Application of Profit Maximization Concept and Decision Making in Pricing and Output by Farmers in Selected Communities ofDelta State, Nigeria.

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Abstract

This study examined the application of profit maximization concept in pricing and output of agricultural crops in three studied areas of Agbor, Abraka and Ozoro within Delta State. Each study area is stratified into four (4) zones/neighborhoods, and each zone has 100 administered questionnaires: totaling four hundred (400) questionnaires in each study zone hence, the aggregate of 1200 questionnaires. This was administered to farmers learned enough to respond to questionnaire and those that cannot respond were guided by the researcher. Descriptive statistical method of averages and graphs were employed to illustrate the data collected. It was discovered that the best optimum production and maximization profit level for a farmer is where marginal cost is equal to marginal revenue (MC = MR). This should be the best choosing output and profit maximization level for the farmers. It was discovered that farmers output depended on the size of farm holdings, rate of output and income generated. It was therefore recommended for the purpose of sustenance of income by the farmers in the agricultural business. In order to avoid fluctuations in pricing and output that usually hinder growth and development, farmers are expected to maintain a state of equilibrium both in the short and long run where marginal cost will be equal to marginal revenue. To obtain excess profit margin, the marginal revenue should exceed marginal cost.

Keywords: Agricultural Farmers, Marginal Cost, Marginal Revenue, Optimum Output and Profit Maximization,

Introduction:

In Nigeria, agriculture with regards to farming constitutes the backbone of the economy employing about 65-70% of the labour force (Yakubu, 2015). Izuchukwu (2011) is of the opinion that agricultural holdings are generally small, scattered and of subsistence nature which usually involves the use of simple implements and shifting cultivation. These small farmers produce about 80% of the total food crops in the country and also 30.7 million hectares (76 million acres) or 33% of the country's land area, which is put to cultivation (Odetola and Etumnu, 2013; Adebayo and Olagunju, 2015). Nwankpa (2017) found out that with Nigerians current population employed in agricultural sector and most of them living in rural areas, the agricultural sector has become the key to the country's economic development contributing about 40 percent of the gross domestic product (GDP). In addition, Oyenbo and Rekwot (2014) are of the view that this sector constitutes a vital source of income, employment and the production of raw materials to feed the agro-allied industries. Agriculture being a major source of income to the rural and some urban dwellers, it is imperative that those who are engaged in this sector of the economy must take useful decisions that will enhance their income level for growth and human development. Accordingly, Ilbery (1978) and Umo (2012) stated that all that happens in the agriculture sector especially to those

who practice farming will depend on the nature of the decision taken which could either be in form of short or long run decision. The first decision involves planning or policy making which is purely concerned with major questions such as the choice of enterprise and allocation of capital resources. Such decisions are usually made in advance of their implementation and they provide a 'structure plan' for the future organization of the farm, while others involve decisions that are made on daily or weekly basis. These decisions are made based on prevailing weather and market conditions and in the event of unforeseen problems such as crops and livestock diseases or staff absence. Policy making decisions require careful and original thought, while short term decisions require snap judgments.

For the past fifty-five (55) years or thereabout, Nigeria farmers has practiced subsistence farming which invariably have led to small holdings and output thereby ending up in providing for the immediate family needs. This situation has decreased the profit margin of most farmers who do not forge to create wealth from agriculture as an economic enterprise (Mogborukor, 2012).

Apart from been motivated by profit maximization, farmers in Nigeria can also base their decision on social recognition. That is, achievement of status, respect, or even power within a particular community or group. The main push according to Akinbode (2005 and Adesina (2012) of any farmer is to make profit and minimize cost as it is well emphasized in the economic principles of demand and supply. Over time, farming in Nigeria has grown from being subsistence to an economic enterprise which entails maximization of profit from those involved in farming as a business. This brings to the fore, the importance of the concept of profit maximization in evaluating farmer's decisions. The objectives of this study are as follows;

i. To assess the output and cost of production in a short and long run.
ii. To examine the profit margin of the farmers due to fluctuation in the prices of agricultural products in the market.

Description of Study Area

The study was carried out in three Senatorial districts of Delta State which include; Delta North (Agbor), Delta South (Ozoro), and Delta Central (Abraka) (See Figs 1, 2, 3 and 4). Delta State is located in the south-south region of Nigeria. It lies approximately within Latitude $05^{0}00^{1}$ North to 05^{0} 45^{1}Northof the Equator and Longitude $06^{0}00^{1}$Eastto 06^{0} 30^{1}Eastof the Greenwich meridian. The Study area covers an area of 1,920km^{2}. The population of Delta State is 4,112,445 people (National Population Census, 2006). The population is now estimated to be more than 5 million (Federal Bureau of Statistics, 2018)

The stateis drained by two major rivers which are River Ethiope and Forcados and empty their water into the Atlantic Ocean and both rivers have the dendritic pattern of drainage.

The study area displays a low relief and has an elevation of about 6^{0} which is by physical region classification of Nigeria falls under the interior costal margin of the country.

The climate of the area is influenced by two air masses, the tropical maritime air mass and tropical continental air mass. This region is of the humid tropical climate with high temperature between the months of November and April with variation in temperature between 25^{0}C-30^{0}C between April and October. The average rainfall distribution in these regions is about 2500mm-3000mm annually and there is usually rainfall all through the year.

The three major vegetation types found in the study area arethe mangrove swamp forest, the fresh water swamp forest, and the tropical lowland rainforest. Vegetation is a source of lumbering, provision of herbs for medicinal purpose, income and employment to the inhabitant of this area. The soils are loamy in nature with muddy soil which varies from coarse through medium to fine grained.

Fig. 1. Map of Delta State Showing Study Areas
Source: Ministry of Lands, Survey and Urban Development, Asaba (2005)

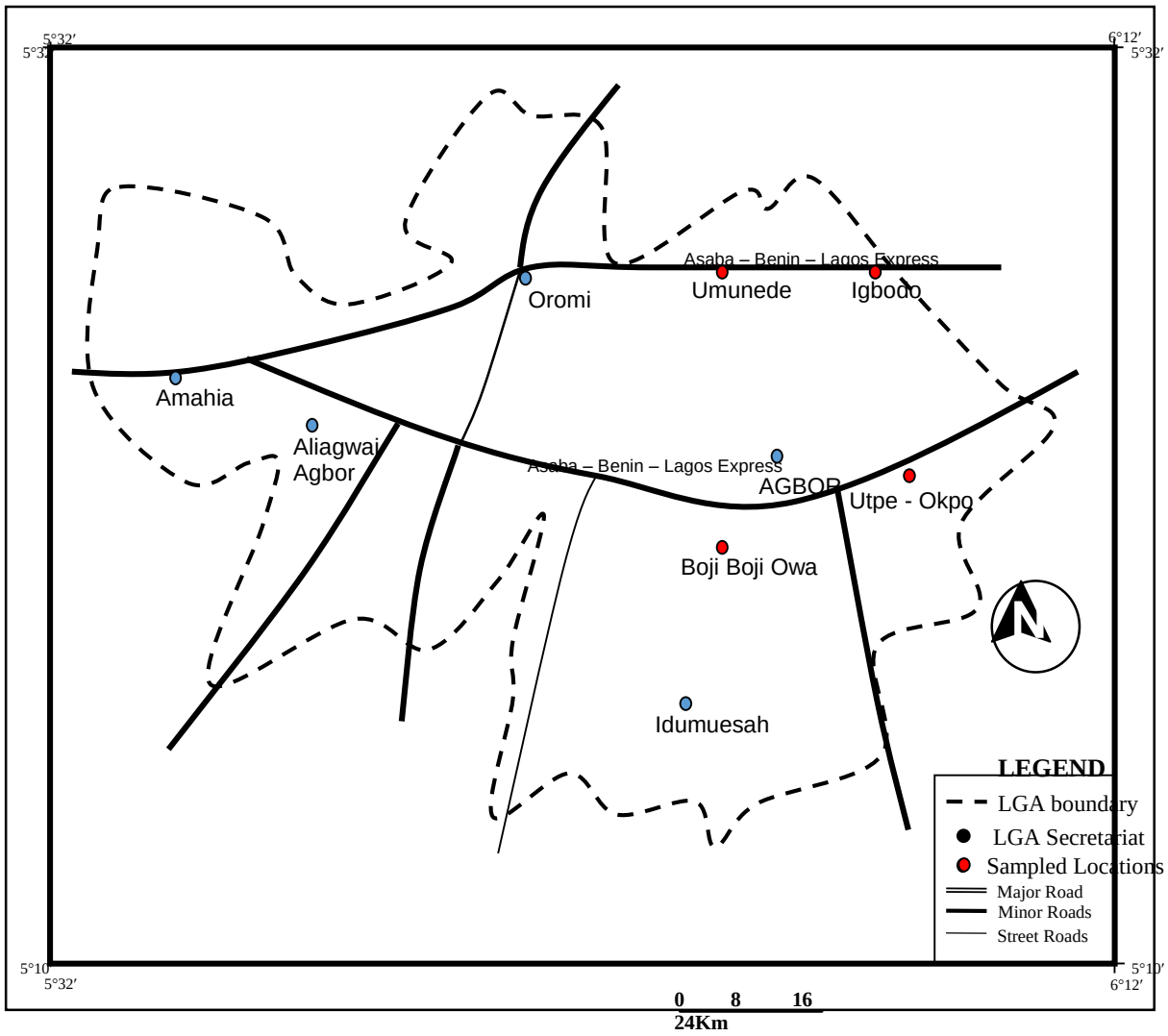

Fig. 2. MAP OF AGBOR SHOWING SAMPLED LOCATION
Source: Fieldwork, (2019)

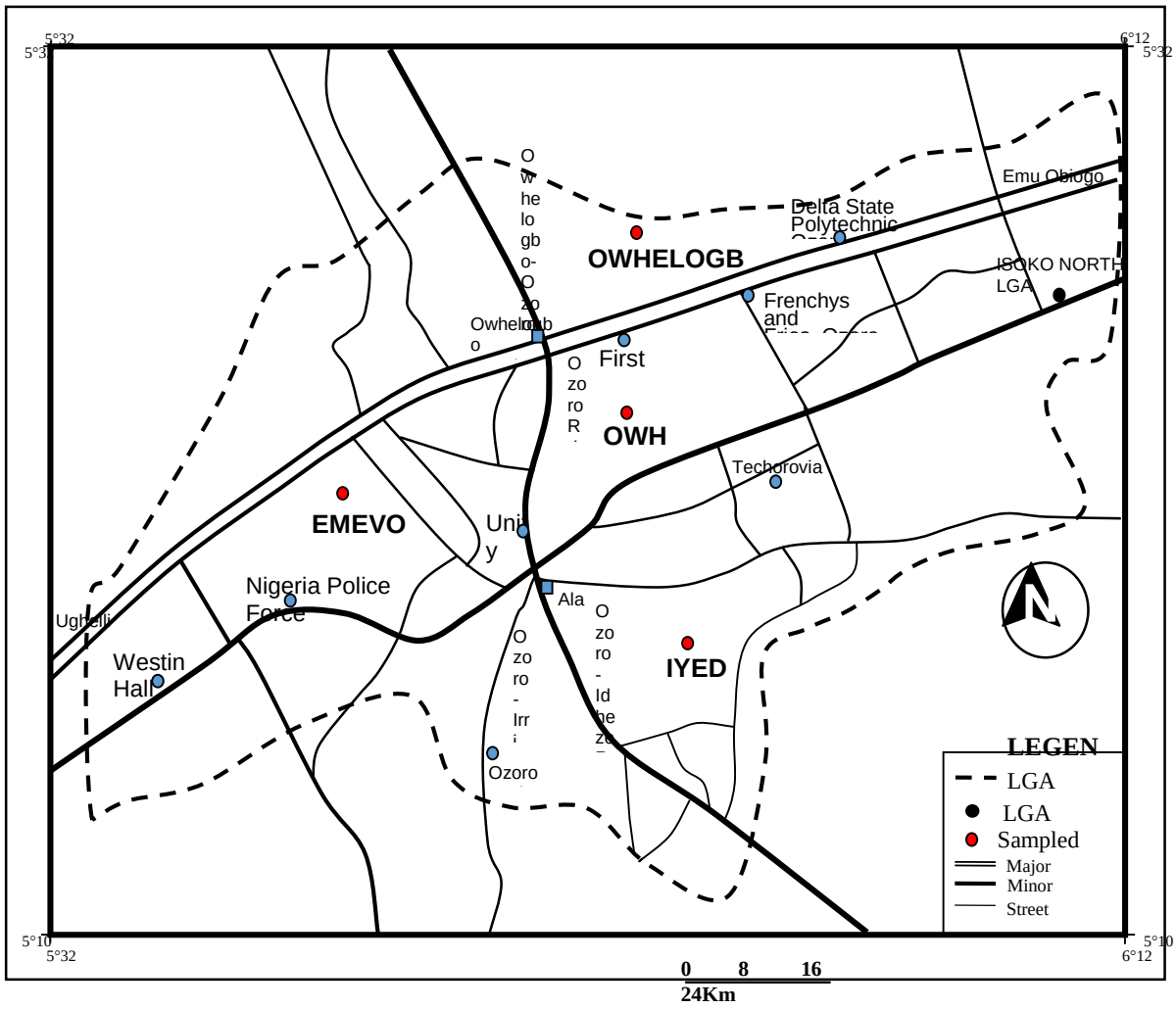

Fig. 3. Map of Ozoro Showing Sampled Location
Source: Fieldwork (2019)

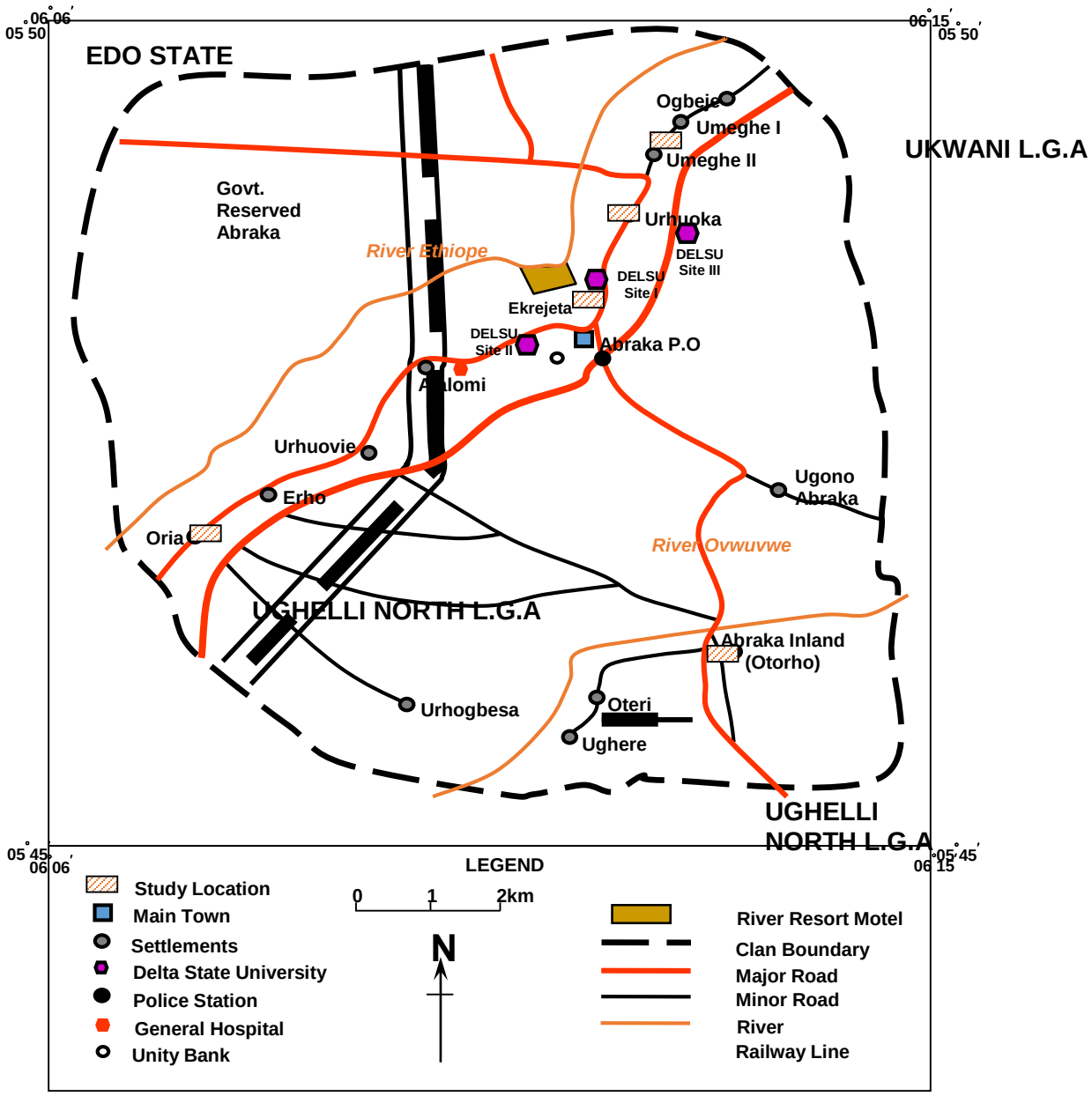

Fig. 4. Map of Abraka Showing Sample Location
Source: Fieldwork (2019)

Conceptual Issues

Theconcept of profit maximization which is borrowed from the discipline of economics is also applicable to agricultural geography to explore and explained some basic issues in farmer's decision making. It is the short and long run process in which any firm be it industrial, commercial or agricultural may determine price based on input and output levels that will give the greatest profit margin

Generally, maximizing profit is a very important goal of every farmer because when profit is maximized, more revenue will accrue to the individual who eventually will result in the expansion of their farm holdings, capital outlay, and employment of more labour force and other areas of the business. Therefore, maximization is a decision making process which involves choosing the best option through an exhaustive search.

In the opinion of (Akinbode, 2002; Adebayo and Olagunju, 2015) most farmers in Nigeria take their decisions based on the need to provide for the present and future requirements whether in terms of food production or in the accumulation of wealth. This propensity to increase food production and inherent wealth acquisition leads the desire for maximization of profit. Therefore, Tarrant (1974), stated that maximization of returns underlies the decisions of individual farmers and apart from that, the need for self-satisfaction also act as an alternative to profit maximization which also affects the farmer's process of decision making. Profit maximization states that individual or firms that choose to maintain a stable profit must stay at a level of output where Marginal Cost (MC) is equal to Marginal Revenue (MR).

In investigating decision making in pricing and output, agriculture involves applying economic principles which entails orientation towards market demandsince agriculture is no longer regarded as a "way of life" but as earlier stated, it is now an economic enterprise.

Economically, farmers should produce agricultural products and raw materials with the intent to maximize profit or minimize cost in order to increase both Marginal Revenue (MR) and Total Revenue (TR). That is, farmers should be ready to produce more of a crop or livestock as price rises, and less as price falls in order to reap the benefits of profit maximization as applied by other enterprises. Farmers usually change their products as price change, always aiming at more profits; this leads them to adjustment of their inputs and outputs in order to maximize profit (Tarrant, 1974; DFID, 2015). The farmer has to always decide on how much of single input to use; how to combine two or more inputs to produce a given amount of product at the least cost; and what combination of products to raise so as to make more profits.

Research Method

Two sources of data were used to investigate carry out this study. This includes the primary and the secondary sources which are meant to bring out the relevant information required for the study. In order to collect data and carryout analysis, each of the study zone was stratified into four neighborhoods and one hundred (100) questionnaires was administered in each neighborhood given a total of four hundred (400) in each study zone of Agbor, Abraka and Ozoro with each from a Senatorial district of the State. This is with a view to achieving the above stated objectives. At the end, one thousand two hundred (1200) questionnaires were administered in twelve neighborhoods using systematic sampling techniques at an interval of five (5) houses along a particular street. The hundred (100) structured questionnaires were given to farmers who were learned enough to respond and those who are not were guided by the researcher.

The above sampling size and sampling frame was arrived at from the 2012 estimated population of the three towns in the local government areas using the Yamane formula (1967) for sampling size determination:

$$S = \frac{N}{1+N(e)^2}$$

Where S= Sample size
1= constant
N= Population size

e = margin of Error is 5% (0.05)

Applying the formula, the following was obtained:

i. Agbor 67,610
ii. Abraka 6,940
iii. Ozoro 43,877

Total population equal to

$$\frac{118427}{1 + 118427(0.05)^2}$$

=399

Therefore, the sample size is 399. For the purpose of evenness however, the questionnaire was increased to 400 administered at each neighborhood. But not all questionnaires were retrieved as shown in the various zones. The purpose of the questionnaire is to elicit information on the types of crops produced in each zone, the total and average output annually and the average monthly income of farmers.Descriptive statistics using averages, percentages and graphs were used to analyze the data obtained from the field.

Table 1:Questionnaire Distribution to study Neighbourhoods in Abraka Zone

S/N	ZONE B- (Abraka)	No of Respondents
1	Ekrejeta	96
2	Oria	98
3	Umeghe/Urhuoka	94
4	Otorho-Avwraka	97
5	Total	385

Source: Field Survey, 2019

Table 1, Shows the various number of retrieved questionnaires in the study areas of Abraka with Ekrejeta having 96 respondents, Oria 98, Umeghe/Urhuoka 94, and Otoro-Avwraka 97. The total is 385 questionnaires retrieved out of 400 distributed. Apart from the table indicating number of questionnaires administered, it is meant to gather information on the average income of farmers in each area of the zone by farmers (see Table 3).

Table 2. Questionnaire Distribution to study Neighbourhoods in Agbor Zone

S/N	ZONE A- (Agbor)	No of Respondents
i.	Owa	96
ii.	Igbodo	95
iii.	Ute-Okpo	94
iv.	Umunede	95
	Total	380

Source: Field Survey, 2019

Table 2, indicates the various number of retrieved questionnaires in the study areas of Agbor with 96 respondents in Owa, 95 in Igbodo, 94 in Ute-Okpo and 95 in Umunede. The total is 380 questionnaires retrieved out of 400 distributed. The other purpose for administering these questionnaires is to gather information on the average income of farmers in each area of the zone by farmers (See Table 3).

Table3. Questionnaire Distribution to study Neighbourhoods in Ozoro Zone

S/N	ZONE C- (Ozoro)	No of Respondents
1	Iyede	94
2	Emevor	92
3	Owhe	96
4	Owhelogbo	98
5	Total	380

Source: Field Survey, 2019

In Table 3, the number of questionnaires retrieved from Iyede is 94, Emevor 92, Owhe 96 and Owhelogbo 98 giving a total of 380 questionnaires retrieved from Ozoro zone. The questionnaires were also used to elicit information on farmer's average income (see Table 3). One of the specific objectives of this study/research is to assess the output of farmers in the three (3) zones of Abraka, Agbor and Ozoro.

From Tables 2, 3 and 4 similar food crops are produced in the three zones but with different output in metric tons annually. The total amount of all the crops produced in the different zones, are given as: Abraka 1,750, Agbor 2,120 and Ozoro 1,630 metric tons.

However, to arrive at the percentage reflected on tables 1, 2 and 3 of each crop produced, this is gotten by dividing each output of a particular crop in any zone by the total output of all crops and multiplying by 100. This is done for all crops in zones A, B and C. An example is shown below:

Abraka

$$Yam = \frac{200}{1750} \times 100 = 11.4\%$$

Results of Findings

Output and Cost of Production of Crops as ranked in the three zones of Agbor, Abraka and Ozoro

The amount of output or production by many farmers depends on three factors, namely; the size of the farm holdings, the rate of output and the numbers of output of other farmers. A short period is long enough to permit any desired change of output technologically through a change in the rate of output but is not long enough to permit any adjustment of size and numbers of other firms or farmers coming into production. The total annual output in metric tons of crops as well as responded annual output were both derived from Table 4.

Table 4. Types of crops and output in Agbor

Zone A (Agbor)		
Types of crops produced	Respondents output metric tons annually (00)	Percentage (%)
Cassava	500	23.6
Yam	300	14.2
Cocoyam	400	18.9
Rice	200	9.4
Potato	200	9.4
Maize	150	7.1
Okro	120	5.7
Melon	80	3.8
Plantain	120	5.7
Pepper	50	2.4
Total	2,120	100

Source: Fieldwork, 2019

Table 5. Types of crops and output in Abraka

Zone B (Abraka)		
Types of crops produced	Respondents output metric tons annually (00)	Percentage (%)
Cassava	200	11.4
Yam	400	22.8
Cocoyam	100	5.7
Rice	300	17.2
Potato	150	8.6
Maize	250	14.3
Okro	200	11.4
Melon	90	5.1
Plantain	40	2.3
Pepper	20	1.7
Total	1,750	100

Source: Fieldwork, 2019

Table 6. Types of crops and output in Ozoro

Zone C (Ozoro)		
Types of crops produced	Respondents output metric tons annually (00)	Percentage (%)
Yam	200	12.3
Rice	300	18.4
Cassava	300	18.4
Cocoyam	200	12.3
Potato	250	15.3
Maize	100	6.1
Okro	80	4.9
Melon	130	8.0
Plantain	40	2.5
Pepper	30	1.8
Total	1,630	100

Source: *Fieldwork, 2019*

From Tables 4, 5 and 6 in the three Zones of (Agbor) has the highest amount of output (2,120) metric tons annually, this is followed by Zone B (Abraka) which is 1,750 and Zone C (Ozoro) with 1,630 metric tons of crops produced annually.

Table 7**:** Average monthly income per farmer (output)

Average income	No of Responses	Percentage (%)
Less than ₦5,000	72	36
₦5,000 - ₦10,000	104	52
₦10,000 - ₦20,000	20	10
₦20,000 - ₦30,000	4	2
Above ₦30,000	0	0
Total	200	100

Source: *Fieldwork, 2019*

Table 7, reveals the socio-economic characteristics of the respondents which showed that farmers earn between ₦5,000 - ₦30,000 monthly in income from their output of crops produced in the studied areas.

Table 8. Output and cost of production in Agbor,Abraka and Ozoro

Total Annual Output (metric tons) 000	Total Fixed Cost (Naira)	Total Variable Cost (Naira)	Total Cost (Naira)	Average Fixed Cost (Naira)	Average Variable Cost (Naira)	Average Cost, AC (Naira)	Marginal Cost, MC (Naira)
100	200	100	300	2.00	1.00	3.00	1.00
200	200	160	360	1.00	0.80	1.80	0.60
300	200	180	380	0.66	0.60	1.26	0.20
400	200	200	400	0.50	0.50	1.00	0.20
500	200	230	430	0.40	0.46	0.86	0.30
600	200	276	476	0.32	0.46	0.78	0.46
700	200	336	536	0.28	0.48	0.76	0.60
800	200	402	602	0.24	0.50	0.74	0.66
900	200	486	686	0.22	0.54	0.76	0.84
1000	200	600	800	0.20	0.60	0.80	1.14

Source: *Fieldwork, 2019*

Cost of output and Profit Margin

From Table 8 and Fig. 5 below, there is a positive correlation between increase in price and output. Therefore, the higher the price the more units of output the farmers we will be ready and willing to put into the market for sale. In the table pepper for example, had a total annual output of 100 metric tons at a total fixed cost of two hundred (₦200) and total variable cost of three hundred naira (₦300) with a marginal cost of ₦1.00. If there is further increase in the price of pepper in the market increases from three hundred naira (₦300) to four hundred naira (₦400) total output will also increase in the margin of an additional fifty (50) metric tons which will invariably increase marginal returns to farmers. This concept of cost as revealed above is very important in the determination of pricing and output by farmers in the market.

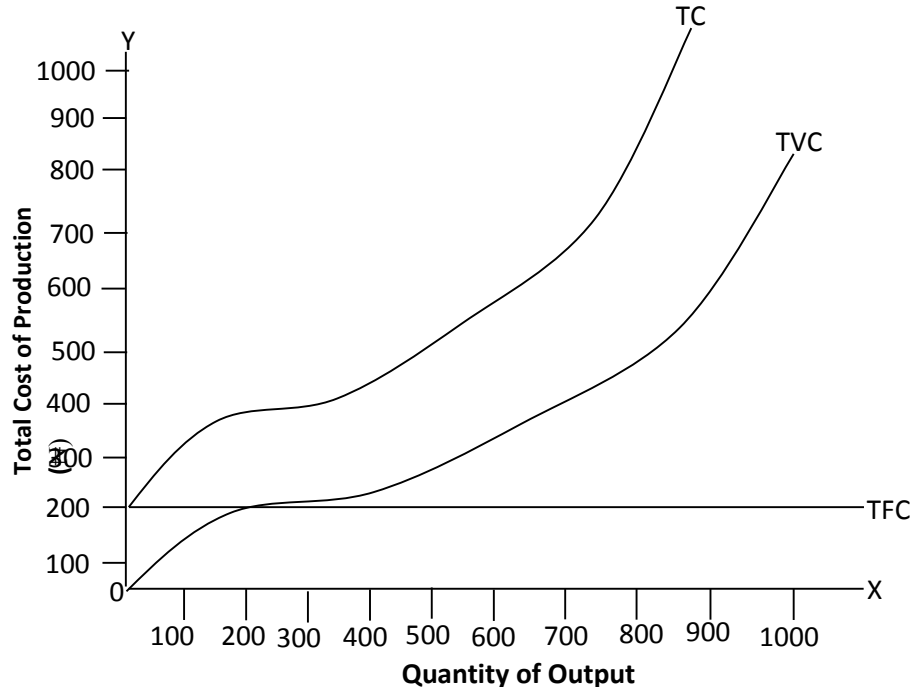

Fig 5. Graphical illustration of diminishing marginal returns of food crop production

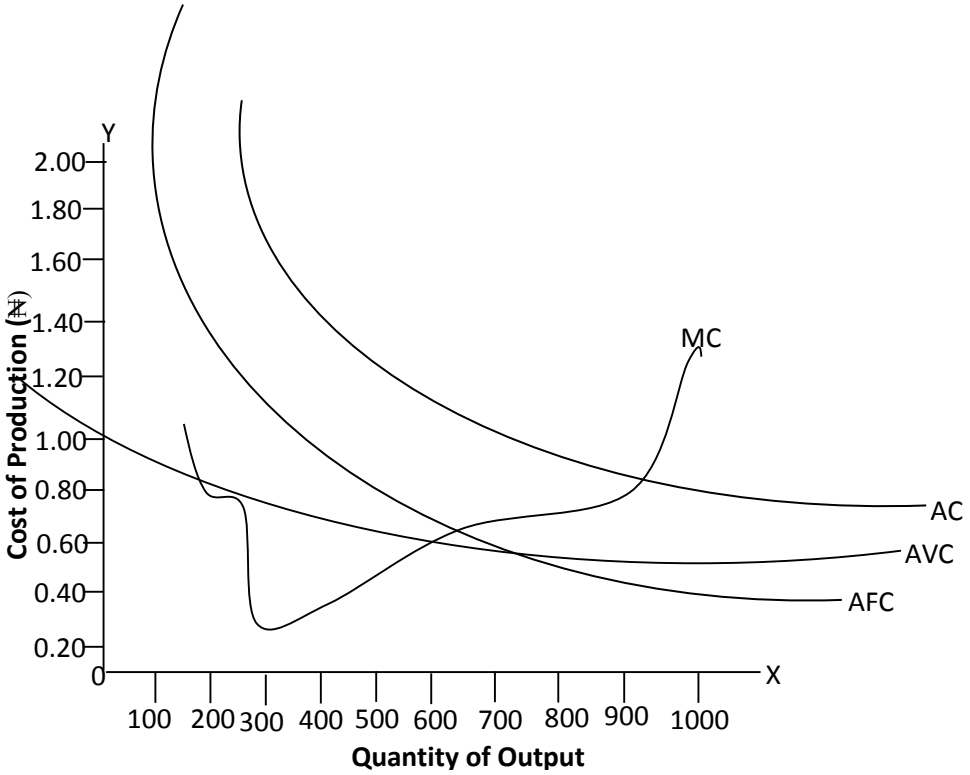

Fig. 6. Graphical illustration of marginal cost of food crop production

From Tables 4, 5, 6 and Fig 6, Farmers in Agbor and Abraka were able to maximize profit as greater quantity of food crops such as cassava was produced and brought to the market for higher price increases. As price increased from 0.60 naira, marginal cost also rose at a corresponding rate. If the output of cassava is (5000 tons) annually in Agbor and (200 ton) in Abraka, the marginal cost will be 0.60 and 0.20 naira respectively. This buttresses the point that, the higher the price the more output farmers are prepared to put into sale in order to realize more units of profit. This is the basis of profit maximization which is applicable to other study areas and crop output in the market.

Optimum level of output

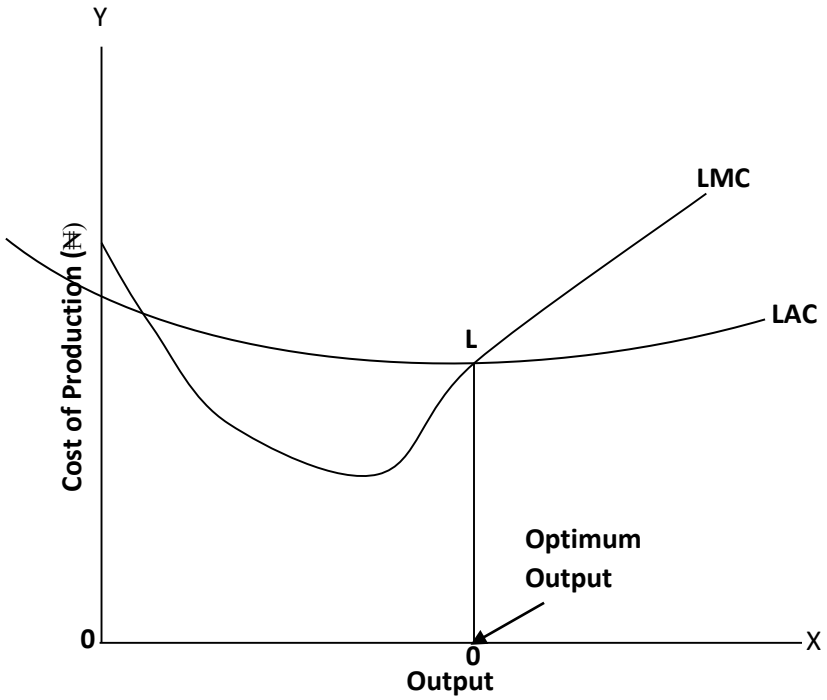

Fig.7 Graphical illustration of production cost in the long run

Table 2 and Fig 7 illustrates the point at which farmers in the three study areas of Agbor, Abraka and Ozoro are prepared to optimize their profit. That is, the farmers are not willing to fall below cost of production and not going above cost of production. This decision is mostly taken by the farmers in order to remain in the business due to the fluctuating prices of crops in the market. However, farmers most farmers will want to sell their crops at a point above marginal cost in order to make excess profit. The optimum output from the diagram is at point (0OL) and the unit price is ₦0.20(naira) at which marginal cost cuts across marginal revenue from below.

The Best Pricing and Output Level for Farmers to Maximize Profit and Minimize Loss in the Market

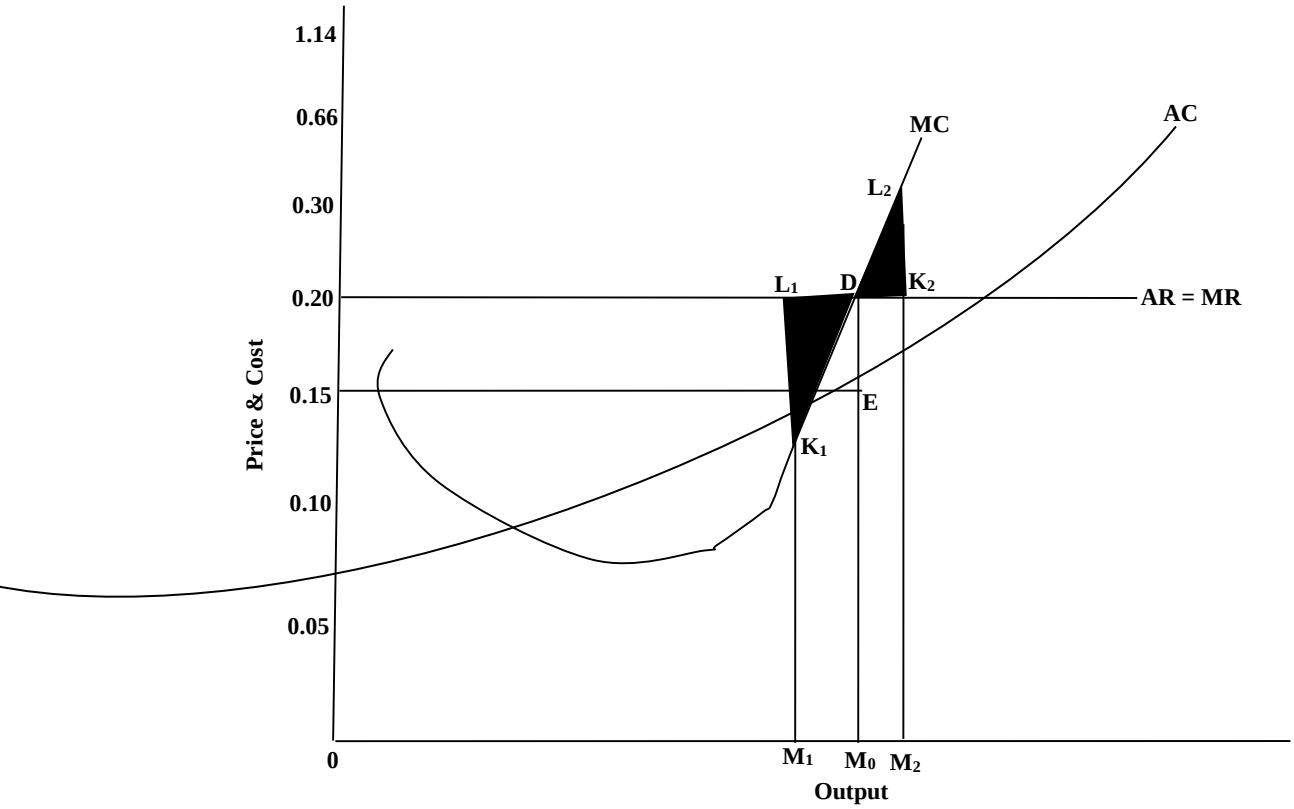

Fig.8. Profit maximization level curves in output and pricing

In Table 4 and fig. 8 shows that farmers in the study areas makes decision about the most profitable output level. The diagram illustrates the cost and revenue of farmers in Agbor, Abraka and Ozoro. Cost and output are measured along the X and Y axis respectively. MC and AC are the marginal and average cost curve and MR and AR are the marginal and average revenue curves.

In making a decision on the most profitable output, farmers take cognizance of the interplay of market forces which is very fundamental. The farmer's produces output up to a level at which the increase in total cost due to additional unit of output is exactly equal to the increase in total revenue associated with that output unit. In order to maximize profits, the farmer must produce that output level at which marginal cost is equal to marginal revenue. In the diagram, OM_O, is the output at which MC=MR at the intersecting point D with a cost of 0.20naira, If the farmer stops production at output level OM_1, marginal cost is M_1K_1 and marginal revenue is M_1L_1. From M_1 to Mo, every additional unit of output adds more to total revenue than to total cost. The farmer will therefore, expand output to OM_O and so get extra net revenue represented by the area K_1L_1D.

On the other hand, if farmer expands output beyond OM_O to say, OM_2 marginal cost is M_2L_2 while marginal revenue is M_2K_2. At this point, marginal cost exceeds marginal revenue by L_2K_2. From M_1 to Mo, every additional unit of output adds more to total revenue than to total cost. If the farmer decides to remain at OM_1, output level, he would actually lose revenue by the amount

represented by the area DL_2K_2. Since he also aims at loss minimization, it is better for the farmer to cut back production from OM_2 to OM_O where MC=MR at unit cost of 0.20 naira.

Conclusions

From the study, it was discovered that the various zones of study differ in output of crop production annually and average income per farmer differs but the basic issue is that, all farmers in the area will maximize profit at a point where marginal cost is equal to marginal revenue. This is explicitly stated in table 4 and fig 2.4 where MC=MR at OM_OD. This is the best option in order for the farmers to remain in business. Beyond point OM_OD the farmers will incur loss, while below area OM_1L_1. There will be "Super normal profit" earnings in excess of contractual payments. This is not too desirable for farmers in the study areas of (Agbor, Abraka and Ozoro).

Recommendation

In order for the farmers in the three study areas to benefit from agricultural output of farm crops and maximize profit as well as minimize loss, it is important that certain mechanism be put in place such as; modern storage facilities like silos to absorb excess food crops produced during off season. This will enable farmers to put their produce to the market all year round and avoid fluctuations in prices in both pre and post-harvest period. Also of importance, is provision of credit facilities through the agricultural banks to farmers to cushion the effect of scarcity of funds to implement the purchase of modern equipments which eventually will enhance productivity and the wealth status of farmers in the rural areas of Agbor, Abraka and Ozoro.

Farmers should form co-operative societies in their respective area of operation to enable them enhance their financial resources to mobilize more labour, agricultural lands, modern implements for tilling the soil and access species that are resistant to diseases. The coming together to form farmers co-operative society will also enable them have a formidable front to negotiate with different agencies and governmental authorities for better access roads, provision of health facilities that will enhance their well-being.

Farming in recent times has gone beyond subsistence level to purely an economic enterprise where profit margin is considered as very important. The farmers in Agbor, Abraka and Ozoro should key into these recommendations to attain growth, development and sustainability.

The study examined the application of profit maximization as a concept in decision making both in pricing and output by farmers in some selected communities. The concept is important to farmers in order to maximize profit and minimize loss. However, there is no straight jacket process to arrive at a farmer making maximum profit, but the concept will act as a guide to every enterprising farmer.

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