes up a bulk of the production cost. It is N89,000 and N126,000 in Kano and Kaduna State respectively. The total cost of production is N160,800 and N237,400 for Kano and Kaduna respectively and this justifies the high prevalence of youths unemployment in the country as they cannot afford to raise such sum so as to engage in agricultural activities.

Extending the above analysis to capture the mean cost per cob, it is recorded that the total output in cobs per hectare is 68,882 cobs in Kano location and 79,600 cobs in Kaduna location. Given that the total cost per hectare is N160,800 in Kano and N237,400 in Kaduna location respectively, the average value of the total cost per cob is N2.33 in Kano and N2.98 in Kaduna State. This further indicates that, the Kaduna location has a comparatively higher cost of production than Kano.

The survey indicates on Table 5 that, there are various markets at which the farrmers sell their produce. These markets include: farm gate, local market, town market and ther available markets. From the analysis on table 5, about 50% of the respondents sell their outputs at local market in Kano locations, while in Kaduna, 50% sell theirs in other markets. Farm gate market attracted about 28% of the respondents in Kano locations and 23% of the respondents sell at a

local market in Kaduna location. The least percent of the respondents that sell at other or any available markets was 2% in Kano location. It further reports that, 11% of the respondents sell at town market in Kaduna location.

Table 5: Markets for the Respondents

Market	Kano		Kaduna	
	Frequency	**Percent**	**Frequency**	**Percent**
Farm gate	18	28	10	16
Local market	32	50	15	23
Town market	12	19	7	11
Any available market	2	3	32	50
Total	**64**	**100**	**64**	**100**

Source: Field Survey, 2015.

The statistics indicated that farmers have ready markets for the dry season maize they produce. The sale of the product at the farm gate may be more economical as it reduces cost of transportation and other handling charges to other markets.

From table 6, it is evident that there are also a number of regular buyers of maize produced by the Respondents. The number of regular buyers of dry season maize from respondents in the survey indicated that, 94% of the respondents have customers between 1 to 4 and 6% had 5 to 12 customers in the markets in Kano location. In Kaduna location, the highest percent 40%) of the respondents had 1 to 4 customers, followed by 32% and 28% with customers between 9 to 12 and 5 to 8 customers respectively. The figures indicate that, in both locations the sampled farmers have substantial number of customers patronizing the maize output within their reach.

Table 6: Number of Regular Buyers of Output of the Respondents

	Kano		Kaduna	
No. of Regular Buyers	**Frequency**	**Percent**	**Frequency**	**Percent**
1 - 4	60	94	26	40
5 – 8	2	3	18	28

9 - 12	2	3	20	32
Total	**64**	**100**	**64**	**100**

Source: Field Survey, 2015.

- **Profit and viability determination**

This section focuses on delineating how total cost, total revenue and profit are determined using the means or averages of price, cost and output per hectare. Table 7 reports that the profit from the investment in the dry season maize production in Kano location is N390,255 per hectare, which was much less than the N149,600 per hectare recorded as profit in Kaduna location. The wide margin in the profit levels in the two locations is associated with high costs on labour in Kaduna location compared to Kano location. This high cost in Kaduna than in Kano, could be linked to the ease at which unemployed youths can leave the Kaduna State in pursuant of better opportunities in Abuja and Lagos.

Table 7: Mean Total Cost, Revenue and Profit Determination per Hectare

Description	Cost/Price (N)	
	Kano	**Kaduna**
Cost of Cob	2.33	2.98
Price per Cob	8	10
Total output in cob per Ha	68,882	79,600
Total cost per Ha	160,800	237,400
Total revenue per Ha	551,055	796,000
Profit per Ha	390,255	558,600

Source: Field Survey, 2015.

Table 7 suggests that, the mean cost per cob is N2.33 in Kano and N2.98 in Kaduna State, while the mean selling price per cob in Kano is N8 and N10 Kaduna. Clearly from Table7, though cost of production is higher in Kaduna State than in Kano State, productivity is also higher there, and consequently more profit is realized per hectare in Kaduna than in Kano. The respondents uphold that this project served as source of income generation to them in the two locations. The mean net income or profit that accrue to the respondents per hectare is N390,255 in Kano location and N558,600 in Kaduna location. The farmers explain that income is very useful to them as it helps them meet the needs of their families on food, education of their children,

medication, and gifts among others. This USAID MARKETS II project could be said to serve as a new life line to the dry season maize farmers in the project sites.

Also, the Net Present Value (NPV) of the Projects, the internal rate of returns and the benefit cost ratio are used to analyse the viability of the project in both Kano and Kaduna. The results are presented below.

The NPV compares the present value of the cost streams with the present value of the benefit streams. For this survey, the net present value is calculated using a Bank discount rate of 10 per cent. NPV is given by:

$$NPV = PV - I$$

Where, PV refers to the future value of the initial investment or cost as is obtained. $(10\%*I/1+0.10)^{1}$ and, I, is the actual total cost or investment. The mean total cost of production per hectare is used as the initial costs of investments in each of the two locations. The total cost in Kano location is N160,800 per hectare and N237,400 per hectare in Kaduna location. From this, an NPV value of 0 (zero) is obtained for both Kano and Kaduna locations. Going by the decision rule concerning the NPV which states that, accept all projects for which NPV value is positive or zero, independently, the projects in Kano and Kaduna are viable and could continue.

With regards to the Internal Rate of Return (IRR) of the Projects, which represents the rate of return in economic prices that would be achieved on all expenditures of the project, the results obtained is as follows:

$$IRR = \frac{\text{Net Returns}}{\text{Total Cost}}$$

Where Net Returns = Total Revenue – Total Cost. Given that the net returns per hectare in the two locations are N390,255 and N558,600 in Kano and Kaduna respectively; and that the total cost also per hectare are N160,800 and N237,400 in Kano and Kaduna respectively (Table -----), the IRR obtained are 2.44 and 2.35 for Kano and Kaduna respectively. This implies that, a unit

naira invested in to dry season maize production, would generate about 244% of the naira investment in Kano and about 235% in Kaduna location. Given the decision rule that a project with an IRR value greater than the discount rate should be accepted as viable, the results of the IRR in these case indicates that both projects are viable.

Further Benefit-Cost Ratio (BCR) which measures the associated benefits and costs of a given project is deployed to assess the viability of the USAID Markets II dry season maize production project in the two locations under study. appears suitable for the measure. The average monetary benefits is used for the said purpose and the corresponding costs per hectare. The BCR is expressed as:

$$\text{BCR} = \frac{\text{Discounted value of incremental benefits}}{\text{Discounted value of incremental costs}}$$

This could simply be obtained by dividing the total revenue (total incremental benefits) per hectare by the initial investment or total cost of production (total incremental cost) per hectare. A summary of the benefits and cost of the projects in Kano and Kaduna locations are on table 8.

Table 8: Benefit Cost Ratio

Kano Location			**Kaduna Location**		
Benefits (N)	**Costs (N)**	**BCR**	**Benefits (N)**	**Costs (N)**	**BCR**
551,055	160,800	3.28	796,000	237,400	3.36

Source: Field Survey, 2015.

From table 8, the BCR coefficient in Kano location is 3.28, while that of Kaduna is 3.36. Considering the decision rule of BCR which suggests that, all projects with BCR greater than 1 should be accepted, it can be concluded that the BCR in the two locations are greater than 1 and hence the USAID MARKETS II dry season maize project in the two locations should be accepted as viable and should be continued.

In a nutshell, the dry season maize production in the two locations of Kano and Kaduna States are viable as the net returns are greater than the total costs as reported by the total cost – total

revenue approach, net present value, internal rate of return and the benefit-cost ratio. This corroborates the results of the field survey in which 100% of the farmers or respondents in the two locations assert that, they would continue with the project as it generates income and provide jobs to many people.

5. Conclusion

According to the findings of the study in the two locations, Kano and Kaduna under dry season maize production during the 2014 season, the paper finds that there are wide variations in the mean total costs, output levels and market selling prices per hectare in the two locations. The Kano location appears to have both lower cost, level of output and final market selling prices per cob/Hectare. But the costs and market selling price profile in the two locations appeared to be much similar. The report also using the profit determination, net present value, internal rate of return and benefit-cost ratio conclude that, the project in the two locations are viable and sustainable but with high returns in Kaduna location which could be associated to ground water availability to the plants even before the rainy season, the fertiliser application, strict adherence to the acquired modern irrigation practice and seed variety, among others. One key observation in the survey appeared to be high labour cost in Kaduna location, followed by non-group selling of the produce in the markets and this may affect their bargaining power in the markets which prevents them from maximizing profit. In conclusion, the USAID MARKETS II dry season maize project in the two locations are viable projects that should be sustained and replicated for other areas.

Finally, farmers in Kano location should be further training and encouraged to engage and get acquainted to modern dry season maize farming practices in order to produce more maize, increase their returns, and reduce the fear of food insecurity in the country.

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