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Economic Sustainability of Rice Production during Covid-19 Pandemic in Afikpo North L.G.A of Ebonyi State

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Abstract

This work analyzed the economic sustainability of rice production during the COVID-19 pandemic in Afikpo North, L.G.A of Ebonyi State. A total number of two hundred and forty (240) copies of the questionnaire were administered for data collection in the fifteen (15) sampled areas to elicit information on the spatial distribution of rice production sites, socio-economic characteristics of rice producers, economic impacts of COVID-19 pandemic on rice production and sustainable practices of rice production during the pandemic. The data were analyzed using Nearest neighbour analysis, Frequencies and Percentages, Gross margin analysis and Likert type scale. The study revealed that rice is produced in all the villages in Afikpo North except Ehugbo village. Nearest neighbour analysis showed that rice milling sites are clustered in a particular area in each village. The socio-economic characteristics of rice producers show that a greater percentage (52.5 %) of them are males, also greater percentage (64.2 %) of the rice farmers have a household size ranging from 6-10, also 54.2 % of them aged between 41-50 years, while 60.8 % are married, (50.8 %) attended secondary school, the majority (79.2 %) used both hired and family labour during the pandemic, a greater percentage (40 %) had an annual income between #81,000- N120,000, most of them (55.8 %) had a farming experience of between 11-15 years. The positive economic impacts include large farm output, higher personal income, higher regional income, increased personal property/assets and creation of employment. The negative economic impacts are loss, high labour costs and problems of finance. The budgetary technique employed to analyze the profitability of rice production and the return on investment showed that for the rice farmers who cultivated one acre of land during the pandemic, although they incurred huge production cost (#115,120), they had a high gross margin and profit (#114,500 and #94,880), with ROI of #1.82. The result of the mean scores showed that from the farmer's perspective, cultivating on large expanse of land, use of cheap and efficient labour, use of quality seed, among others were all sustainable practices in rice production during the pandemic. Recommendations include among others that the youth should be encouraged to participate fully in rice production. These recommendations were proffered based on findings to enhance the economic sustainability of rice production in the study area.

Keywords: Economic Sustainability, COVID-19 Pandermic, Rice Production, Afikpo LGA, Ebonyi State

1. Introduction

The concept of sustainability has garnered significant attention in the scientific community, particularly in the context of ensuring food security and alleviating poverty, especially in developing countries with high population growth rates (Onyango, 2010). Conway (1985) defines sustainability as the ability of a system to maintain productivity despite major disturbances, emphasizing the resilience of the system (Hansen and Jones, 1996). This definition underscores the importance of ensuring that farming systems can persist into the future. While there is broad consensus on the importance of sustainability, there is no universal agreement on how to assess it, both in agriculture and more broadly.

Economic sustainability involves utilizing various strategies to optimize existing resources in a way that ensures a responsible and beneficial balance over the long term (Walker and Schulze, 2008). In the context of rice production, economic sustainability is crucial for maintaining the well-being of households and society through profitable rice cultivation (Arrow et al., 2004; Pezzy, 1992). It encompasses assessing the impact of rice production on the economic conditions of farmers and the broader economic systems at local, national, and global levels. This includes understanding the flow of capital among different farmers and the overall economic implications of rice production on society.

Rice production in Nigeria has shown significant growth, reaching 8.03 million tonnes in 2017, representing a 14.7% increase from the previous year, making Nigeria the leading rice producer in West Africa, responsible for over 40% of the region's total production (FAO, 2017). This production is spread across various regions, including the middle belt, southeast, and some far northern states. Afikpo North, a Local Government Area in Ebonyi State, is actively involved in rice cultivation (Singh *et al*, 2011 FAOSTAT, 2007). However, rice production in Nigeria faces challenges despite its potential to meet the food requirements of the population (Audu, 2008). Afikpo North is one of the Local Government Areas of Ebonyi State in the southeastern part of Nigeria that is fully involved in rice production. Rice production is generally seasonal while consumption is regular and continuous throughout the year.

Rice is grown successfully in a rain-fed environment. It has immense potential to meet the food requirements of the human population. High demand for rice has made it less affordable for poor consumers, thus the need for its increased productivity and sustainability can never be over-emphasized (Nwele, 2016). The adoption of improved and sustainable rice technologies holds the key to ensure both sustainability and increased rice production but with COVID-19, the challenges hampering the attainment.

of food security in Nigeria could deepen (Kushal, 2018).

The Coronavirus disease (COVID-19) pandemic has affected many spheres of life, including the educational, health, economic, and agricultural sectors. Some public health safety measures were introduced to break the transmission chain of the pandemic, such as social distancing, regular hand hygiene, border closure, restrictions on internal movement, and lockdowns. Some of these measures have contributed to reduced economic power, shortage of labor for agricultural production, and huge losses in the agricultural sector (Ilesanmi *et al*, 2021).

The impact is already being felt in the form of rising food prices. As at April 2020, food inflation rose to 15% compared to 14.7% in December 2019 (PwC Nigeria, 2020). With reference to food inflation, rice play a key role in Nigeria staple food. Rice is one of the most consumed staples in Nigeria, with a consumption per capita of 32kg. Significant progress has been recorded in rice production; rice production in Nigeria reached a peak of 3.7 million tonnes in 2017. Despite this improvement, comparatively, Nigeria's rice statistics suggest there is an enormous potential to rise in productivity and increase production. Yields have remained at 2 tonnes per hectare, which is about half of the average achieved in Asia. Again, as the population increases, along with rural-to-urban migration, ensuring food security becomes critical in key staples.

The effect of COVID-19 on agriculture in Nigeria has been enormous due to the limited mechanization and high labour intensity in agriculture in the country. Over one-third (35%) of the country's total labour force is employed in the agricultural sector (World Bank, 2020). Idu and Onyenekwe (2021) suggested that commissioners of agriculture have important roles to play to help mitigate these negative impacts on agricultural livelihoods and food systems. These include a push for a bill to integrate social protection mechanisms into the Nigerian legal framework, lobby for increased budgetary allocation to the agricultural sector, formulation of good agricultural policies and provision of adequate infrastructures, organization of these farmers into farming clusters to help stimulate agglomeration economies by integrating agricultural value chains and development strategies, and frameworks and initiatives that will ensure a seamless transition from emergency response to resilience building.

To the farmers in the study area, the effect of COVID-19 pandemic on agriculture, especially rice production, is very important. This is because the majority of the inhabitants depend on rice production for their livelihood. Rice is highly susceptible to seasonal shock, greenhouse gases and climate vagaries because of its sensitivity to changing climatic conditions (Esiobu et al, 2021). The COVID-19 pandemic is already affecting the livelihoods of rural communities across Southeast Nigeria,

which is predominately rice-based, and increasing their vulnerability as well. The increasing variability, greenhouse gases, intensity, and erratic nature of rainfall, rising incidence of flood and soil erosion, and serious decline in agricultural yields are among the obvious climate change hazards ravaging communities across Southeast Nigeria (Esiobu et al, 2021; Esiobu and Onubuogu, 2014). To overcome this challenge, rice production/yield should be increased particularly now there is new threat for farmers. As a matter of urgency, farmers must respond to this new threat (COVID-19) by choosing measures that increase their yield.

Furthermore, there are empirical studies that documented the effect of COVID-19 pandemic on rice yield. For instance, Gafar (2022) noted that the farming activities mostly affected by the pandemic on the pre-harvest activities was access to inputs while that of post-harvest activities was marketing of rice after harvest. Also, Panpakdee and Palinthorn (2021) observed that Covid-19 affected organic rice production as the organic farmers had to make changes to adapt to the new changes brought about by the pandemic. Hence, they noted that organic rice production's resilience was truncated by the emergence of the Covid-19. Ejike-Alieji (2023) on the other hand assessed rice farming challenges during the pandemic period in Ikwo and noted that the lockdown resulted in a surge in the demand for rice within the State and its neighbouring areas. Rice became a primary relief product utilized by the government, NGOs, and the general population. This heightened pressure on the rice supply chain, exacerbated labour shortages, and mobility issues, thereby placing additional strain.

On average, the poverty level in the study area is high and the inhabitants are classified as very poor (CBN, 2020). Also, it is estimated that the number of people living below the poverty line in developing countries of which Nigeria is included will rise by 29 million (UN, 2020). Therefore, this demonstrates how vulnerable farmers in the study area and Nigeria in general are to the COVID-19 pandemic.

The pandemic poses new challenges to the already vulnerable rice value chain in Afikpo North, potentially suppressing its economic viability in the future. This prompted a critical examination of whether rice production adequately sustained farmers and communities during the pandemic. To address this, the study analyzed the economic sustainability of rice production in Afikpo North L.G.A. It also investigated the spatial distribution of rice production sites, socio-economic characteristics of rice producers, economic impacts during COVID-19, and sustainable production practices. Recommendations were made to enhance economic sustainability, urging urgent measures to increase rice production and yield to mitigate the threat posed by the pandemic to farmers in the area.

2. Study Area

The study area is located between latitudes 5° 51´N and 6° 03´N; and longitudes 7° 5´E and 8° 06´E and covers the areas around Amasiri, Ehugbo, Ohaisu, Ibii, Ugwuegu, Amizu, Oziza, Akpoha, Uwana, Amuro, Enohia Nkalu, Amangbala, Ozaraukwu, Itim and Ndibe. It has an area of 240km². Figure 1 is Ebonyi State showing Afikpo North LGA and the villages.

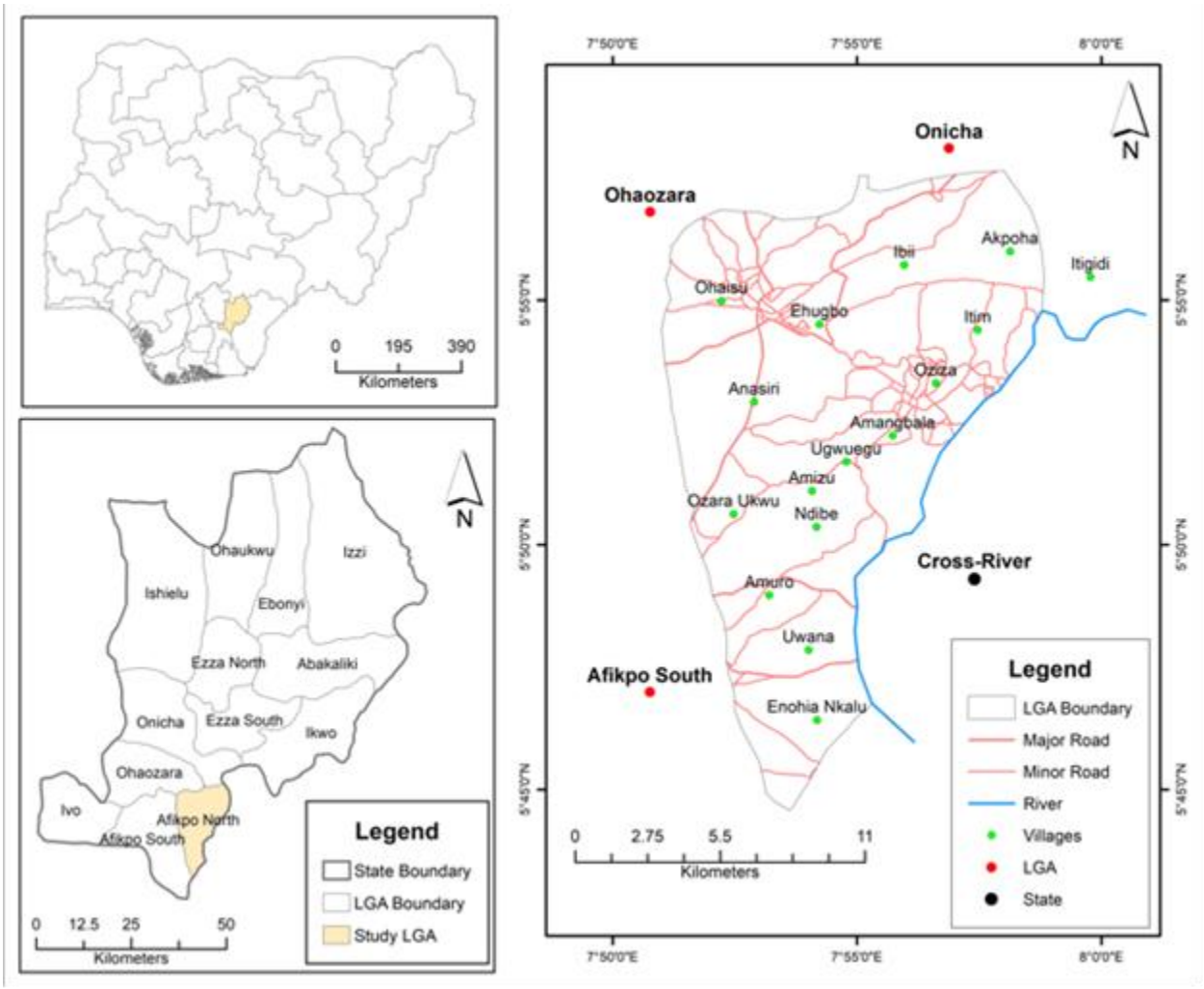

Fig 1: Ebonyi State showing Afikpo North L.G.A and the villages.
*(*Source: Adapted from Google maps, May 2020*)*

Afikpo North has a lower elevation on average of less than 100 m and is characterized by ridge and swale topography. The ridges are most prominent towards the Western part of the study area around Amasiri and Ibii where they trend NE-SW. The ridge profiles are asymmetrical with a gentle southeastern dip slope and a steeper northwestern scarp slope (Ofomata, 2002a). There is evidence of the exposure of older sedimentary rocks which are deposited during the younger secondary or cretaceous

age (i.e. some 120-180 million years ago) by erosion. Afikpo North and its environs are characterized by an undulating plain alternating from East-West comprising of as high as 137m to low land of about 15m above sea level. The gap between the highest and the lowest is due to the erosion within Afikpo sandstone. The plains are underlain by shales, while the ridges are underlain by siltstones and sandstones (Ofomata, 2002a)

The vegetation in the study area is derived from Guinea savannah with relict forest. This area was originally the drier part of the high forest. Due to bush burning and overgrazing, cultivation, and hunting activities over a long period in the area, most of the high forest trees were destroyed and the forest was replaced with a mixture of grasses and scattered trees. The study area enjoys a warm tropical climate with relatively high temperatures (27°C on average) throughout the year and two seasons; the rainy or wet season that lasts from March to November in the South and from May to October in the north; and the dry season that occupies the rest of the year (Anyadike, 2002). The rainy season has two periods of maximum rainfall separated by a short relatively dryer period in August (the August break). The climate of Afikpo North supports rice production.

The soil of Afikpo North is clayey, loamy clay and clayey loam soils. The clayey swampy soil is suitable for rice farming. This explains why rice is cultivated in Afikpo North L.G.A. The soil in Afikpo North can also be used for yam and cassava cultivation. The Afikpo town is drained by the Ozizza beach, Ndibe beach and Uwana beach which are major tributaries of Cross River (Anyadike, 2002). The river has a dendritic pattern with tributaries forming tree structures and mainly associated with coastal area and clay siltstone dominates the environment. Afikpo North has an area of 240km² and a population of 156,611 as at the 2006 census (NPC 2006), projected to be 207,635 persons in 2023.

The economic activity of Afikpo North Local Government Area is predominantly agriculture. Rice, yam and cassava are mostly produced in the study area. Other activities carried out in Afikpo North include quarrying activity, lumbering, fishing, trading among others.

3. Testing for Significance

Let Ho be: "There is no significant difference between the distribution (pattern) of rice milling sites in Afikpo North L.G.A and random pattern".

Here Z is negative (because Do is greater than De). As a result, (-3.298) is less than +/-1.96, Ho is accepted. Thus, there is no significant difference between the distribution and a random pattern, and since the nearness neighbour index is 0.7, the earlier conclusion that the pattern of rice milling sites in LGA is not random is accepted.

The Rn value of 0.7 and a negative Z score indicate that the spatial distribution of rice milling sites in Afikpo North Local Government Area is clustered. As observed in the field, in different villages in Afikpo North, the concentration of rice milling sites is in a particular area close to the market.

4. Research Methodology

4.1 Research Design

A reconnaissance survey of the area under study was first carried out in which observation for familiarization with the nature and general characteristics of the study area was done. It also enabled the researcher identify the villages and households in Afikpo North that are involved in rice production in order to administer questionnaire and to interview key informants. It was necessary for this research work as it helped to select suitable areas with the target population for ease of data collection. This was followed by the actual fieldwork whereby a cross-sectional research design was used. According to Mba (2004) a cross-sectional design involves the collection of data at one point in time. In this type of research design, either the entire population or a subset thereof is selected. A subset of the population was selected for the purpose of this work and from these individuals, data were collected to help answer research questions of interest.

4.2 Sample Size and Selection

Afikpo North has a total population of 115,611 persons (2006 population census), but was projected to 207, 635 persons in 2023. All the villages in Afikpo North L.G.A were selected for the study. From the total population of 156,611 persons, the sample size for this study was determined using the method by Yamane (1967) with the formula:

$n = N/ [1+N (e) 2]$

Where;

n= Sample size

N= Finite population

e= Level of precision (or sampling error usually 0.10, 0.05 and 0.01)

1= Unity (a constant).

A total of 400 sample size was arrived at using 0.05 as the level of precision (e) while a total of 240 rice farmers were involved in this study.

Multi-stage sampling technique was adopted for this study. At first, a purposive sampling technique was employed in selecting 240 rice farmers that were used for the study. Thereafter, random sampling was used at stage two, to select four villages from each of the fifteen (15) major villages in Afikpo North making a total of 60 villages. For stage three, we purposively selected 4 rice producers from each of the villages which made a total of 240 respondents used for the study. At this stage, the criteria for selection were years of rice farming and level of yearly productivity.

4.3 Data Collection Methods

4.3.1 Primary data

Primary data were collected from different sources employing a combination of methods including field observation, collection of coordinates with the aid of GPS, use of camera, oral interview, the use of structured questionnaire, and key informant interview. The copies of the questionnaire were administered one at a time and all were collected back from the respondents.

4.3.2 Secondary data

Secondary data was obtained through a review of relevant literature concerning the subject. Also, other important materials were obtained from published and unpublished documents, textbooks, research papers and journals in libraries and from the Internet.

4.4 Data Analysis

Descriptive and inferential statistics were used to analyze the data generated. For each objective, a particular type of data analytical tool was used. Nearest neighbour analysis was employed in objective one to determine the spatial distribution of rice milling sites in the study area. Frequencies and percentages were used to analyze the socio-economic characteristics of rice producers as well as the positive economic impacts of rice production. Gross margin analysis was used to determine the profitability of rice production during the pandemic in the study area. Means scores using the Likert type scale was applied in objective three which is to examine the sustainable practices of rice production in the study area. Maps and pictures were also used to enhance data analysis and description.

The spatial distribution of rice production sites was ascertained by carrying out a fieldwork in which global positioning system (GPS) was used to establish the absolute locations of sites where production of rice takes place in Afikpo North. They include rice farms and rice milling sites. The rice farms and rice milling sites were observed in all the villages in Afikpo North except for Ehugbo village which has no rice farm. The presence of these rice farms and rice milling sites in these villages indicate that rice production is practiced in almost all the villages in Afikpo North. The GPS location of these sites helped to fix the exact location on the map of Afikpo North and further input them into GIS GIS-compatible format/environment. Then, the coordinates generated with the GPS were fixed exactly on the map and digitized for full conversion to the digital map.

Nearest neighbour analysis was used to determine the pattern of distribution of the rice milling sites. Nearest neighbor analysis entails that any calculated value of nearest neighbour index (Rn) will fall between 0 and 2.1491 (Clark and Evans, 1954). The lower the value of the nearest neighbour index, the more clustered the pattern. Values of the nearest neighbour index between 0.10-0.90 indicate a clustered pattern, a negative Z score indicates clustering, a positive score indicates dispersion or evenness. And if Rn is 1.0 or close, then the pattern is random. If Rn is 2-2.15, it is at a regular pattern.

4.5 Discussion of the results

The data collected were analyzed and presented into sections to cover all the objectives. Firstly, the spatial distribution of rice production sites was presented, followed by the socio-economic characteristics of rice farmers. The economic impacts of rice production were presented. Finally, the sustainable practices of rice production in the study area were assessed.

4.5.1 Spatial Distribution of Rice Production Sites in Afikpo North

1. Rice farms

Fig. 2 shows the different locations of sampled rice farms in Afikpo North.

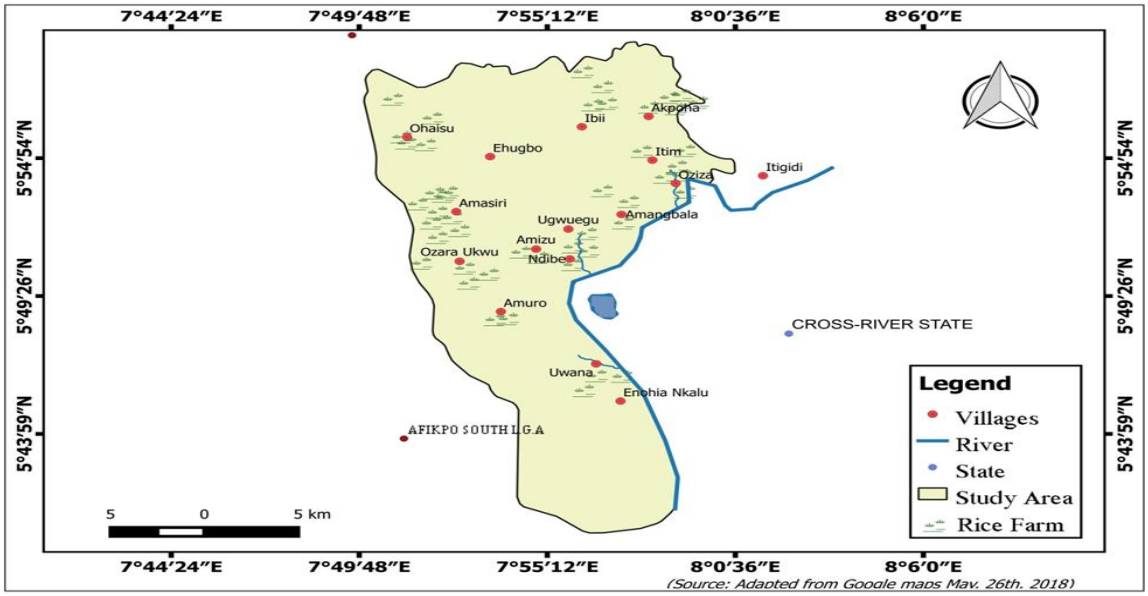

Fig 2: Spatial distribution of the sampled rice farms in Afikpo North

*(*Source: Adapted from Google maps, May 2020*)*

Results from Figure 2 shows that rice farms are numerous in Afikpo North but a total number of 45 rice farms were identified and used for this study. Amasiri village has the highest number of rice farms as well as rice producers in Afikpo North. This is followed by Amangbala, Akpoha, Ugwuegu ,Oziza among others, (Eze and Chukwuma, personal communication). It was observed from the field study that Ehugbo which is the Local Government Area headquarters has no rice farm. This is because Ehugbo is on a hilly area which doesn't support swamp rice production. The photographs in plate 1 and plate 2 are rice farms captured in Afikpo North L.G.A.

Plate 1: Rice farm at Amasiri village in Afikpo North before transplanting (temporary site)
(Source: Fieldwork, 2020)

Plate 2: Rice farm at Akpoha village Afikpo North after transplanting to the swampy area.
(Source: Fieldwork, 2020)

2. Rice milling sites

Rice milling sites are limited in Afikpo North with the number of rice milling sites highest in Amasiri village and lowest in Ehugbo. A total of thirty-seven rice milling sites were identified in the study area and used for the study. Fig 3 shows the spatial distribution of rice milling sites in Afikpo North.

Fig 3: Spatial distribution of rice milling sites in Afikpo North
*(*Source: Adapted from Google maps, May 2020*)*

From the result of the nearest neighbour analysis for the rice milling sites, the observed mean distance was 0.00968860001938, the Expected mean distance was 0.0135209451228, the Nearest neighbour index was 0.7165623358, N was 37, the Z Score was -3.29829354812. Since the Nearness neighbour index is 0.7 with a negative Z score, the pattern of rice milling sites is be described as clustered

.4.5.2 Socio-Economic Characteristics of Rice Farmers in Afikpo North.

The socioeconomic characteristics of rice farmers are given in table 1.

Table 1: The socio-economic characteristics of rice farmers in Afikpo North L.G.A

Variable	Frequency	Percentage (%)
Gender		
Male	126	52.5
Female	114	47.5
Householdsize		
1-5	86	35.8
6-10	154	64.2
Marital status		
Single	50	20.8
Married	146	60.8
Divorced	4	1.7
Widowed	40	16.7
Educational qualification		
No formal education	18	7.5
Primary education	80	33.3
Secondary education	122	50.8
Tertiary education	20	8.3
Age		
21-30	10	4.2
31-40	40	16.7
41-50	130	54.2
>50	60	25
Type of labor used		
Family	36	15
Hired	14	5.8
Both family and hired	190	79.2
Mode of land acquisition for farming		
Inherited	26	10.8

Purchased	10	4.2
Rented	28	11.7
Both inherited and rented	176	73.3
Source of planting material		
Market	40	16.7
Previous harvest	18	7.5
Both market and previous harvest	182	75.8
Annual income		
<#80,000	46	19.2
#81,000-#120,000	96	40
#121,000-#160,000	62	25.8
>#160,000	36	15
Farming experience		
<5 years	20	8.3
6-10 years	42	17.5
11-15 years	134	55.8
>15 years	44	18.3

Frequency total = 240 (number of respondents) and Percentage total = 100
(Source: Author's computation, 2020)

1. Gender

From the result in Table 1, it was observed that 126 of the respondents are male and the remaining 114 female. This shows that even though a greater percentage of the rice producers are male (52.5%), it is just a little above the percentage of females (47.5%). This implies that both men and women in Afikpo North L.G.A are fully in rice production. If both men and women will continue in this trend of producing rice, there will surely be increase in rice production which in turn will lead to economic sustainability of rice production.

2. Household Size

The results show that majority of the rice farmers had family sizes of between 6 and 10 (64.2%). This implies that rice farmers in Afikpo North L.G.A may have adequate labour supply from the family if properly utilized and this will make them not to depend solely on hired labour for production. This could have a positive effect on labor cost and profitability of rice production if family members are willing to engage in rice production. The consequence may be decreased production costs as extra money would not be required to pay for hired labour.

3. Marital Status:

Most of the rice farmers (60.8%) were married with 50 (20.8%) single, 40 (16.7%) widowed, and only 4 (1.7%) were divorced. This result shows that married people who dwell more in Afikpo North engaged more in rice farming, while the young people reside in the city in search of other livelihood options outside agriculture. It also shows that regardless of marital status, rice production can be practised by just anybody

.4. Educational Qualification:

About 50.8% of the rice farmers attended secondary school, 33.3% attended primary school 8.3% of the respondents had tertiary education and the remaining 7.5% had no formal education. This implies that majority of the rice farmers can read and write and as such innovations can easily be adopted by them with little effort. This will thus have a positive impact on the adoption of new techniques that would ensure the economic sustainability of rice production.

5. Age

The result shows that 54.2% of the rice farmers fell between the ages of 41-50 years, followed by 25% being above 50 years while 16.7% are between the ages 31-40 years, the least percentage 4.2% fell between the ages of 21-30. This shows that rice production in the area is dominated by advanced people who are still energetic and responsive. It also shows that the younger ones are not fully committed to rice production. Hence, there is a need for younger ones to develop more interest in rice production to enable its continuity. The age bracket of rice farmers is presented in Fig 4.

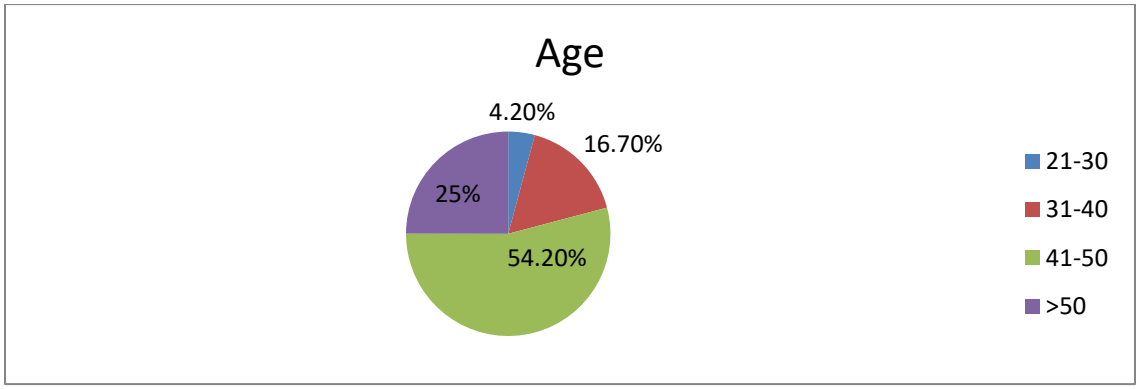

Fig 4: A pie chart showing the ages of rice farmers in Afikpo North L.G.A
(Source: Author's computation, 2020)

6. Type of Labor

The result shows that 15% of the respondents depend solely on family labor and 5.8% on hired labor only, while majority (79.2%) use both family and hired labor. This implies that even though most of the farmers have large household sizes as the research indicated, they do not provide adequate labor needed by most rice farmers. Drawing from the problem of research, this could be attributed to the fact that their children migrate to bigger cities for education or in search of a better livelihood options.

Land is one of the key determinants of agricultural production. The study revealed that some of the rice farmers (10.8%) farm on inherited land only, 4.2% purchased theirs, 11.7% farm on only rented land while a large percentage of the respondents (73.3%) make use of both inherited and rented land for rice production. This shows that the inherited lands are not enough for most rice producers which makes them rent land for sufficient production. This can be attributed to the high population density which could result in low availability of land. The modes of land acquisition for rice farmers in the study area are presented in Fig 5.

7. Mode of land acquisition for farming:

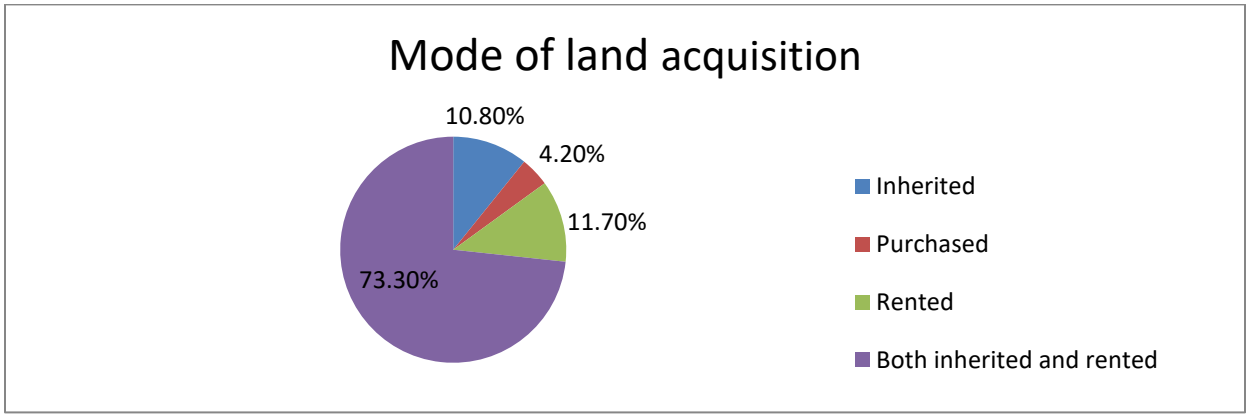

Fig 5: A pie chart showing the mode of land acquisition by rice farmers in Afikpo North L.G.A (Source: Author's computation, 2020)

8. Source of Planting Material:

The result shows that 16.7% and 7.5% of the respondents depend on the market and previous harvest respectively for the source of planting material, while about 75.8% get from both market and previous harvest. This could be because the previous harvest is not always sufficient for majority of the rice farmers to cultivate with which may be because of low yield or because the stored yields are more susceptible to pest and disease because of contamination from soil and storage media.

9. Annual Income:

The research showed that majority (40%) of the respondents had an annual income ranging from #81,000-#120,000, while some (25.8%) had in between #121,000- #160,000.

The result further shows that 19.2% had less than #80,000 while only about 15% of the respondents had more than #160,000 annual income. The gap across the groups could be as a result of the differences in quantity of land cultivated, planting materials used, method of planting operations adopted, use of labor and other factors of rice production. The annual income of rice farmers in the study area are presented in Fig 6.

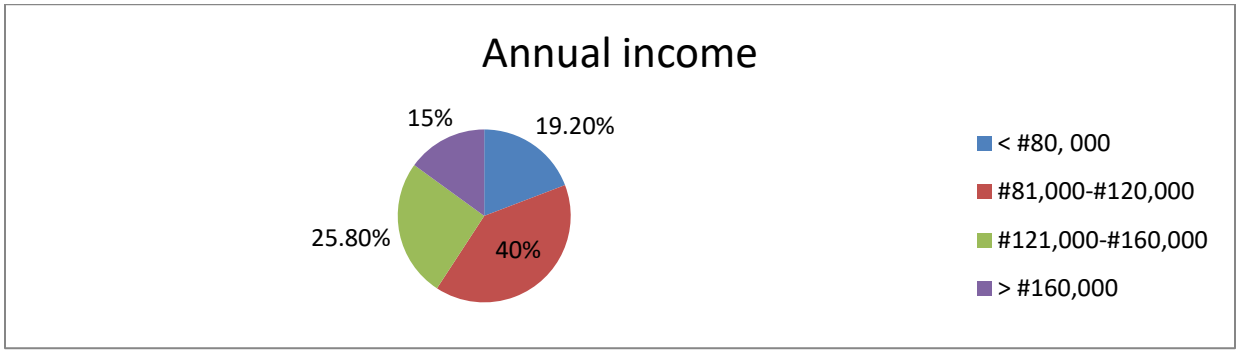

Fig 6: A pie chart showing the annual income of rice farmers in Afikpo North. L.G.A (Source: Author's computation, 2020)

10. Farming Experience:

The experience of the rice farmers is very important in decision-making, although it is worth noting that an increase in years may only increase production or productivity to a certain level after which it may be negative. The study shows that 8.3% of the respondents had farming experience of less than 5 years, 17.5% had between 6-10 years of experience, 18.3% had more than 15 years farming experience while 55.8% had 11-15 years of experience. That is to say that majority (18.3% and 55.8%) had more than 11 years' experience in rice farming. This could be that younger ones are gradually drawing back from rice production as a source of livelihood leaving it mainly for the older ones. If this trend continues, the economic viability of rice production will be suppressed shortly.

4.5.3 Economic Impacts of Rice Production during Covid-19 Pandemic in Afikpo North L.G.A

Economic impacts are the effects of the economic activities in a given area. In crop production, they are viewed in terms of; farm output (productivity), personal income (individual profit), regional income (collective profit), personal property/assets and employment creation. Any of these measures can be an indicator of improvement in the economic well-being of area residents as well as indicator of economic sustainability. Economic impacts are different from the valuation of individual user benefits of a particular facility or service, and they are also different from broader social impacts. Social impacts and individual benefits come because of economic impacts.

Table 2 shows the percentage response of the respondents on the positive economic impacts of rice production during the COVID-19 pandemic in the study area.

1. Positive economic impacts

Table 2 shows the percentage response of the rice farmers on the positive economic impacts of rice production during the COVID-19 pandemic in Afikpo North L.G.A.

Table 2: Positive economic impacts of rice production in Afikpo North

Positive economic impacts	Frequency	Percentage
Large farm output (productivity)		
No	50	20.8%
Neutral	5	2.1%
Yes	185	77%
High personal income/profit		
No	86	35.8%
Neutral	3	1.7%
Yes	151	62.9%
High regional income /profit		
No	89	37.1%
Neutral	-	-
Yes	151	62.9%
Increased personal property/Assets		
No	129	53.85%
Neutral	-	-
Yes	111	46.3%
Creation of employment		
No	50	20.8
Neutral	-	-
Yes	190	79.2

Frequency total = 240 (number of respondents) and Percentage total = 100]
(Source: Author's computation, 2020)

2. Large farm output: From the results from Table 2, 20% reported a low output. The majority which is 77% reported a high output. This indicates that rice production was productive during the COVID-19 pandemic in Afikpo North. The output size difference is because of the general lockdown during the COVID-19 pandemic which provided the opportunity for more people to be available for farm activities and again the differences in the factors of rice production practised or used by the farmers.

3. High personal income/profit: The study revealed that rice production in Afikpo North generates substantial income for most of the rice farmers. Hence, 62.9% of the rice farmers accepted this notion whereas 35.8% reported negative.

4. High regional income/profit: Rice production generates income for most of the people in different villages in Afikpo North as shown in the result, whereby 62.9% of the rice farmers accepted the notion while 37.1% rejected it.

5. Increased personal property/Assets: From the result, 46.3% of rice farmers acquired their personal property/assets from rice production and 53.8% did not. Even though the number of people who accepted are lower than those who rejected, the gap is not highly significant. This shows that rice production during the pandemic contributed to the acquisition of personal property/assets in Afikpo North.

6. Creation of employment: Rice production provides jobs for people during the lockdown as a result of the pandemic in Afikpo North as revealed by the result whereby a majority (79.2%) of the respondents agreed to that while only 20.8% reported negative.

From the general result, the large output of rice revealed by the result satisfies the productivity indicator of economic sustainability. The high personal income and regional income also satisfy the profitability indicator of economic sustainability of rice production while the property/assets acquired through rice production and employment opportunities available to the people in Afikpo North through rice production are also indicators of economic sustainability during the pandemic. Therefore, from the results of the study, it can be concluded that rice production is economically sustainable during COVID-19 pandemic in Afikpo North. Fig 7 shows the positive economic impacts of rice production in the study area.

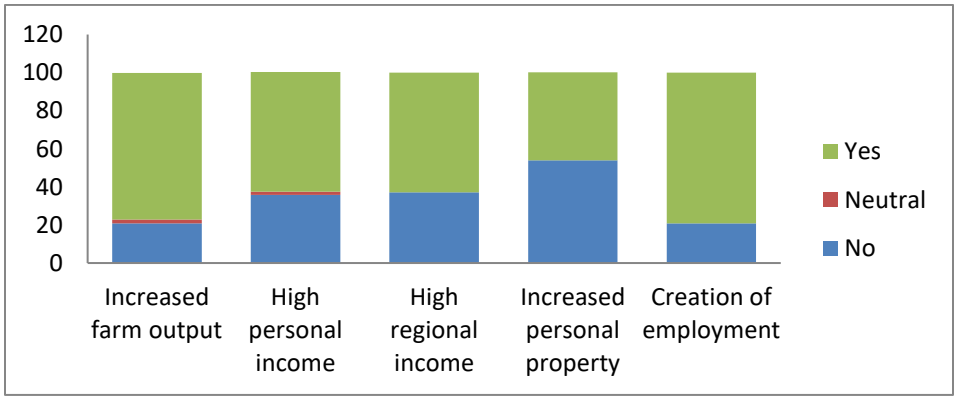

Fig 7: A bar graph showing the positive impacts of rice production during the COVID-19 pandemic in Afikpo North
(Source: Author's computation, 2020)

In the graph above, the vertical row shows the percentage of respondents while the horizontal row shows the economic impacts.

4.5.4 Cost and return of rice production in Afikpo North L.G.A

Efforts were made to determine the costs associated with rice production during the pandemic and the revenue generated. The analysis is based on the cost and return from the cultivation of 1 acre of land (6 plots).

Table 3: Net farm income analysis of rice production per acre.

Item	Average Quantity	Unit Cost(#)	Amount(#)
Variable cost			
Seed rate	150kg	150	22,500
Fertilizer	3 bags	7000	21,000
Herbicide	10 bottles	1200	12,000
Pesticide	-	-	-
Labor	16man-days	2500	40,000
Total variable cost (TVC)			**95,500**
Fixed cost			
Opportunity cost of land			15,000
Depreciation of farm implements		4620	
Total fixed cost (TFC)			**19,620**
Total cost (TC) = TFC+TVC			**115,120**
Revenue			
Yield (TR)	30 bushel	7000	**210,000**
Gross margin (GM) = TR-TVC			**114,500**
Net Farm Income = GM-TFC or TR-TC			**94,880**
Return on investment (ROI) = TR/TC			**1.82**

*(*Source: Author's computation, 2020)

Table 3 shows the cost and income generated from cultivation of rice using 1 acre of land. Farm budgetary technique was used to get the net farm income as well as the return on investment. Farm budgetary technique is a method used to estimate the farming come (revenue) and expenses (cost) as well as the return on investment associated with crop production.

Though scores may vary a little from one man to the other, from the gross margin analysis, it could be seen that a profit of #94,880 was made after investing #115,120. The return on investment (ROI) was #1.82, implying that for every one naira invested, there was a return of 82 kobo. From this, one is right to assume that every other thing been equal, during COVID-19 pandemic, cultivation of rice was profitable in the study area and since

profitability is the outcome of productivity which is the core indicator for economic sustainability, this study shows that rice production is economically sustainable in Afikpo North. It was also observed that they expend more on production cost but the better yield obtained results in high revenue and consequently higher returns. It is therefore suggested that if farmers could have access to these inputs at subsidized prices, it will enhance profitability of rice production.

The result also shows that there is a high prospect for rice production in the study area. One striking observation about the profitability of rice production in the area was the significance of labour cost in rice production. Labour cost accounted highest in all the total production cost. Drawing back to the research problem, this is as the result of the fact that public safety measure of the lockdown during COVID-19 prevented many labourers from traveling from neighbouring villages leaving relatives and friends to hire labour from within the village for most of the rice production processes. Thus, any practice that would reduce the cost of labor will be a welcome development as it will improve profitability which in turn leads to economic sustainability

4.5.5 Negative economic impacts of rice production during COVID-19 pandemic in Afikpo North L.G.A

Some of the negative economic impacts of rice production were elicited through oral interview and they include loss, labour cost and finance.

1. Loss: Some rice farmers reported that during the pandemic, they did not enjoy increased production. Most of the farmers complained about the negative effects of the lock down which restricted access to hired labourers from nearby villages, which affected their yield greatly.

2. Labour cost: Most of the rice farmers complained about high cost of labour. Rice production is not an easy process, and it involves rigorous stages. All the stages require labour and at the end of each production, the total cost of labour exceeds the cost of almost all other variable costs accrued during production.

The high cost of labour was attributed to the lock down which restricted labourers from travelling to nearby villages to farm, thereby leaving labour for the immediate family, relative and friends for every production process.

3. Finance: Rice production requires adequate capital for start- up as well as for its continuity. Finance is needed to buy or rent land, buy farming tools as well as their repair, buy farm input such as seed, fertilizer, herbicides etc and pay for labour. Some rice farmers reported that they are constrained by finance. They desire to enlarge their production but lack adequate finance to do so.

4.5.6 Practices of Sustainable Rice Production during Covid-19 Pandemic in Afikpo North L.G.A

There are factors or practices that could enhance rice sustainability in Afikpo North. Some of these practices were listed and famers were asked to rate them in a 5-point

Likert type scale to show to what extent they agree or disagree to their capacity to sustainability of rice production. The 5-point rating availed the farmers the opportunity to choose the best practice they think that could enhance rice sustainability in the study area. The ratings were in the order: Strongly agreed (SA) = 5, agreed (A) = 4, neutral (N) =3, disagree (D) = 2 and strongly disagree (SD) = 1. The mean score based on the five-point scale is 5+4+3+2+1 = 15, 15÷5 = 3.00. Using the interval scale of 0.05, the upper limit cut-off point will be 3.00+0.05 = 3.05. The lower limit was 3.00 – 0.05 = 2.95, (Likert, 1932). Based on these, mean scores below 2.95 (i.e. MS< 2.95) were regarded as not important. The mean scores between 2.95 and 3.05 are considered important and mean score greater than 3.05 (i.e. MS >3.05) were however considered as very important practices. Table 4 shows the responses and the corresponding mean scores.

Table 4: **Mean scores and decision of the practices that could lead to sustainability of rice production in Afikpo North.**

Sustainable practices	Mean scores	Decision
Cultivating on large expanse of land	4.36	Accept
Use of quality seed	3.38	Accept
Early planting	2.97	Reject
Adequate fertilizer use	3.73	Accept
Crop rotation	1.87	Reject
Use of cheap and efficient labor	4.37	Accept
Mixed cropping	1.98	Reject
Practice of irrigation	1.4	Reject
Good storage system	3.03	Accept
Pest and disease control	3.63	Accept
Use of animal manure	2.63	Reject
Erosion control	2.98	Accept

[Decision rule: <2.95= reject and ≥ 2.95 accept]
*(*Source: Author's computation, 2020*)*

From table 4 above, practices like cultivating on large expanse of land, use of cheap and efficient labor, use of quality seed, adequate fertilizer use, pests and diseases control loaded above 3.05and going by the decision rule, they are very important practices towards sustainable rice production in the study area. Good storage system and erosion control loaded 3.03 and 2.98 respectively, which means, they are important practices. On the other hand, practice of crop rotation, engaging in mixed cropping, use of irrigation, good storage system and use of animal manure loaded less than 2.95 meaning they are less important practices as observed from the study.

In the cases of crop rotation and mixed cropping, it could be because most of rice farmers do not have owned sufficient land and thereby farm on rented plots and as such only plant rice as a sole crop during the period of rice production. Also, the use of irrigation and early planting were rejected, this could be because these farmers only engage in wet season rice production and always wait till the onset of rain to start cultivation. Animal manure was also rejected against expectation, most of the farmers reported that they do not make use of animal manure, they only need little fertilizer to support the already fertile swampy soil.

As the study indicates, cultivating on large expanse of land and cheap and efficient use of labor are the most important practices in the study area. This may be because rice production requires a large rice field to get a maximum yield and requires lots of labor for the rigorous stages of its production. As earlier stated, labor cost has been a major issue in rice production process which may be because their children are losing interest in rice production, leaving their parents to hire labor. Other very important practices include adequate fertilizer use, use of quality seed, pests and diseases control. Good storage system and erosion control are also important.

5. Summary of findings

The study examined the economic sustainability of rice production during COVID-19 pandemic in Afikpo North L.G.A of Ebonyi State. Presented in this work include the spatial distribution of rice production sites in the study area, the socioeconomic characteristics of rice farmers in the study area, economic impacts of rice production during COVID-19 pandemic in the study area, and finally, the sustainable practises of rice production during COVID-19 pandemic in the study area.

From the data analysed, it was discovered that the location of rice milling sites are clustered in each village in Afikpo North aside Ehugbo that has just one. Rice farms are scattered in all the village with Amasiri having the highest rice farms and rice producers.

The socio-economic characteristics of rice producers shows that both male and female engaged in rice production during COVID-19 pandemic in Afikpo North with the percentage of males a bit higher than that of females. It was also discovered that the majority (64.2%) of the rice farmers have household size ranging 6-10. Majority of the rice producers are advanced people with the higher proportion between the ages 41-50 year. Married people in Afikpo North engage more in rice production with a score of 60.8%. Only about 20.8% was single, and others were either divorced (1.7%) or widowed (16.7%). Not all the farmers had access to formal education, about 7.5% had no formal education, while 33.3% had primary, 8.3% tertiary and majority (50.8%) attended secondary school. Majority (79.2%) of the rice farmers made use of both hired and family labour during the pandemic. Most of the respondents made use of both inherited and rented land for production as well as

source their planting material from both market and previous harvest. Only 40% of the rice producers had annual income between #81,000- N120,000, 25.8% had up to #160,000 and above. Majority of the rice producers had farming experience of between 11-15 years.

The positive economic impacts revealed by the study include large farm output, higher personal income, higher regional income, increased personal property/assets and creation of employment. The negative economic impacts are loss, high labor cost and problem of finance. The budgetary technique employed to analyse the profitability of rice production and the return on investment showed that for the rice farmer that cultivated one acre of land during the pandemic, although they incurred huge production cost (#115,120), they had a high gross margin and profit (#114,500 and #94,880 respectively), with ROI of #1.82. This means that rice production was profitable during COVID-19 pandemic in the study area and this is a core indicator of economic sustainability in any crop production.

The result of the mean scores using the Likert type scale on the practices of sustainable rice production in the study area during the pandemic showed that from the farmer's perspective, cultivating on large expanse of land, use of cheap and efficient labour, use of quality seed, adequate fertilizer use, pest and diseases control were all sustainable practices in rice production during the pandemic. Erosion control and good storage systems were also regarded as important. The study also noted other practices which included: practice of crop rotation, mixed cropping, practice of irrigation, early planting and use of animal manure which were less important for sustainability of rice production in the study area during the period.

6. Recommendations

The study concluded based on the findings that Covid-19 pandemic has both positively and negatively affected rice production output, resulting in a change in their level of production in the study area and therefore recommended that:

- Incentives in the form of farm inputs such as fertilizers and seeds should be given to rice farmers during pandemic.
- The regulation to strictly exempt farmers during lockdown like medical personnel should be enforced by relevant agencies.

Even after the COVID-19 pandemic the following are the general recommendations if implemented effectively would enhance economic sustainability of rice production in the study area. They include:

- Investing in economic sustainability especially among small-holder rice farmers should be given the highest priority to ensure steady production without hindering future generation. This can be done by government developing more hectares of land for rice production and provision of rice production input such as quality seeds, pesticides, herbicides and also

subsidize them and make them available to farmers at appropriate time during the planting season or before the onset of planting season.

- Efforts should be made by the rice farmers to look out for practices that can reduce labour cost as it constituted more of the production costs. Such efforts as partnering with the Government or NGOs to provide equipment for mechanized rice farming. This will enhance productivity and profitability.
- The youth should be encouraged to participate fully in rice production. This can be done through provision of rural development like rural regular power supply, water supply, communication and transport facilities and medical care. These can serve as motivators in addition to youth enlightenment campaign.
- Rice farmers should adopt better processing technique which include; proper de-stoning, proper packaging and selling of their produce in polished form.
- The establishment of more rice milling sites should be taken into consideration as they are limited in Afikpo North, making the rice farmers to be delayed when they come to mill their rice produce.
- To increase the profit and ensure high return on investment, subsidy should not stop with fertilizer rather, it should be extended to rice seed. Extension agents should be made readily available and accessible so as to ensure adequate use of inputs in the right proportions and also to educate rice farmers on the best farming techniques.
- Rice farmers need to form cooperative groups to enhance access to subsidized inputs and extension agents or even NGOs should dedicate themselves to educate and direct farmers so as to boost their profit margin. Policies should be put in place to improve rice farmers access to information. Through these groups, they can have access to improved farming implements in order to reduce labour cost.
- Government through Agric banks and financial institutions should be giving loans to rice farmers at a reduced interest rate.
- Vigilante groups (especially non-governmental) should be formed so as to curb theft in the farms and destruction by nomads before harvest.

7. Conclusion

A fundamental issue in economic sustainability of rice production during COVID-19 pandemic is how a farmer manages/combines asset, human capital as well as other rice farming inputs within his disposal to maximize productivity, profit and improvement of well-being during the pandemic. Economic sustainability is closely linked to social sustainability which emphasises quality of life/well-being of the people. The study shows that there are potentials for economically sustainable rice production in Afikpo North. Therefore, the

quality of life/well-being of the people in Afikpo North can be improved through rice production. If only the young ones can be encouraged to settle down and engage fully in rice production and Government itself do the needful on the recommendations outlined above, there is sure to be continual productivity and profitability as well as other economic impacts accruable to rice production even after the pandemic in the study area.

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