EFFECTS OF ANCHOR BORROWERS' PROGRAMME ON SMALLHOLDER RICE PRODUCTION RISK AND TECHNICAL EFFICIENCY IN KEBBI STATE, NIGERIA

HAMIDU ABUBAKAR KARA

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By

HAMIDU ABUBAKAR KARA

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

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HAMIDU ABUBAKAR KARA

September 2019

Chairman : Professor Mad Nasir Shamsudin, PhD
Faculty : Agriculture

Rice is Nigeria's major staple crop and strategic for food safety. Besides the primary source of food its production provides millions of smallholder farmers with livelihoods. However, rice production in Nigeria has been extensive over the years. This has created a huge gap between supply and demand. The Nigerian government spends US$ 300 million annually on rice imports. Imports policy has discouraged domestic production, increased unemployment, and increased poverty. In the past, various funding actions were launched to encouraging domestic production, but the required goals were not accomplished because of the failure of smallholder farmers to access credit and profitable markets to dispose of their products. The Anchor Borrowers' programme was launched in Kebbi state in 2015 to address the two fundamental issues facing smallholder farmers in boosting national output. The research aims to contribute to a clearer knowledge of the possible causes of rice production volatility in the Kebbi state Anchor Borrowers' Programme. The output gap between the real output and achievable output presents an opportunity for output growth. Data from a total of two hundred and twenty-two loan beneficiaries and one hundred and fifty-five non-beneficiaries farms were gathered using a cluster sampling technique. The data were obtained from the survey conducted for the 2016 farming season. The research adopts a Trans-log stochastic frontier model with flexible risk properties to estimate efficiency levels while taking into account production risk. The variability of production from two sources, production risk and technical efficiency is therefore evaluated. Data envelopment analysis was also used to estimate the level of technical efficiency without accounting for production risk.

Results show that the Trans-log production frontier is the best fit model for the mean output function of both the beneficiaries and non-beneficiaries. In their production methods, there is also the presence of technical inefficiency and production risk. The

effects of technical inefficiency relate to exogenous variables. Input variable seeds, fertilizers, agrochemicals, and labour positively affect rice production for both the beneficiaries and non-beneficiaries. The research also demonstrates that the beneficiaries' farms in the research region show increased scale yields while non-beneficiaries decrease scale yields. Fertilizer and agrochemicals reduce the risk of output for the beneficiaries, likewise seeds and labour reduce the risk of output for non-beneficiaries. The variability of the input variable on the output risk could be ascribed to the variability in soil type, application rate, and technique of application among others. The mean technical efficiency estimated with the flexible risk element was 85.3 percent while without risk element was 65.5 percent for the beneficiaries. Similarly, the average technical efficiency estimated for non-beneficiaries with risk element was 77.6 percent while without risk element was 56.7 percent. There is a substantial distinction in the mean level of technical efficiency of the beneficiaries and non-beneficiaries as shown by independent t-test. The transplanting method used was the best farming practice that increases the efficiency of the beneficiaries and non-beneficiaries. It was also realized that years of education, extension services and loan access significantly enhance the beneficiaries' technical efficiency.

The study proposes making rice inputs easily available, inexpensive and accessible to both the beneficiaries and non-beneficiaries. The beneficiaries should ensure the effective and proper use of fertilizer and agrochemicals to mitigate production risk while non-beneficiaries should appropriately use labour and seeds to mitigate risk. The beneficiaries and non-beneficiaries education should be encouraged, extension services and access to credit should be common to both.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KESAN PROGRAM PEMINJAMAN ANKOR KE ATAS PEKEBUN KECIL PADI DAN KECEKAPANNYA DI NEGERI KEBBI, NIGERIA

Oleh

HAMIDU ABUBAKAR KARA

September 2019

Pengerusi : Profesor Mad Nasir Shamsudin, PhD
Fakulti : Pertanian

Beras merupakan tanaman ruji utama di Nigeria dan strategik untuk keselamatan makanan. Selain daripada sebagai sumber makanan utama, pengeluaran beras juga menyediakan mata pencarian kepada berjuta-juta pekebun kecil. Walau bagaimanapun, pengeluaran beras di Nigeria semakin terancam sejak beberapa tahun lalu. Hal ini telah mewujudkan jurang yang besar antara penawaran dan permintaan. Kerajaan Nigeria telah membelanjakan AS$ 300 juta setahun untuk mengimport beras. Dasar mengimport beras ini menyebabkan pengeluaran beras domestik tidak digalakkan, meningkatkan pengangguran dan meningkatkan tahap kemiskinan. Pada masa dahulu, pelbagai langkah untuk mendapatkan dana telah dilancarkan bagi menggalakkan pengeluaran domestik, tetapi matlamat yang diperlukan tidak tercapai kerana kegagalan pekebun kecil untuk mengakses kredit dan pasaran yang menguntungkan untuk memasarkan produk mereka. Program peminjaman ankor telah dilancarkan di Negeri Kebbi pada tahun 2015 untuk mengenalpasti dua isu asas yang dihadapi oleh pekebn kecil dalam meningkatkan pengeluaran nasional. Tujuan kajian dijalankan adalah untuk menyumbangkan pengetahuan yang jelas tentang kemungkinan penyebab kepada ketidakstabilan pengeluaran beras dalam Program Peminjaman Ankor di Negeri Kebbi. Jurang antara output sebenar dengan output yang boleh dicapai mewakili peluang untuk pertumbuhan output. Data daripada sejumlah dua ratus dua puluh dua benefisiari dan seratus lima puluh lima bukan benefisiari pesawah padi telah dikumpulkan menggunakan teknik pensampelan secara kluster. Data telah diperoleh daripada tinjauan yang dijalankan dalam tempoh musim pertanian pada tahun 2016. Kajian ini menggunakan stokastik trans-log frontier model dengan spesifikasi risiko yang fleksibel untuk menganggarkan tahap kecekapan dalam masa yang sama mengambil kira risiko pengeluaran. Seterusnya, kepelbagaian pengeluaran daripada dua sumber iaitu risiko pengeluaran dan kecekapan teknikal telah dinilai. Analisis penutupan data turut digunakan untuk menganggarkan kecekapan teknikal tanpa mengambil kira risiko pengeluaran

Hasil kajian menunjukkan pengeluaran trans-log frontier adalah model yang paling sesuai untuk fungsi purata output untuk kedua-dua benefisiari dan juga bukan benefisiari. Ketidakcekapan teknikal dan juga risiko pengeluaran turut terdapat dalam kaedah pengeluaran mereka. Kesan daripada ketidakcekapan teknikal akan berkait dengan pembolehubah eksoginus. Pembolehubah input iaitu bijian, baja, agrokimia dan tenaga buruh boleh mempengaruhi secara positif keatas pengeluaran beras untuk kedua-dua benefisiari dan juga bukan benefisiari. Kajian ini turut menunjukkan bahawa ladang-ladang benefisiari didalam kawasan kajian menunjukkan peningkatan dalam skala hasil manakala bukan benefisiari menunjukkan pengurangan dalam skala hasil. Baja dan agrokimia mengurangkan risiko output untuk benefisiari, manakala bijian dan tenaga buruh mengurangkan risiko output untuk bukan benefisiari. Kebolehubahan pembolehubah input keatas risiko output boleh dinisbatkan kepada kebolehubahan dalam jenis tanah, kadar aplikasi, dan teknik aplikasi diantara satu sama lain. Purata kecekapan teknikal telah dianggarkan dengan elemen risiko fleksibel ialah 85.3 peratus manakala tanpa elemen risiko ialah 65.5 peratus bagi benefisiari. Sama juga, purata kecekapan telah dianggarkan untuk bukan benefisiari dengan elemen risiko ialah 77.6 peratus manakala tanpa elemen risiko ialah 56.7 peratus. Terdapat perbezaan yang ketara didalam purata tahap kecekapan benefisiari dengan bukan benefisiari seperti yang telah ditunjukkan oleh ujian-t bebas. Kaedah pemindahan tanaman yang telah digunakan adalah amalan pertanian yang terbaik bagi meningkatkan kecekapan benefisiari dan juga bukan benefisiari. Ianya turut disedarai bahawa tahun-tahun pendidikan, perkhidmatan lanjutan dan akses pinjaman dengan ketara dapat meningkatkan kecekapan teknikal benefisiari.

Kajian ini mencadangkan agar input-input berkaitan beras mudah didapati, murah dan boleh diakses oleh kedua-dua benefisiari dan bukan benefisiari. Para benefisiari harus memastikan penggunaan baja dan agrokimia yang efektif dan berkesan untuk mengurangkan risiko pengeluaran manakala bukan benefisiari harus menggunakan tenaga buruh dan bijian dengan sewajarnya untuk mengurangkan risiko. Pendidikan kepada para benefisiari dan bukan benefisiari harus digalakkan, perkhidmatan lanjutan dan akses kepada kredit sepatutnya sama kepada kedua-dua benefisiari dan bukan benefisiari.

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This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

Mad Nasir Shamsudin, PhD
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Zainal Abidin Mohamed, PhD
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Ismail Abd Latif, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Kelly Wong Kai Seng, PhD
Senior Lecturer
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Edon Aboki, PhD
Senior Lecturer
Faculty of Agriculture
Taraba State University Jalingo, Nigeria
(Member)

ROBIAH BINTI YUNUS, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

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Name and Matric No: Hamidu Abubakar Kara, GS47341

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Signature: _____
Name of Chairman of Supervisory Committee: Professor Dr. Mad Nasir Shamsudin

Signature: _____
Name of Member of Supervisory Committee: Professor Dr. Zainal Abidin Mohamed

Signature: _____
Name of Member of Supervisory Committee: Associate Professor Dr. Ismail Abd Latif

Signature: _____
Name of Member of Supervisory Committee: Dr. Kelly Wong Kai Seng

Signature: _____
Name of Member of Supervisory Committee: Dr. Edon Aboki

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LIST OF ABBREVIATIONS

ABP	Anchor Borrowers Programme
ADP	Agricultural Development Programme
AE	Allocative Efficiency
APS	Agricultural Production Survey
BLP	Better Life Programme
BVN	Bank Verification Number
CADP	Commercial Agricultural Development Programme
CBN	Central Bank of Nigeria
DEA	Data Envelopment Analysis
DFI	Development Financial Institution
DMB	Deposit Money Bank
DMU	Decision Making Unit
DRS	Decreasing Return to Scale
DFRRI	Directorate of Food Road and Rural Infrastructure
EE	Economic Efficiency
FCT	Federal Capital Territory
FEAP	Family Economic Advancement Programme
FMARD	Federal Ministry of Agriculture and Rural Development
FSP	Family Support Programme
FSS	Farm Settlement Scheme
GDP	Gross Domestic Product
GR	Green Revolution
IITA	International Institute of Agriculture
IRS	Increasing Return to Scale

KARDA	Kebbi State Agricultural Development Authority
KATASHI	Kebbi State Agricultural Transformation Self Help Initiative
LGA	Local Government Authority
ME	Maximum Likelihood Estimator
MFBs	Micro Finance Banks
MSMEDF	Micro Small Medium Enterprises Development Fund
NATASHI	New Agricultural Transformation and Self Help Initiative
NAIC	Nigerian Agricultural Insurance Corporation
NAFPP	National Accelerated Food Production Programme
NALDA	Nigerian Agricultural Land Development Authority
NCRI	National Cereal Research Institutes
NCR	National Collateral Registry
NEEDS	National Economic Empowerment Development Strategy
NFDP	National Fadama Development Project
NRDS	National Rice Development Strategy
NERICA	New Rice for Africa
NPN	National Party of Nigeria
NSS	National Seed Service
OFN	Operation Feed the Nation
OLS	Ordinary Lease Square
PFI	Programme Financial Institution
PMT	Programme Management Team
RBDAs	River Basin Development Authority
SHFs	Small Holder Farmers
TE	Technical Efficiency
USDA	United State Department of Agriculture

CHAPTER 1

INTRODUCTION

This chapter composed of background of the study, problem statement, research questions, and objectives of the study, significance of the study and organization of the thesis.

1.1 Background of the Study

Rice is the leading staple crop in Nigeria and strategic commodity for food security. It has turned into an important food in Nigeria because each family unit comprising the privileged and less privileged consume a large quantity (Godwin, 2013). A mix of different components appears to have set off the basic increment in eating rice throughout the years with eating widening over all people having the same social, economic or education positions, including the less privileged. As elsewhere in West Africa, urbanization appears to be the main cause of Nigeria's change in consumer preferences to rice. Compared with other traditional cereals, rice is simple to prepare by decreasing the core of food preparation and fitting the lifestyles of rich and poor alike more readily. Other factors includes increased in the number of people who live in Nigeria, and changes in income level (GAIN, 2012; Ugalahi *et al.*, 2016). House hold study uncovered that urban buyers on low salary spend more of their aggregate spending plan on rice than higher pay families, these advancements implies that rice is never again an extravagance nourishment however has turned into the primary source of calories for low pay families (AfricaRice, 2011). Rice has become a major source of calories for urban poor. For example, 33 percent of their cereal-based calories are obtained from rice by the poorest third of urban households, and rice purchases are a major component of cereal cash spending (World Bank, 1995).

The importance of rice in the Nigerian economy extends beyond food; its production also serve as an important source of income for farmers. Nigeria's food supply is primarily provided by smallholder farmers constituting about 80 percent of the nation's total farmers population (Akinsuyi, 2011). These smallholder farmers are confined to the rural areas where they depend on farming as their main source of income. Data from several states in Nigeria show that the availability of rice and the prices of rice have become a major determinant of welfare for the poorest segments of consumers in the country who are at the lower level of food safety (Akpokodje *et al.*, 2001).

Rice is produced in basically all the agro-natural zones in Nigeria because of its climatic conditions (Erenstein *et al.*, 2003). In spite of this, the land prepared for growing rice in Nigeria seems little. In 2000, out of around 25 million hectares of land prepared for growing different food crops only around 6.37 percent was allotted for raising rice (Akpokodje *et al.*, 2001). Figure 1.1 demonstrates that rice cultivation in Nigeria previously encountered a boom in 1976 when output remained at 406

thousand tons. Amid this time, the area of land used for growing rice remained at 310 thousand hectares while the average national yield was 1.31 tons per hectare. Another important progress in rice cultivation in Nigeria happen in 1987 when output expanded to 1.184 million tons while the area of land used for raising rice and yield rose to 745 thousand hectares and 1.60 tons per hectare separately. But in the 1990s, while rice output increased, the yield of rice reduced, suggesting extensive rice cultivation (Figure 1.2). Also, in 2017 it was reported that rice production in Nigeria increases to 5.8 million tones and the increase was as a result of the Central Bank of Nigeria's Anchor Borrowers' Programme with a total of 12 million rice producers and 4 million hectares of "FADAMA" (flood plain) land (RIFAN, 2017).

As observed in Table 1.1, the area harvested has been steadily increasing from 210 thousand hectares in 1965 to 3.1 million hectares in 2015 and production increased from 236 thousand tons in 1965 to approximately 3.53 million tons in 2015 (Figure 1.1). However, the average yield per hectare declined from 1.6 tons per hectare in 1987 to 1.1 in 2015 (Figure 1.2).

The world price is a major factor that influences domestic rice production, particularly where rice normally accounts for a larger share of both consumer budgets and total employment (Teguh, 2010). The rice price increases boost the real income of those who sell rice, many of whom are relatively poor in Nigeria, thus harming the buyers of net food. Ivanic and Martin (2008), using data from households for ten observations on nine low-income countries found that the short-term effect of higher staple food prices on poverty varies significantly among goods and nations, but rises in poverty are much more frequent and greater than the reduction in poverty. Nevertheless, the government could impose a short period of zero import tariffs on rice in response to the dramatically rising prices and protecting low-income groups. It is widely accepted that the control of price and quantity policies through tariff and trade barriers is always politically sensitive in most developing countries, especially where rice averagely accounts for a bigger portion of consumer budgets and total employment (Teguh, 2010). A rise in the world price would lift the domestic price directly and generate misery for most Nigerian households who are buyers. On the contrary, a drop in the price of rice would lower farmers' income and create fewer jobs, especially in the rural areas where the agricultural sector depends on a large proportion of employment.

Table 1.1 : Rice area harvested, yield, production, import and consumption In Nigeria, 1965-2015

Years	Area Harvested (Ha)	Yield (T/Ha)	Production (MT)	Imports (MT)	Consumption (MT)
1965	210000	1.12	236000	1000	237000
1966	242000	1.11	270000	1000	271000
1967	220000	1.18	260000	1000	261000
1968	193000	1.29	249000	1000	250000
1969	234000	1.09	257000	1000	258000
1970	254000	1.11	284000	1000	285000
1971	263000	1.17	307000	6000	313000
1972	275000	1.13	310000	11000	321000
1973	280000	1.22	342000	2000	344000
1974	285000	1.35	348000	4000	352000
1975	300000	1.30	390000	6000	396000
1976	310000	1.31	406000	94000	500000
1977	325000	1.27	412000	446000	750000
1978	414000	0.95	394000	789000	950000
1979	400000	0.93	372000	242000	845000
1980	550000	0.95	523000	394000	850000
1981	600000	0.96	579000	686000	1227000
1982	600000	1.08	648000	666000	1337000
1983	630000	0.96	607000	903000	1648000
1984	670000	0.86	579000	629000	1220000
1985	710000	0.96	680000	569000	1249000
1986	660000	0.95	630000	462000	1042000
1987	745000	1.60	1184000	642000	1152000
1988	1041000	1.20	1249000	344000	1350000
1989	1652000	1.19	1982000	164000	1550000
1990	1208000	1.24	1500000	224000	2757000
1991	1657000	1.15	1911000	296000	2207000
1992	1664000	1.18	1956000	440000	2436000
1993	1564000	1.17	1839000	382000	2221000
1994	1714000	0.85	1456000	300000	2136000
1995	1796000	0.97	1752000	300000	2000000
1996	1784000	1.05	1873000	350000	2175000
1997	2048000	0.96	1961000	731000	2712000
1998	2044000	0.96	1965000	900000	2815000
1999	2191000	0.89	1966000	950000	2866000
2000	2199000	0.89	1979000	1250000	3029000
2001	2117000	0.78	1651000	1906000	3051000
2002	2185000	0.80	1757000	1897000	3307000
2003	2210000	0.85	1870000	1448000	3670000
2004	2348000	0.85	2000000	1369000	3750000
2005	2494000	0.86	2140000	1650000	3800000
2006	2725000	0.93	2546000	1500000	4040000
2007	2451000	0.82	2008000	1800000	4100000
2008	2382000	1.10	2632000	1750000	4220000
2009	1837000	1.22	2234000	1750000	4350000
2010	2433000	1.16	2818000	2400000	4800000
2011	2269000	1.28	2906000	3200000	5600000
2012	2864000	1.20	3423000	2800000	5700000
2013	2931000	1.04	3038000	2800000	5800000
2014	3096000	1.10	3465000	2600000	5900000
2015	3100000	1.14	3528000	2100000	6000000

[Source: United States Department of Agriculture (USDA), 2016]

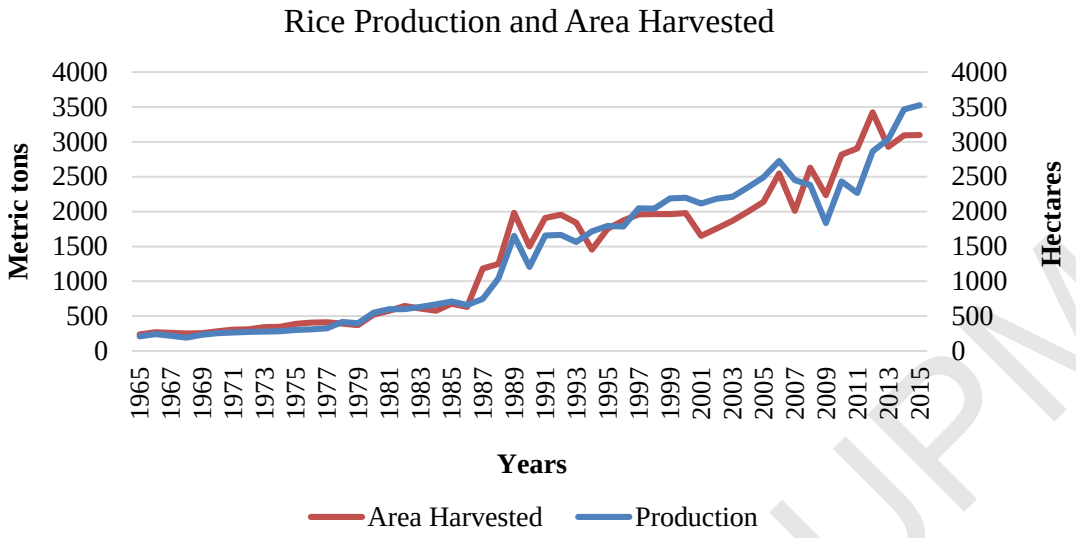

Figure 1.1 : Rice production (tons) and area harvested (Ha) in Nigeria, 1965-2015
[Source: United States Department of Agriculture (USDA), 2016]

As demonstrates by Figure 1.1, the increase in rice production in Nigeria from 236 thousand tons in 1965 to about 3.53 million tons in 2015 is mainly attributed to land expansion which has expanded from 210 thousand hectares to 3.1 million hectares. The yield trend of rice production in Nigeria from 1965 to 2015 is illustrated in Figure 1.2 below.

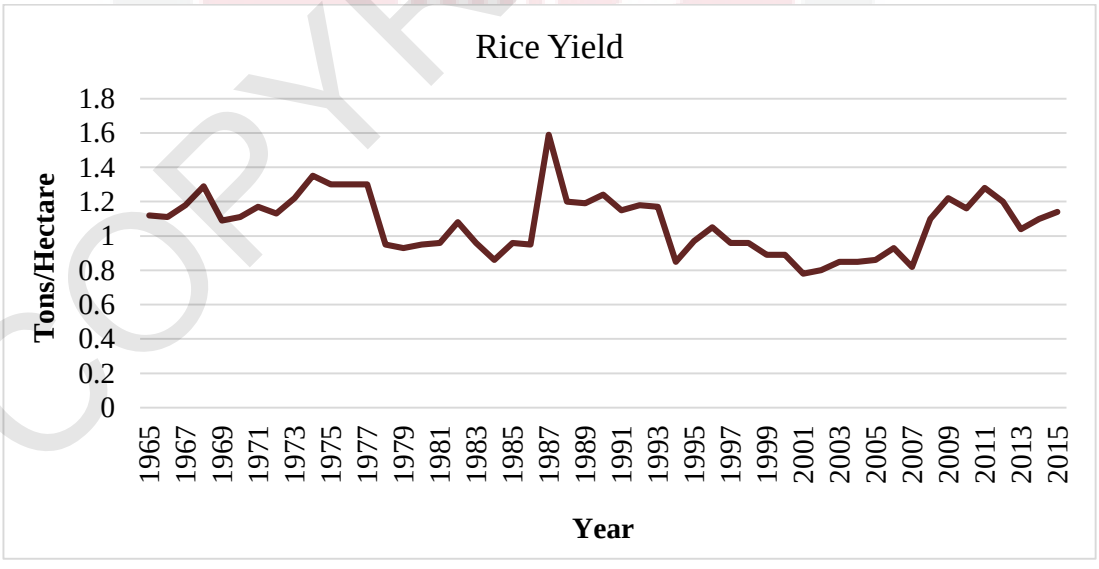

Figure 1.2 : Yield of rice production in Nigeria, 1965- 2015
[Source: United States Department of Agriculture (USDA), 2016]

Rice yield recorded an increase in the average from 1.35 tons per hectare in 1974 to 1.60 tons per hectare in 1987. In the 1990s the yield has been observed with a declining trend and in 2015 the average yield stood at 1.14 tons per hectare.

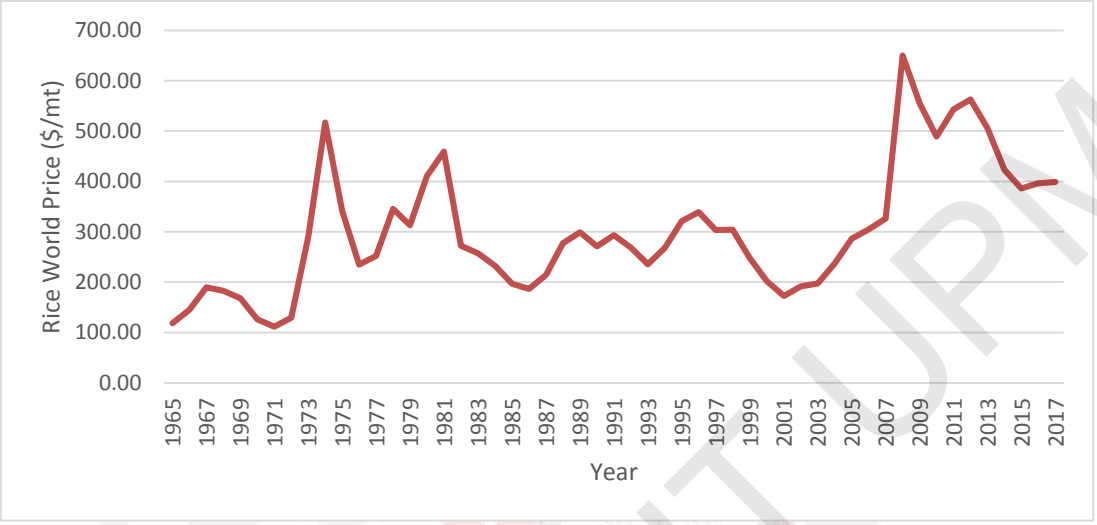

Figure 1.3 : World rice price trend, 1965-2017
[Source: Annual prices October 2019 (XLS) World Bank Commodity Price]

Figure 1.3 shows that world rice price increased from US$118.79 per metric tons in 1965 to US$517.17 per metric tons in 1974, dropped to US$186.25 in 1986 and jumped to US$650.19 in 2008 (FAOSTA).

Furthermore, there is great disparity in both output and yield between the federation states in rice production in Nigeria. In 2000, the state of Kaduna was the biggest rice producer accounting for about 22 percent of the country's rice production. This was accompanied by the state of Niger (16 percent), the state of Benue (10 percent) and the state of Taraba (7 percent). Geographically, the central Zone was Nigeria's biggest rice producer, representing 44 percent of total rice production in 2000. The North West (29 percent) followed this, while the South West was the least (4 percent) (Akpokodje *et al.*, 2001). In terms of irrigated rice production, Kebbi state has the highest potential in the country given its drainage systems (Longtau, 2003).There is also a great variation in yield between the states. In 2000, during dry season, the average national rice yield (3.05 tons/ha) was higher than the wet season yield (Akpokodje *et al.*, 2001). This could be a confirmation of the acclaimed higher yield associated with the rice production system being irrigated. In 2016, Kebbi state recorded the average yield of 4.14 tons per hectare (APS, 2017) from dry season rice production which is the highest in the country.

On the other hand, rice consumption in Nigeria is soaring. Between the times of 1985 to 2015, yearly rice consumption in Nigeria expanded from roughly 1.25 million tons to 6.0 million tons (USDA, 2016). Ugalahi *et al.* (2016) reported that in the last decade, the growth rate of eating rice has ascended yearly by 10.3 % on average.

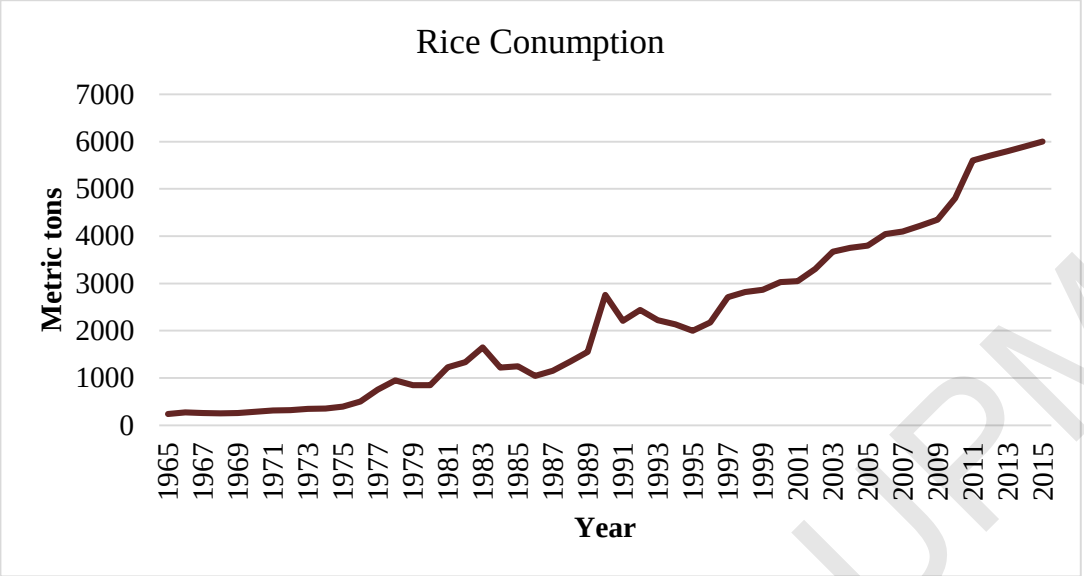

Figure 1.4 : Rice consumption in Nigeria, 1965- 2015
[Source: United States Department of Agriculture (USDA), 2016]

As observed in Figure 1.4, rice consumption in Nigeria 1965 has increased throughout the years from an average of 237 thousand tons in 1965 to around 6.0 million tons in the year 2015 (USDA, 2016). In 2017, it was reported that rice consumption has increased to 7.9 million tons (RIFAN, 2017). The consumption trend is likely to increase because of the increase in the number of people living in Nigeria, urbanization and consumers' preference for rice. With declining yield trend and relating increment in consumption, Nigeria has turned into a net importer of rice. Importation ascended from 569 thousand tons in the year 1985 to around 3.2 million tons in 2011 (USDA, 2016). According to Jane (2016), Nigeria is the second largest rice importer in the world between 2000 to 2005. Ugalahi *et al.* (2016) reported that the Nigerian Government is spending approximately three hundred million dollars (US$300,000,000) on annual importation of rice.

Onu (2018) examined the preference among rural families in Imo state, Nigeria for imported and local rice. The specific objectives were to determine the level of preference of imported and local rice, to determine the factors influencing the households' preference of imported and consumed Nigerian rice and to identify the major constraints for the consumption of imported and local rice. The findings showed that the large mean score of 2.67 and 1.60 imported rice was preferred by the respondents than local rice. The problems with the local rice were husk, dirt and stones (90.0 percent), bad quality (85.8 percent), broken grains (75.0 percent), and absences of competitive benefits (68.3 percent). The factors that substantially influenced the household consumption preference for imported and local rice were, price ($P<0.05$), nutritional value ($P<0.05$), easy preparation ($P<0.01$), cleanliness ($P<0.01$) and flavour ($P<0.05$). Thus, Nigerian rice producers were advised to enhance the rice quality in order to have a competitive advantage over imported rice. By issuing loan to Nigerian rice farmers, the government should invest in Nigerian rice manufacturing and promote mechanization.

Efforts to improve the production of rice in Nigeria have been made by different government administrations as part of the intervention to boost its local production. Different agricultural policies and programs were implemented by the sequential government to address the issues hindering the overall development of the agricultural sector and rice to be specific. However, the policy has not been reliable, including swinging to and fro of import tariffs and import limitation (Akpokodje *et al*., 2001). Imports were illegal for example, from 1986 to the mid-1990s. Imports were permitted at a tariff of 100 percent in 1995. The tariff was decreased to 50 percent in 1996 but increased at 85 percent in 2001 (Akpokodje *et al.,* 2001). Similarly, the Structural Adjustment Programme (SAP) was presented in 1986, and the fundamental plan of the programme was to stop buying and bringing in foods from foreign countries particularly rice. However, the nation has turned into the second buyer of rice in the global market following Indonesia over the most recent five years of the most recent decades (2000 to 2005) (Kadiri *et al.*, 2014; Jane, 2016). The erratic policy represents the dilemma of consumer securing inexpensive rice and a fair price for manufacturers.

Rice imports have affected the domestic production and marketing of Nigeria's local rice. This is because of the superior grade of foreign rice, price, easy to prepare, cleanliness, flavour and high competitive benefits when contrasted with local rice (Onu, 2018). Also, as a reaction to the overall rice supply shortfall in Nigeria, sequential Nigerian governments interceded through the establishment of parastatals and policies since 1970; all these were aimed at empowering and encouraging local rice production. Along these lines, Federal Rice Research Station (FRRS) was set up in Badeggi in 1970 and the National Cereal Research Institute (NCRI) in 1974 accordingly. Also established were the National Seed Service (NSS) in 1975, Agricultural Development Project (ADPs) in 1975, and Structural Adjustment Programme (SAP) in 1986, Presidential Initiative on Increased Rice Production, Processing and Export (PIIRPPE) in 2001, National Rice Development Strategy (NRDS) in 2009 and Agricultural Transformation Agenda (ATA) in 2013 among others (Kadiri *et al.*, 2014). Despite these programmes, smallholder farmers are having problems with low yield and rice processing is still substandard (Udemezue, 2014).

1.1.1 Rice Sector in Kebbi State

Kebbi State is the rice centre point of Nigeria. The state is endowed with abundant human, land and water resources including the Rima Basin, River Niger, and River Ka. These rivers have provides an extensive flood plain (Fadama) of more than 525 thousand hectares of land which could be helpfully utilized for irrigation. Just around 5 % of these flood plain possibilities have been exploited for irrigated agriculture (Usman, 2016). Amaechina and Eboh (2017) revealed that irrigated rice production in Nigeria is characterized with an average yield of 3.3 tons for each hectare and has the possibilities of 5 to 6 tons for every hectare as against 2 tons for every hectare got in rainfed rice production. Also, it gives the farmers the chance to cultivate two or more times in a year. Another advantage is the fact that it increases food production and decreases the effects of drought. This irrigation potential of the Kebbi state is of paramount importance in Nigeria.

Given the crucial role of rice in the sustenance security of urban and rural family units alike, the development of rice growing has long been viewed as a need in Nigeria. The nation has adopted a scope of instruments designed to protect and increase local production. The Nigerian National Rice Development Strategy (NRDS) set up in 2009 expects to make the nation self-sufficient in rice by raising production of rice from 3.4 million tons in 2007 to 12.8 million tons in 2018. The NRDS outlines three priority areas to focus to accomplish this production level; (i) improving post-harvest processing and treatment (ii) developing irrigation and extending cultivated land and (iii) making seed, fertilizer and farming equipment more readily available. In a bid to also accomplish rice self-sufficiency following the rice transformation plan, the Ministry of Agriculture and Rural Development rolled out a special intervention program on dry season rice production plan in 2013. The dry season rice production is scheduled to take place across ten states of the federation namely; Kaduna, Kebbi, Zamfara, Kano, Jigawa, Sokoto, Katsina, Bauchi, Gombe and Kogi states (Ugalahi *et al.*, 2016). Kebbi State was also a beneficiary of the World Bank Intervention program from the year 1993 to 1997 introduced to harness the potentials of the State to develop irrigation known as the National Fadama Development Project I (NFDPI). The project targeted the development of small scale irrigation especially in the low-lying alluvial flood plain or" Fadama." It was intended to increase productivity, income and raise the living standard of the farm families (Olaolu *et al.*, 2013).

Historically, the Kebbi State Agricultural Transformation and Self Help Initiative (KATASHI) project which was initiated and funded by the state government and implemented in the year 2005 as a dry season rice production support project which targeted the youth and other interested dry season farmers with exploitable water resources laid the foundation of rice revolution in the state. Under the program, 5000 farmers were supported by the project with production inputs for dry season rice farming. These included irrigation pumps, tube-wells and wash-bores, improved seeds, fertilizer, agro-chemicals and various training on improving agricultural practices among others. For consolidation and up-scaling of the gains of the KATASHI program, the New Agricultural Transformation and Self Help Initiative (NATASHI) project was implemented in 2010 where over 15000 farmers participated in dry season rice farming. The various programmes and projects have brought a lot of benefits to the farmers and the state at large.

Rice production trend in Kebbi State shows that the sector first experiences a boom in 2005 when the average output stood at 75 thousand metric tons. During this period area harvested was 29 thousand hectares while the average yield was 2.58 tons per hectare. Another significant improvement was recorded from 2010 to 2016 when output increased from 175 thousand metric tons to about 605thousand metric tons while the area harvested expanded from 84 thousand hectares to 145 thousand hectares. Further, the yield per hectare increased from 2.08 to 4.14 tons per hectare (APS, 2017). The drastic increased in output and yield could be as the result of the Anchor Borrower' Programme that was launched in the state in 2015.

Table 1.2 : Rice area harvested, average yield and production in Kebbi State, 1994-2016

Years	Area Harvested(Ha)	Yield (T/Ha)	Production (Tons)
1994	19000	1.53	29000
1995	27000	1.74	47000
1996	28000	1.82	51000
1997	28001	1.43	40000
1998	20400	1.47	30020
1999	31000	2.20	68080
2000	75020	0.99	74700
2001	75020	1.09	82010
2002	77020	1.05	81100
2003	32000	1.97	63020
2004	38090	2.02	77000
2005	29050	2.58	75000
2006	30040	2.62	78800
2007	28002	2.14	60030
2008	55081	1.82	100050
2009	83060	1.81	150000
2010	84080	2.08	175020
2011	86090	2.10	181010
2012	87000	2.46	214040
2013	120005	2.25	270010
2014	115030	3.02	347080
2015	130000	3.87	503000
2016	145000	4.14	600800

[Source: Agricultural Production Survey (APS, 2017) Kebbi State]

As observed in Table 1.2, rice production in Kebbi State shows an increasing trend in the period 1994 to 2016 when average output rose from 29 thousand tons in 1994 to 6008 thousand metric tons in 2016. During this period, the area harvested increased from 19 thousand hectares to 145 thousand hectares. Also, the average yield increased from 1.53 tons per hectare in 1994 to 4.14 tons per hectare in 2016.

However, the World Bank conducted the baseline study of the impact assessment of the feed the future Nigeria livelihood project. The baseline study was finished in Kebbi state in the northern Nigeria prior to the beginning of the rainy season between May 2015 and June 2015. Feed the future aims to boost agricultural output and incomes in rural regions for both males and females who rely on agriculture for their livelihood (World Bank, 2016).

The research sample consist of rural, farming homes consistent with program targeting, with 80 percent of the surveyed population naming crop and livestock manufacturing as their primary income activity. Eighty-five percent of the families in the research sample fall below international poverty line of US$1.25 per day based on a per capita measure of daily spending. Nineteen percent of the homes in the previous

12 months have allegedly faced food insecurity (World Bank, 2016). Unemployment is high in the study population, with 37 percent of the sample reporting that in the past 30 days prior to the baseline survey, no individuals within their household worked in an income generating activity. Fifty-five percent of homes reported owning at least one plot of agricultural property in terms of agricultural land ownership (World Bank, 2016).

Similarly, the Programme Management Team (PMT) of Anchor Borrowers' Programme (ABP) in Kebbi state reported the input supply difficulties at the implementation stage. Despite the early placing of orders for the supply of inputs, the delivery of inputs, specifically fertilizers had severe shortcomings. The difficulties of rising merchandise expenses in the nation owing to the inflation and the lack of accessibility of certain fertilizer brands had resulted in a shortage in the delivery of some quantity of some fertilizers. For example, at the advent of the rainy season, when many states placed orders, urea which was to be delivered as ordered at US$15.1/50 kg bag, sold at US$17.8/50kg bag on the factory floor. As a consequence of non-supply, some farmers were unable to obtain the last 2 bags of urea and 1 bag of NPK (PMT, 2016). Also, farm irrigation in Kebbi state is done exclusively by using petrol-driven irrigation pumps and mostly on wash-bores or tube-wells and sometimes pumping through open water bodies. In all instances, there is a very strong demand for petrol and a critical supply throughout the dry season. The farmers encountered severe scarcity of the item and were compelled to purchase a litre of US$1.1 petrol at the official US$0.23 price (PMT, 2016). In view of the consequences to this, Kebbi state government had to intervene and obtain several trucks of petrol at a very high cost and sale the product to farmers at official rate at designated filling stations across the state to ease the suffering of the farmers. Further, the challenge in the sheer number of farmers to be reached and their geographical spread, the introduction of the requirement for Bank Verification Number (BVN) despite low infrastructure in terms of the network all posed challenges and caused delay in the disbursement of the funds to farmers (PMT, 2016).

In support of the programme, the Kebbi state government had to incur several expenses. From the outset, the Kebbi state had to provide the Bank of Agriculture (BOA) with an advance of US$10,958,904.11 to ensure that programme was started as it took so long for BOA to obtain funds from the Nigerian Central Bank (PMT, 2016). Also, as the delivery of critical inputs such as seeds, fertilizers, agrochemicals, petroleum driven water pumps and so on would have postponed, the time-bound programme would have been postponed and likely fail. In relation to the above, the Kebbi state government had to deal with the payment of allowances of all members of the state implementation committee and Local government committees, the supply of cars and fuelling to project surveillance teams throughout the state including offering extra assistance to the BOA to tackle the low ability of cars and employees. This involves the recruitment and payment of allowances for 240 National Youth Service employees and 105 unemployed graduates to help the Bank of Agriculture in the initial farmers' registration and account opening information capture (PMT, 2016). In addition, 100 motorcycle units were procured and circulated to field surveillance to the Village Extension Agents.

1.1.2 Anchor Borrowers Programme

Nigeria is a huge nation, covering an area of 910.8 thousand square kilometres out of which 77.7 percent is capable of being farmed (Group, 2014). The topography can support different crops and livestock potential outcomes. It has the biggest population in Sub-Saharan Africa evaluated at 180.7 million in 2014 and it is one of the ten most populated nations on the planet (CBN, 2015). Along these lines, the nation is wealthy in both human and natural resources. Accessible insights demonstrated that crude oil exchanges brought Nigeria just eight point eight million naira (₦ 8.8 000,000) approximately US$24109.6 at independence in 1960 and this set up just 2.7 percent of aggregate exports earnings, while non-oil exports added up to ₦321.2 million approximately US$880000 making 97.3 percent of aggregate exports in the same time. However, by 1976, the table turned and the estimation of oil sends out expanded drastically to ₦ 6321.6 million (US$17319452), making 93.6 percent of the aggregate exports, while the extent of non-oil trades in Nigeria's foreign earnings had reduced substantially to 6.4 percent at ₦429.5 million (US$1176712.4) and this trend has remained over the years (Evbuomwan, 1996).

Regardless of the way that oil trades set up a significant part of Nigeria's foreign earnings its importance in the Gross Domestic Product (GDP) is lower than that of the non-oil segment, and especially troubling is the way that its chances have been on the descending pattern in recent years with extremely bad repercussions for the Nigerian economy. For example, the dedication of unrefined oil and gaseous petrol to the country's GDP reduced from 14.95 percent in 2011 to 9.61 percent in 2015, while, the agricultural sector added 23.35 and 23.11 percent to the nation's GDP in these specific periods (CBN, 2015). Also, oil refining has been adding less than 0.5 percent to the country's GDP as Nigeria only exports unrefined petroleum, whose price is resolved externally. Unluckily, unrefined petroleum price has been on the decrease over the most recent four years. From an average of US$ 113.5 in 2012, a barrel of unrefined petroleum sold for under US$50.00 in 2015 and the greater part of 2016 (CBN, 2016; Yeeles and Akporiaye, 2016). It is because of this foundation that calls for expansion of the Nigerian economy from oil to various portions. In perspective of the available agricultural resources accessible in the nation, clearly, this division would convey the quick win in the journey to diversify the Nigerian economy.

However, throughout the years, the relative advancement of the agricultural sector is below the necessities of a rapidly growing masses, bringing about an increased in the amount spent on buying food and industrial materials from foreign countries. For example, import of food and live animals increased from ₦1.8 billion approximately US$4931506.83 (at the exchange rate of ₦ 365 to 1US$). This comprising 14.1 percent of the aggregate imports in 1981 to ₦2 885.4 (US$7,905,205,479) in 2011, and its extent of the aggregate imports also expanded to 20.2 percent. Import of animal and vegetable oil and fat, a major raw material in the food industry, expanded from ₦0.1 billion (US$273972.6) in 1981 to ₦144.7(US$396,438,356.1) in 2015, constituting 0.8 and 1.3 percent of total imports in the separate time frames (CBN, 2015).

The possibilities of the commercial farming segment as a major employer of the growing labour force and earner of foreign exchange have also been hindered from normal operations. Therefore, a huge dominant part of the populace many of whom live in the rural area stays wretched, while the nation is not secure in terms of food. This circumstance in the Nigerian agricultural sector has been followed to different factors militating against the effective execution of the sector. prominent among them are: low harvest yield, limited opportunities for credit and other services from agricultural experts, small farm holdings, low level of mechanization, poor infrastructure, high level of post-harvest losses due to pests and diseases, declining soil fertility, poor transport, processing and storage facilities (Ojo and Evbuomwan, 1997; Evbuomwan, 2016; Mojo *et al.*, 2017). Because of these reasons, Nigeria has continued to buy agricultural products from foreign countries throughout the years. These incorporate; wheat, processed rice, raw cane sugar, whole milk powder and additionally fish and fish items, a large portion of which can be produced locally. For instance, Nigeria's yearly imports charge on rice alone remained US$300,000,000 (Ugalahi *et al.*, 2016).

Different policies and financing arrangement activities have been initiated to enhance the performance of these farmers and transform the agricultural sector (Evbuomwan, 2016). However, the desire objectives have not been accomplished as a result of some peculiarities of the smallholder agriculturists. Conspicuous among these is their poor access to credit and lucrative markets to dispose of their products, which have abandoned them in a vicious cycle of poverty (Evbuomwan, 2016). Keeping in mind the end goal to address these two basic issues of the smallholder agriculturist in Nigeria, the Central Bank of Nigeria (CBN) through its developmental mandate propelled the Anchor Borrowers Programme (ABP) in 2015. The ABP is like the contract farmer concept found in other developing countries like India and Malaysia. The program organizes farmers into groups, provides financial connections between the farmers and agro-processors (Anchor) to increase the production of rice and some targeted commodities. Substantial commercial organizations and non-governmental organizations keep on supplementing the efforts of the government by setting up successful vertical coordination mechanisms (for instance, contracting) with farmers groups (Barrett *et al.*, 2017; CBN, 2016). Under these connections, the program provide subsidizes farm inputs both in cash and kind to farmers, technical support amid the cultivating period and ready market for the farmers to dispose of their products at harvest. The wide goal of the program is to make a financial linkage between Small Holder Farmers (SHF's) and respectable large scale processor (Anchor) to increase agricultural output and significantly enhanced the capacity utilization of the coordinated factories. Some specific objectives include: increase banks financing to the agricultural sector, decrease agrarian item importation and save foreign reserves, make new age of agriculturists and business, and lessen the level of poverty among SHF's (CBN, 2016).

The credit is focused at SHF's engaged in the production of identified commodities of comparative advantage in different States of the nation. The focused commodities include but not constrained to: cereals (rice, wheat, maize, etc.), cotton, roots and tubers (cassava, potatoes, yam, ginger, etc.), sugarcane, tree crops (oil palm, cocoa, rubber, etc.), legumes (soya bean, sesame seed, cowpea, etc.), tomato, livestock

(poultry, ruminants, etc.), fish and any other commodity that will be introduced by the CBN from time to time. The farmers are mandated to organize into groups/cooperatives of between 5 and 20 for ease of administration. The credit shall be disbursed to farmers through qualified Participating Financial Institutions (PFIs). The eligible PFIs under the ABP are Deposit Money Bank (DMBs), Development Financial Institutions (DFIs) and Micro Finance Bank (MFBs). The Anchor shall be private large- scale incorporated processors who have gone into an agreement with smallholder farmers to purchase the harvested produce at an agreed price or as might be audited by the Project Management Team (PMT). The State Government may go about as Anchor after meeting the set down rules. The inputs providers are required to submit an expression of interest letter to the workplace of the PMT for consideration and issuance of Local Purchase Orders. The CBN states that the credit would be given from the two hundred and twenty billion naira (₦ 220 billion) approximately US$ 602,739,726 Micro, Small and Medium Enterprises Development Fund (MSMED). The credit sum for every smallholder farmer shall be reached base upon the economics of production concurred with partners. The interest rate under the anchor borrowers' programme shall be guided by the rate on the US$602,739,726 MSMEDF, which is presently at 9 percent for each annum (all- inclusive, pre and post disbursement charges). The PFIs shall access at 2 percent from CBN and loan at the most extreme of 9 percent for every annum. The loan term under the ABP shall be the gestation time frame (i.e. the time it takes for a crop or animal to develop and be prepared for market) of the identified commodities. Loan conceded to SHFs shall be reimbursed with the harvested produce that shall be obligatorily conveyed to the anchor at an assigned collection in line with the provisions of the agreement signed. The produce to be delivered must cover the loan principal and interest (CBN, 2016).

1.1.3 Management and Administration of the Anchor Borrowers Programme

There are two models of organization of Anchor Borrowers Programme based on the anchor arrangement which are Private Sector-drove and State windows. Under each model, a programme management team should be built up to organize the implementation of the programme (CBN, 2016).The PMT under the private division drove window comprised of the Head Development Finance Office of the CBN as the Chairman, representatives of Anchor Firms as Co-Chairman. Members include; program manager of the State Agricultural Development Program (ADP), representatives of partaking banks, representatives of farmers' affiliations and the Nigerian Agricultural Insurance Corporation (NAIC). Additionally, the PMT under the State window might be set up with delegates of stakeholders as follows: Head Development Finance Office of the CBN as the Chairman to be co-chaired by the individual named by the State Government. Members are; an agent of the State Ministry of Agriculture and Rural Development (ADP), participating banks, Anchor firms, NAIC and agents of farmers' affiliations.

The Process Flow of the Anchor Borrowers' Programme incorporates: writing a letter to the CBN by the Anchor/State Government showing interest to join the program, the focused agricultural commodities, planned number of agriculturists, the hectares to be

secured and the PFI(s) involved. Also, arrangement of the PMT, verification of the farmers and farm sizes by the PMT, verification of support by the Head Offices of the PFI(s), finding of respectable agrarian inputs providers by the PMT, organization of town hall meeting to concur on the financial matters of production per hectare, selling price, signing of agreement, and some other important issues (CBN, 2016).

The gathering might have in participation every one of the partners including the inputs providers, signing of tripartite agreement by the PFI, Anchor and the farmers, submission of loan applications from head offices of PFIs with the list of agriculturists in the prescribed format with account numbers, gender, farm size, Bank Verification Number (BVN), phone numbers, cooperative name and Local Government Area (LGA) and enlistment of agriculturists on the National Collateral Registry (CBN, 2016). An obligatory preparing programme should apply for farmers that will take an interest under the ABP covering: farming as a commercial activity enhanced rural practices and group management dynamics. The cost of such preparing should be borne by the participating Anchor. In any case, partnership with Development Partners is encouraged on the preparation of the agriculturists. Certificates issued toward the finish of the preparation form a prerequisite for farmers to get credit facilities in kind and money under the program. The Anchor/State Governments is expected to provide agricultural expert services to supplement the preparation, guarantee support for a good agricultural practices and lessen side selling (CBN, 2016). The collateral under ABP to be promised by SHFs include: cross and several guarantees by farmers in cooperatives/gatherings, a tripartite agreement signed by the parties, cross and several guarantees by farmers to be enrolled in the NCR and equity commitment by the farmers (least of 5 percent). Participating farmers are required to store the base value (minimum equity) necessity in their account with the PFI before credit payment as no input would be conveyed to any farmer that has not given the value commitment (CBN, 2016). The planting season might be instructed by the ministry of agriculture/State Agricultural Development Program from the state planting logbooks (because the nation is extensive and the climate is diverse, consequently different states have different planting dates). Side selling by the farmers is limited and it shall attract applicable sanctions as communicated in the ABP Rules. These include: boycotting of the SHF on any intervention by the CBN, arraignment of the SHF and payment of the loan by the guarantors and cooperatives. Sanction has additionally been stipulated in the ABP Guidelines for infractions by different partners like PFIs for diversion of funds, Anchor for inability to collect certified quality output from agriculturists, and PMTs for insider related contracts and inflation of contract figures among others. To induce the interest of PFIs in the program, the CBN shall absorb 50 percent of the sum in default after satisfactory evidence that each means of loan recuperation has been exhausted by the PFI. The PFI shall bear the credit risk of the balance (CBN, 2016).

Kebbi State has the highest potentials in the country in terms of irrigated rice production (Lontau, 2003) and was the first state to key into the program due to its comparative advantage on dry season rice production and the commitment of the state governor to tackle poverty and provide employment opportunities. Anchor borrowers' programme was kick off on November 2015 in Kebbi State, Nigeria. About 70,012 smallholder farmers registered under the first launched of the programme (CBN, 2016)

Thus, there is a need to study the effects of Anchor Borrowers Programme on smallholder rice production in its attempt to increase rice production and contribute to the attainment of food security in Kebbi State and Nigeria at large. Technical efficiency examination is of principal significance. Understanding the causes and extent of technical inefficiency would suggest how potential yield could be expanded or potential expenses could be diminished. Also, the presence of risk in the atmosphere where the crop is being produced influences producers decision making as far as their inputs allocation decision and consequently output supply. A state of exposure involving risk results or events relies upon the decision-maker state of mind toward risk. Farmers under ABP in Kebbi State exemplified such conditions. Production risk is prevalent and solid in its impacts on farming operations. In this way, it is additionally vital to break down how risk influences farmer's choice on input assignment and likewise how it affects the farmer's efforts to achieve technical efficiency. Agricultural risk is associated with any farming-related activity that exposes farmers to a chance of loss and damage and can't be anticipated perfectly. These elements could be natural for instance, incidence of pests and diseases, climatic factors and value factors, for example, unfriendly changes in both inputs and output prices (Wanda, 2009). Production risk is a problem that needs serious attention especially in developing nations where subsistence agriculture dominates the farming activity. Reducing changes in likely yield has been a significant focal point of farm managers. Antle (1983) attested that variation in yield is not just clarified by the variables outside the control of the farmers, for example, input and output prices, yet additionally by factors inside the agriculturist control, for example, varying levels of input. A risk-averse farmer accordingly utilizes to a greater degree a risk decreasing variable than a risk-neutral farmer (Pope and Kramer, 1979). The variability in output as the result of certain input decision is the risk associated with input use.

The stochastic frontier examination model of Aigner *et al.* (1977) and Meeusen and van Den Broeck (1977) is the standard econometric stage for efficiency analysis. The model established the framework that gives a clear explanation for technical inefficiency in the stochastic frontier production approach. Notwithstanding, investigation in this approach mostly disregards production risk despite the approach agrees with the heteroskedastic approach (Villano and Fleming, 2006). The work by Just and Pope (1978) was the first to clear a route for understanding the process of cultivating crops under risk through the estimation of the heteroskedastic formula of production. An inadequacy of Just and Pope Model is that they analysed a unit change effect of input on production risk without considering the effect of input on mean output and failed to assess the risk preference of the decision-makers. The risk preference function developed by Kumbhakar (2002) provides a platform for us to estimate production risk, risk preferences and technical efficiency in rice production at the same time. The precise estimates of technical efficiency and production risk are important for policy makers.

1.2 Problem Statement

Rice consumption in Nigeria has risen enormously. It has expanded from more than 1.2 million metric tons in 1985 to around 6 million metric tons in 2015. In the most

recent period, the growth rate of eating rice in Nigeria has expanded yearly by 10.3 percent on average and it is expected to increase because of increment in population, urbanization, and changes in consumers' inclinations for rice (Ugalahi *et al.*, 2016; USDA, 2016).

In spite of the fact that production has additionally expanded throughout the years from an average of 1.5 million tons in the year 1990 to around 3.5 million tons in the year 2015 the increment has been by extension in area harvested which has expanded from 1.2 million hectares in 1990 to around 3.1 million hectares in the year 2015. However, yield per hectare declined from 1.6 tons for each hectare in 1987 to 1.14 tons in 2015 (USDA, 2016). The decline in yield may likely continue because of the traditional method of cultivation defined with low yield per hectare, incidence of pests and diseases, drought and declining soil fertility, among others (Evbuomwan, 2016; Mojo *et al.*, 2017). Although Kebbi state got the average yield of 3.87 tons per hectare in 2015 irrigated rice production which is the highest in the country, however, the average yield is low when contrasted with a potential yield of 5 to 6 tons for every hectare that could be acquired from irrigated rice production (APS, 2017: Amaechina and Eboh, 2017: Udemezue, 2014). Therefore, there has been an emerging difference between the demand for rice and its availability from low yield. This is a possible danger to the food independence of the nation. The pressure coming from demand for rice in contrast to its supply is shown in the continuous increase in the costs of the commodity, this has relatively large implications for the food independence and economic advancement of the nation's economy.

The productivity challenge is driven by limited opportunities for credits to smallholder farmers who form the bulk of the farming populace and using cultivating techniques that is to a great extent wasteful. Therefore, an aging number of farmers who inhabit in the country do not have enough quality seed, fertilizer, irrigation facilities, storage facilities, and other related support to be successful (CBN, 2016). Other factors blamed for low yield are; lack of research and extension services, lack of public and private investment, and predominance of small farm holdings among others (CBN, 2016). Also, the inherent production risk emanating from weeds, incidence of pests and disease, birds, drought, flood and sudden changes in prices of inputs and outputs ultimately affects the farmers' ability to attain high yield (Wanda, 2009). This is because the realization of output is uncertain and the capacity of farmers to acquire most extreme yields given a set of input factors is often influenced by their input decisions as well as environmental factors (Kumbhakar, 2002). Certain input factors may contribute positively to the realization of output whiles others may not (Just and Pope, 1978). Each farmer will likely utilize input factors to get the maximum achievable yield. Large variations between observed yields and maximum achievable yields are therefore undesirable. Farmer's input allocation decision would affect output supply.

Government and other stakeholders have invested a lot of resources on research and development of inputs towards rice production. However, results have shown the overall failure of such efforts as rice output is deficient and processing is as yet unacceptable (Udumezue, 2014). Theoretically, increasing output of rice production

would either require increasing its yield per unit area, input utilization particularly land extension, an adjustment in asset use proficiency as well as technological changes got from the utilization of innovations. Given the steady populace pressure and other social and financial limitations in Nigeria, land extension as a beginning of expanded yield has small practical usage. Henceforth, the nation is left with the alternative of adjusting the proficiency of farmers by enhancing their condition or evacuating existing institutional, market and financial limitations and introduction of improving innovations.

For over thirty years, it was believed that choosing food import as a strategy would solve the country's food deficiency issue, be that as it may, this approached has failed, for example, the import bill of rice alone stood as over $US\$\,300$ million yearly (Ugalahi *et al.,* 2016). Import policy has drained the country's little foreign reserve, discouraged domestic production, and increased the level of poverty and unemployment among households. For instance, the World Bank (2016) performed a baseline survey in Kebbi state in 2015 before the launched of the Anchor Borrowers' Programme and reported that 80 percent of the surveyed population identifying crops and animal production as their main revenue activity and 85 percent of households in the research sample fell below the international poverty line of US$1.25 per day based on per capita daily expenditure. They also revealed that 90 percent of households in the previous 12 Months reported encountered food insecurity and joblessness is elevated in the study population with 37 percent of the sample reporting that no people in their family worked in income generating activity in the last 30 days prior to the baseline survey.

This, therefore, necessitates alternative policy actions. The federal government in 2015 embraced partnerships with private sectors across farmers groups and companies in an attempt to boost domestic rice production, this link smallholder farmers with large scale processors to undertake farming as a business. The Government provides input support such as; cash, fertilizer, hybrid seed, pesticide, irrigation facilities, training on better management practices and other supporting infrastructure.

However, at the implementation of the Anchor Borrowers' Programme in Kebbi state, the Project Management Team (PMT) reported the challenges of inputs supply. Despite the early placement of the orders for supply of inputs serious shortcomings were encountered in the delivery of some of the inputs, specifically fertilizers. The challenge of increases in the costs of goods in the country had resulted in the shortfall in the delivery of some quantity of fertilizers. For example urea which was to be delivered as ordered at US$13.7/50kg bag was selling at US$17.80. Some farmers were unable to receive the last allocation of 2bags of urea and 1bag of NPK as the result of non-supply. Also, farm irrigation in Kebbi state is strictly through the use of petrol driven irrigation pumps mostly on wash-bores or tube-wells and in some cases pumping through open water bodies. In all cases, demand for petrol is very high and the costs of it is equally high. Thus, with these challenges technical efficiency of rice farms under this programme is very important. However, the estimation of technical efficiency using a conventional stochastic frontier model fails to adequately address an important aspect of production which is production risk. Not accounting for

production risk concerning input use will give a one-sided estimate of technical efficiency. These biased estimates may be misleading to policymakers.

1.3 Research Questions

a. Are the beneficiaries of ABP loan better than non-beneficiaries in using their production inputs efficiently?
b. What is the production risk with respect to technological inputs use for the beneficiaries and non-beneficiaries smallholder rice farmers?
c. What are the factors affecting the technical efficiencies of the beneficiaries and non-beneficiaries smallholder rice farmers?

1.4 Objectives of the Study

The general objective of this study is to determine the effects of Anchor Borrowers' Programme on smallholder rice production and efficiency in Kebbi State, Nigeria. The specific objectives are:

a. To analyse the technical efficiencies of beneficiaries of ABP loan and non-beneficiaries smallholder rice farmers'.
b. To analyse production risk with respect to the technological inputs of beneficiaries and non-beneficiaries smallholder rice farmers'.
c. To analyse the factors affecting the technical efficiencies of beneficiaries and non-beneficiaries smallholder rice farmers'.

1.5 Significance of the Study

The result from the estimation of technical efficiency will indicate the degree of utilization of the present technology employed in the production process and the potential for improvement. Estimates of the productivities of the input factors to rice output will give understanding about the relationship of the different input factors to output. The degree to which output will change if the input factors are changed. The estimated scale elasticity of production also indicates the change in output if all the factor inputs are varied by the same proportion in the long run. These estimates help to inform policy on the right input mix which will result in increased output.

The existence of risk in production environments such as; incident of pests and disease, changes in the market prices of inputs and outputs, change in interest rate among others, influences decision making by farmers as far as their input allotment choice and, accordingly output supply. The level of risk of a result or events relies upon the decision-makers states of mind toward risk. How farmers manage this risk is greatly influenced by their willingness to take the risk. The findings from the production risk component will give insight into how individual technological inputs affect output

variation. Some technological input factors may tend to increase output variance while others may not. This information is necessary for the input allocation decision. The findings will be able to suggest policy guidance that can improve the ABP mechanism to be more effective in increasing productivity and hence the farm income of the Beneficiaries. The outcomes of this research will also add to the existing literature on the improvement of technical efficiency and mitigation of risk by the Beneficiaries and Non-beneficiaries farmers in Kebbi State, Nigeria.

1.6 Contribution to Knowledge

This study will definitely provide new insights on the effects of Anchor Borrowers' Programme on smallholder rice production and efficiency in Kebbi state, Nigeria. It will provide a clear knowledge of the possible causes of rice production volatility in the Anchor Borrower' Programme and demonstrate the output gap between real yield and achievable yield which presents an opportunity for output growth. The finding will reveal some demographic, institutional and management practices affecting the technical efficiency of rice production in the study area.

1.7 Organization of the Thesis

The thesis is structured into five chapters. Chapter one covers the Background of the study, Problem statement, Objectives, and Significance of the study. Chapter two presents various approaches for the efficiency measurements: the non-parametric and parametric approach (deterministic and stochastic frontier approaches), production risk, the incorporation of production risk in the stochastic frontier model as well as empirical applications of the different methods in the efficiency analysis. It also presents literature review of agricultural policies and programs in Nigeria (The era before 1970, the era1970-1985, the era 1986-1999 and the era after 1999). Chapter three outlines the methodology employed for the study. This includes information about the method of analysis that is, the theoretical framework, conceptual framework, and empirical analysis for estimating technical efficiency and production risk and hypothesis test. It also outlines the data and sampling technique employed and information about the study area. Chapter four covers the results and discussion of the study concerning each specific objective, summary statistics of the output and input variables, description of the demographic characteristics of the respondents, various hypotheses that were tested, the estimates of the marginal output risk, the inefficiency model estimates and the estimates of inefficiency that combine beneficiaries and non-beneficiaries. Lastly, chapter five covers summary, policy implications, limitations and suggestions for further studies and conclusion of the investigation.

1.8 Chapter Summary

This chapter explained the background of the study which includes the discussion of rice sector in Kebbi state, the Anchor Borrowers' Programme and the management and administration of the Anchor Borrowers' Programme. It also presents the problem statements, research questions, objectives of the study and significance of the study.

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