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EVALUATION OF THE LEVEL OF ECONOMIC EFFICIENCY OF IRRIGATED TOMATO PRODUCTION UNDER KANO RIVER IRRIGATION PROJECT, NIGERIA

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ABSTRACT
The broad objective of the study was to evaluate the Level of Economic Efficiency of Irrigated Tomato Production under Kano River Irrigation Project, Nigeria. A multi-stage sampling techniques was used to select 213 irrigated tomato farmers. Primary data was used and were collected using well-structured questionnaire. Data collected were analysed using descriptive statistics such as frequency, percentages and data. The result of the analysis revealed that the average economic efficiency of the irrigated tomato farms was 67%. This indicates that irrigated tomato farms were economically inefficient. It can be concluded that all the three categories of irrigated tomato farms were economically inefficient with large irrigated tomato farms having the highest economic efficiency of 67% in the study area. It is therefore recommended that agricultural extension workers should be provided to disseminate research finding and educate irrigated tomato farmers on ways of improving their economic efficacy.

Keyword: Evaluation, Economic Efficiency, Irrigated Tomato Production, Kano River Irrigation Project

INTRODUCTION

Tomato (*Lycopersicom esculentum*) is among the major vegetables being produced in the country, and is consumed in various forms (Aditi, Kawatra and Sehgal 2011; Aremu, Adeyemo and Olugbire 2016), making agriculture a crucial sector in the Nigerian economy, being a major source of raw materials, food and foreign exchange; employing over 70% of the Nigerian labour force and serving as a potential vehicle for diversifying the Nigerian economy. In Nigeria, half of Nigerians (approximately 70 million individuals) still in rural areas; most of them engaged in small-holder semi-subsistence agriculture (Lenis, Oluyemisi and Akeem 2011).

Smallholder farmers are the backbone of the agricultural production, accounting for the majority of all food produced in Nigeria (Plaisier, Dijkxhoorn, Rijn, Bonnand and Talabi, (2019). However, Nigeria still relies heavily on import to feed its population as only 50% of arable land is under cultivation and yields are generally low. Another incentive for promoting the agricultural sector is the drive for economic diversification by the government away from (only) oil revenue, which currently represents 25% of GDP (Plaisier *et al.*, 2019). Two-thirds of the population in Kano and Kaduna is involved in agriculture and the majority is small-scale farmer with approximately 2-3 ha. Current crop indicative yields per hectare in Kaduna and Kano are low (Food and Agricultural Organization and Federal Ministry of Agriculture and Rural Development, 2015).

Large scale tomato production has been taken up along the important rivers in Kaduna State (Galma, Kuzuntu, and Shika), Kano State (Kano River Irrigation Project) Sokoto State (Rima River), Kwara State (Asa River near Ilorin) and Upper and Lower Benue River basin areas (Olanrewaju and Swarup, 1983). As a result of tomato production under the KRIP, a 1500 tonnes per day tomato processing plant is being constructed in the area. Also a specialised market at "Kwanar Gafan" in Garun Malam Local Government Area was well established. The production also provides employment to thousands of the tomato merchants and brokers in local processing and marketing of the commodity (HJRBDA, 2013). Kano state ranks top in the country with dry season cultivation of over 30,000 hectares of irrigated tomatoes in the Kano River Irrigation Project (KRIP) covering Kura, Bunkure, and Garun Malam local government areas in the State. Large scale tomato production has been taken up along the important rivers in Kaduna State (Galma, Kuzuntu, Shika), Kano State (Kano River Irrigation Project) Sokoto State (Rima River), Kwara State (Asa River near Ilorin) and Upper and Lower Benue River basin areas (Olanrewaju and Swarup, 1983). As a result of tomato production under the KRIP, a 1500 tonnes per day tomato processing plant is being constructed in the area. Also a specialised market at "Kwanar Gafan" in Garun Malam Local Government Area was well established. The production also provides employment to thousands of the tomato merchants and brokers in local processing and marketing of the commodity (HJRBDA, 2013).

On irrigated tomato production in Nigeria, and in Kano State in particular, very limited research has comprehensively focused on efficiency of irrigated tomato production especially on the level of economics efficiencies of the farmers. Katanga, Danwawu and Musa (2018), Aminu and Sadi (2020) and Danmaigoro and Gona (2020) worked on the Profitability and economic analysis of Tomato Production respectively. This leaves a dearth of information and limited empirical findings for policy recommendations. This paper seeks to evaluate the level of economics efficiency of irrigated tomato production under Kano River Irrigation Project (KRIP), Nigeria.

METHODOLOGY

Description of the Study Area

The Study was carried out in Kano State, Nigeria. Kano lies between latitude 12^0 37' North and 9^0 33' South and longitude 9^0 29' and 7^0 43' West. It shares boundary with Jigawa State to the North-East, Katsina State to the North-West and Kaduna State to the South. Kano State consists of two agro-ecological zones namely, Northern Guinea Savannah (NGS) and the Sudan Savannah (SS). The southern part of the State is in the NGS, which has an annual rainfall of 600-1,200mm. The central and northern parts are in the SS, with an annual rainfall of 300-600mm (Kano State Government 2012).

The upland crops commonly grown are millets, sorghum, cowpea and maize, while the low land/Fadama crops grown in the State includes tomato, onion, and pepper with rice and wheat grown in the flood plains and irrigated areas. The Research was specifically conducted under Kano River Irrigation Project (KRIP) because of large scale cultivation and highest number of tomato farmers in the State. The KRIP Phase I is currently providing all year round direct employment to about 41,250 farmers and their families. Over 5.0 million man days of employment are being generated as indirect employment to communities within and outside the project area annually. Farmers produce an average of 200,000 metric tonnes of food and cash crops valued at over ₦2.7 billion annually, thereby contributing significantly toward enhancing national food security (HJRBDA, 2013).

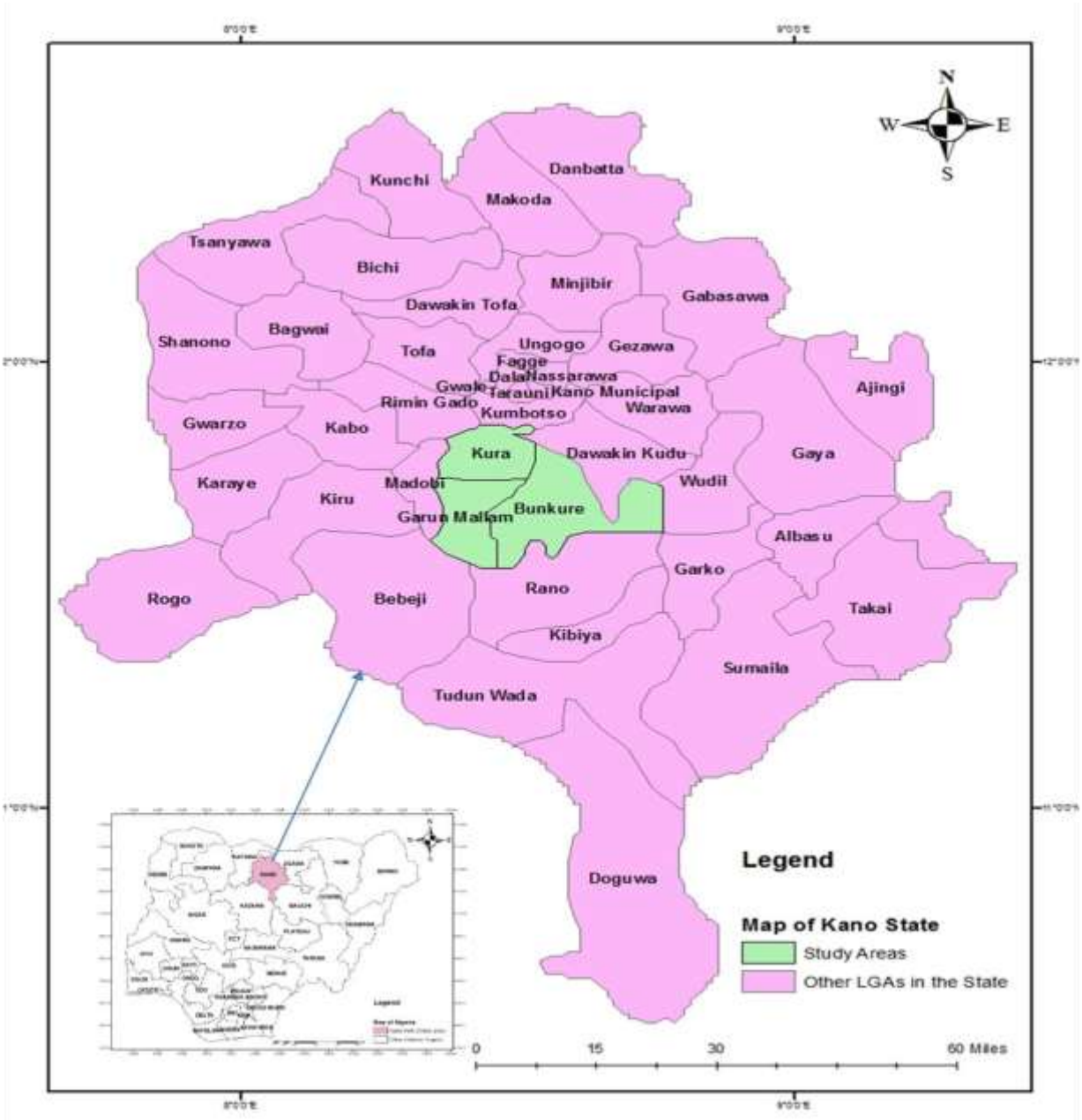

Figure 1: Map showing the study area

Sampling Procedure and Sample Size

Kano State comprises of three agricultural zones, namely Danbatta, Rano and Gaya zones. Rano zone was purposively selected because of its highest number of irrigated tomato farmers. The major irrigated tomato producing local government areas in the zone are Bunkure, Garun-Mallam and Kura which are covered by Kano River Irrigation Project

(KRIP) Phase I, (HJRBDA, 2013). Large scale tomato production has been taken up along KRIP (Olanrewaju and Swarup, 1983). Two villages with the highest number of large scale irrigated tomato farmers from each of the three local government areas were purposively selected. Finally, random number sampling was employed to select 10% of the total population **(**2122**)** of the purposively selected villages to give a sample size of 213.

Classification of the sizes:

The classification of the three sizes of production was based on the categorisations of Haruna (2004) and Usman and Bakari (2013), it is given as farm size of:

i. less than a hectare are small scale farmers **(<1.0ha)**
ii. one hectare to less than three hectares are medium scale farmers **(1.0ha to 2.9ha)**
iii. three hectares and above are large scale farmers (**3.0ha and above**)

Data Collection

Primary data were used for this study and were collected with the aid of structured questionnaire through the assistant of field enumerators in a manner that allows the collection of relevant data on specific variables that were investigated. Information was collected on the following variables: type and cost of labour (both family and non-family), type and cost of inputs used per hectare, revenue, water rate, produce prices.

Analytical Techniques

Descriptive statistics such as percentage frequency distribution, mean, minimum and maximum were used to achieve the objective. The index of economic efficiency measure was used compute the level of economic efficiency, this is derived from the input-output Data Envelopment Analysis (DEA) model. In order to derive the economic efficiency of the firm, the model is solved:

Subject to $\min \theta, w_i' x_i^*$

$-yi + Y\lambda \geq 0,$

$X^*I - X\lambda \geq 0$

$N1 \grave{} \lambda = 1$

$\lambda \geq 0$

$\theta \in (0, 1]$

Where w_i represent firm i's vector of inputs prices and X*I is the cost-minimizing input bundle faced by the firm i. The economic efficiency for firm i is then solved by the following computation.

$$EE_i = \frac{w_i' x_i^*}{w_i' x_i}$$

That is, the observed cost is compared to the minimum cost the firm would face if using the optimal input bundle

RESULTS AND DISCUSSION

Estimate of economic efficiency based on the three sizes of production in the study area

The results in Table 1 revealed that 41%, 47% of the irrigated tomato farmers with small and medium farm sizes in the study area operated within an economic efficiency range of less than 0.20 (<0.20). While, majority (52%) of the irrigated tomato farmers with large farm size operated within an economic efficiency range of 0.61-0.80. Implication of this result is that majority of the irrigated tomato farmers are not economically efficient in the use of production resources. This can result to higher costs per unit of output for a farm firm and hence the inability of the farmer to maximise profit. Result revealed that economic efficiency among the irrigated tomato farmers varied widely ranging between 0.134 and 1.00 for small farms, 0.034 and 1.00 for medium farms and 0.257 and 1.00 for large farms with a mean economic efficiency of 0.50, 0.446, and 0.674 for small, medium and large farms respectively.

Table 1: Frequency distribution of economic efficiency estimate based on the sizes of production in the study area

Economic Efficiency	Small Farms	Medium Farms	Large Farms
<0.20	63	17	6
	(41)	(47)	(24)
0.20-0.40	48	11	4
	(32)	(31)	(16)
0.41-0.60	20	6	2
	(13)	(17)	(8)
0.61-0.80	21	2	13
	(14)	(6)	(52)
0.81-1.00	0	0	0
	(0)	(0)	(0)
Mean	0.5	0.446	0.674
Min	0.134	0.034	0.257
Max	1	1	1

Field Survey 2015

This indicates that irrigated tomato farms were economically inefficient and are not able to minimize the cost of production. The implication is that overall economic efficiency among the irrigated tomato farms could be increased by 50%, 55% and 33% for small, medium and large farms respectively in the area through the reduction in production costs that would occur if production were to occur at the allocatively and technically efficient point given the current state of technology. This agrees with the observation of (Benjamin *et al.,* 2011) and (Asogwa *et al.,* 2011) that Nigerian rural farmers do not produce at the efficient point given the current state of technology.

CONCLUSION

It can be concluded that all the three categories of irrigated tomato farms were economically inefficient (50% and 45% for small and medium irrigated tomato farms, respectively) with large irrigated tomato farms having the highest economic efficiency of 67% in the study area. This means that tomato production has great potential to increase agricultural production and household income, if efforts are made to increase their economic efficiency.

RECOMMENDATION

Based on the finding of this study, it is recommended that agricultural extension workers should be provided to disseminate research finding and educate irrigated tomato farmers on ways of improving their economic effiecncy.

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