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THE ECONOMIC IMPACT OF IMPROVED AGRICULTURAL TECHNOLOGY ON CASSAVA PRODUCTIVITY IN KOGI STATE OF NIGERIA

Adofu, Ilemona
Department of Economics, Kogi State University, Anyigba, Nigeria,
e-mail- ilemonaadofu @ yahoo.com.
Shaibu, Susan Ojone
Department of Economics, Kogi State University, Anyigba, Nigeria,
Yakubu, Sulieman
Department of Economics, Kogi State University, Anyigba, Nigeria,

Abstract

This paper assessed the economic impact of improved agricultural technologies on cassava productivity in Kogi State, Nigeria. The results are drawn from a household survey covering the agricultural season of 2009/2010. The data obtained from interview schedule was subjected to descriptive and inferential statistical analysis. Descriptive statistics for this study include frequency, percentages and means. The hypothesis was tested using chi-square. The result shows that 79.33% of the respondents adopt the use of improved variety within the period under study. The analysis done on the revenue of the respondents before and after the adoption of the improved agricultural technology shows that revenue of farmers after the adoption of innovations are better off than revenue generated before adoption by N27,750 on the average per farmer. This result shows that the impact of improved agricultural technologies on cassava productivity is positive. Additionally, the results attest to the importance of increasing agricultural productivity in tandem with improvements on the adoption and use of improved agricultural technologies and its availability to the reach of farmers with the farmers' ability to store food. This findings is consistence with Idachaba and Ayoola, (1995) who observed that improved agricultural helped in increasing agricultural productivity.

Keywords: *Economic Impact, Technology, Cassava, Kogi State.*

1. Introduction

The Nigeria population according to the 2006 census was estimated to be about 140,003,542m. About 75% of this estimated population is directly or indirectly dependent on agriculture for their livelihood (Adofu, I.,Abula, M., & Audu, S. I., 2010). Agriculture which is the artificial cultivation and processing of animals, plants, fungi and other life forms of food, fiber and other by products, therefore, plays a unique role in the nations' economy. Due to an ever increasing demand for food as a result of population growth and a wide variety of nutritional requirements, the existing gap between food and population expansion, cultivable land and labour has significantly increased. The government through the National Acceleration Food Production Programme (NAFPP) in 1972 instituted the need for agricultural technology development in Nigeria Idachaba and Ayoola, (1995). The purpose was to enhance technology transfer with respect to priority crops like maize, wheat, sorghum, cowpea and cassava to the rural farmers. The development of agricultural technology in Nigeria led to the creation of agricultural technology centre or agricultural

research institutes; and the major role is to breed improved seeds of crops that are early maturing, high yielding, resistant to pests and diseases and are adaptable to local environment. The research gave rise to improved cassava varieties such as TMS 30572, TMS 4(2) 1425, maize (TZESRW) Cowpea (TAR 48) Rice (ITA 150) and Sorghum (KSV 12). The economic impact of improved agricultural technology can be felt on cassava productivity, if the improved agricultural technology development reaches the rural cassava farmers through extension and other means. Farmers need to be educated about improved practices to minimize waste and for better utilization of the resources at their disposal bearing in mind the World Bank Report, (1999), that Farming is inherently a risky business because of weather and prices.Adoption of technological innovation in agriculture has attracted considerable attention among development economists because majority of the population of less developed or developing countries derive their livelihood from agriculture and agricultural product, and because new technology apparently offers opportunity to increase production and income substantially (Nweke & Akorhe, 2002). However, low adoption rate means that new technologies have been partially successful. Cassava is a popular food crop grown in West Africa. It is a native of South America where it is referred to as Manihot, but it is commonly grown throughout the tropics where its importance is known for its starchy, tuberous roots. It is a shrubby perennial that grows to the height of 6 – 8 feet. It has smooth erect stem and resembles the cannabis plant in appearance. The large compound dark green, reddish veined leaves are divided into about seven leaflets in the form of a palmate. The stems contain soft white pith and have nodes from which new plants are obtained. It is relatively easy to cultivate, needing very little cultural attention. It occupy's a unique position in the world's food economy especially due to the fact that it survives where other crops fail. Its advantage and importance over other crops is its drought tolerance and ability to give satisfactory yield on a wide range of soil types including acid soils (Ejiofor & Upkabi, 1997). Through providing food continuously under conditions that causes other crops to fail, cassava has often played a critical role in alleviating famine. Eventually, it becomes the most important root crop in tropical Africa, providing over 50% of the calorie intake of more than 200million people (IITA, 1990). In recognition of the wide consumption and use of cassava for food security among poor and underdeveloped nations, the Food and Agricultural Organization (FAO) has made its production a global focal point of their programme.The Federal Government of Nigeria (FGN) in her effort at increasing food production, raising farmers' income and improving the standard of living of people in the country via increasing productivity of farm products has keyed into FAO programme through their commitment to Cassava production in Nigeria. In pursuit of this commitment, the (FGN) sought technical assistance from international fund for Agricultural development (IFAD) for a programme to increase productivity of cassava through increased use of improved varieties which enjoy the advantages of diseases and pest resistant, high yielding and early maturing couple with better agronomic practices and introduction of improved processing methods, (Kogi State Agricultural Development Project, 1997).

The Cassava multiplication project (CMP) took off in Kogi State in 1997 and it was evident that the major Cassava production technology dissemination were;

- Introduction of improved cassava varieties e.g. TMS 30572, TMS 4 (2) 1425; TMS 30555 and TMS 3000L.
- Introduction of improved cassava management practices such as complementary crop for combination for crop mix farming system, optimal spacing of plant (plant population); and weeding times and methods.

- Introduction of various forms of utilizing cassava such as starch, tapioca, flour for baking and chips apart from the former traditional uses such as Garri, Alebo, Akpu (KSADP, 1997).
- This study assessed the economic impact of improved agricultural technology on cassava productivity in Kogi State of Nigeria.

2. The Concept of Technology

Technology can be seen as the process by which humans modify nature to meet their needs and want. This position approximate Hornby, (2000) view that Technology can be defined as the scientific study and use of mechanical arts and applied science and application of these two practical task in industries. Olayide (1980) also defined technology as the systematic application and collective human rationality to the solution of the problems through the assertion of control over nature and all kinds of human processes. Atala (2002) defined technology as an organized capacity for some purposive activity. The definitions above suggest that agricultural technology include both components and processes of agricultural production. These processes may include; production of plant and animal breeding (including biotechnology), the introduction of new crops, livestock and fisheries, mechanization, infrastructural development and inputs.

3. Literature Review

Agriculture plays a unique role in reducing poverty through the use of new technologies. Partly, this reflects the sheer number of poor people engaged in it. Agriculture is an important livelihood source for about 75% of people surviving on less than $1 a day – the internationally agreed definition of absolute poverty line in rural areas (IFAD, 2001). It was observed by Maxwell, (2001) that 70% of Sub- sahara African's labour force and 67% of South Asians work in agriculture or are employed by agriculture. The argument in favour of agriculture as the poverty alleviating sector per excellence rest on more than population statistics. Improvement in agricultural productivity has a powerful knock–on effect to the rest of the economy like food processing through input supply and increasing the supply of affordable food which stimulates and support economic growth and development. Technology change in agriculture began at least 10,000 years ago when the first cultivation selected wild plants which were experimented with different growing environments Egwu, (2003). Earlier in civilization, the technical performance of agriculture in the great civilization remained roughly equivalent for centuries until the middle of the nineteenth century, where principally in Europe and North America, we saw the introduction of new machinery into agricultural activities. The spread and improvement in agricultural technologies has since then been very impressive, particularly in improved "modern varieties" (MVS) of grains. In 1990 modern varieties (MVS) represented an estimated 75% of Rice, 70% wheat and 57% of the maize growth in the developing world. Although these figures reflected part in the Green Revolution package of seed, fertilizer, irrigation and a substantial proportion of these MVS grown with low or no external inputs (Byerlee & Lopez, 1994). The story is not just confined to cereals or to the development of yield maximizing varieties alone, new technologies have also been developed for non- cereals and many MVS have been developed principally for their resistance to pests and diseases in other areas outside cereals. A very good example is the improved cassava varieties which spread rapidly in part of west Africa (Nweke &Akorhe, 2002). The research undertaken in Nigeria in the 1970 was fundamentally for the development of cassava resistant to mosaic virus (Otim, 2000). The relationship between risk and technology use is a perennial theme. It can work in

two directions. First, the adoption of agricultural technology can make a limited contribution to reducing the vulnerability of the small – scale farmers who are mostly poor. Examples include the adoption of drought resistance varieties as TMS 4(2) 1425 TMS 30555 and TMS 3000L that reduces the risk of crop failure due to drought. Cassava occupies a unique position in the world food economy especially its survival ability where other crops fail. Secondly, it also gives a satisfactory yield on a wide range of soil types including acid soils. There can be tradeoffs between growth through agricultural technologies and risk since taking up a new agricultural technology is in itself risky. While improved productivity through agricultural technology can lead to increase in income, adoption is associated with capital and transaction cost that poor farmers may not be able to afford. Despite the allocation of fund by the Federal government to agricultural sector over the years and the technical assistance from IFAD, yet evidence has shown that the agricultural industry does not command the respect or maintain the pride of the place it was in the Gross National Product (GNP) of the Nigeria economy in the 1970s. Increase in cassava productivity will greatly improve per capita income of the individuals and the National income country. To achieve this is not without some constraints leading to dwindling farmer's performance in the production. While some of these constraints are imposed by the government ability to live up to expectation, the other is imposed by the very complex nature of the society.

Research conducted to investigate into factor related to the adoption of improved farm practices in Kogi State has shown that technology adoption was positively and significantly associated with the followings;

- Characteristics of farmers in terms of age, level of education and social status.
- Characteristics of farmers in terms of agro- climate condition, location, sizes, credit etc.
- Characteristics of the improved technology itself in terms of relative advantage compatibility, complexity and availability.
- Participation of voluntary organization and
- Characteristics of change agents in terms of their personal attributes, techniques of communication, amount of participation obtain and the use of traditional culture

The major problem with the adoption of improved agricultural technology by cassava farmers in Kogi State of Nigeria as observed by KSADP, (1997) is that of inadequate finance. Ngigi, (1999) views' finance as an issue crucial to entering processing and buying of farm inputs like herbicides, insecticides, and fertilizer in farming of which cassava is inclusive. Effective management of cassava farmers toward higher productivity is a function of the availability and level of finance or credit facility at the cassava farmers' disposal. Also, cassava farmers in Kogi State are faced with the problem of land tenure system. This is because land for agricultural production is predominantly acquired through inheritance or within the extended family. This problem of land tenure as observed by Adofu, Orebiyi and Otitilaiye, (2013), robs a lot of people who are interested in the cultivation of cassava the opportunity to do that which now shift their interest to non- agricultural trade. In another thought, some land owners feel that it is unjust and immoral to sell their land to farm users since this may deprive their future generation of the inheritance opportunity. Low level of literacy among cassava farmers is another major problem. Majority of farm populace are those who live in the rural areas and are mostly illiterates. This has adverse effect on the role they play in their different economic activities. Pandey, (1989) observed that the level of education of farmers plays a vital role and accelerates the adoption rate of farmers, Obinne and Anyawu (1991) suggested that education is believed to help develop managerial skills which lead to enhanced adoption index and adoption is positively related to education. Research has shown that the age of farmer plays a significant role in his adoption decision. In accordance with this, the Kogi State Agricultural and Development Project (KSADP) 1997

carried out a research work and the result showed that out of 1,500 respondents covering the whole Kogi State, 87% of the respondents were youths while the remaining 13% were old people. This implies that more youths respond to innovation than the older ones. Extension communication is highly correlated with adoption thus indicating the need to explain the technologies fully to the small- scale cassava growers. In views of this, it can thus be seen that most of the small – scale cassava farmers are necessarily more responsive to the use of the technologies when the attributes of the improved practices are explained to them, supported by efficient techniques of extension communication especially by frequent contact with extension workers. In spite of the efforts made by states and Federal Government to enhance cassava productivity, there is still low cassava productivity in Kogi State. Though a lot of research work has been done on cassava productivity, few research works have been carried out on the assessment of the Economic Impact of improved agricultural technology Development on cassava productivity in Kogi State in recent time. These inadequacies have prompted the researcher to fill this gap by assessing the economic impact of improved agricultural technology on cassava productivity in kogi State, Nigeria.

4. Materials and Method

4.1. Area of Study- The study was carried out in Kogi State of Nigeria. The State has twenty one (21) local government areas and is located in the middle belt or what is historically referred to as the North Central area of Nigeria. The State lies between Latitudes 7^0, 15 minutes North and Longitudes 7^0, 32 minutes East on an altitude of four hundred and twenty meters above sea level. The state experiences two major seasons, dry and wet seasons which favours the growth of varieties of food and cash crops. The major economic activities of the people are farming, fishing, services and government employees and the major crops grown are yam, cassava, and rice while the cash crops include cashew, oil palm, and Neem tree. Kogi State is abundantly endowed with Iron Ore, Limestone and coal Adofu, Orebiyi and Otitolaiye, (2013).

4.2. Population and Sampling Procedure: - The population for the study is cassava farmers in Kogi State, Nigeria who are members of cassava farmers association. Multi stage sampling was employed for the study. The state is divided into three senatorial zones and twenty one local government areas. The first stage of the sampling involves selection of local government areas from each zone. Each of the senatorial zones has an average of seven local government areas. Two Local governments were randomly selected from each zone and 25 cassava farmers were selected from each local government which represents 15% of the population, making it one hundred and fifty respondents as shown in Table 1.

Table 1: Analysis of sample selection

Selected local government Area	No of programme	No of programme Selected	No of Sample respondent
Dekina local government	10	3	25
Idah local government	5	3	25
Lokoja local government	7	3	25
Kabba local government	5	3	25
Okene local government	4	3	25
Ajaokuta local government	4	3	25
Total	35	18	150

Source : Field survey, 2011

4. 3. Data Collection: Data were sourced from primary sources. Data from primary sources were collected with the aid of well structure questionnaire and oral interview/observation.

4.4. Analytical Technique: the data obtained from interview schedule was subjected to descriptive and inferential statistical analysis. Descriptive statistics for this study include frequency, percentages, means and chi- square. The choice of this technique was informed by Adofu, Antai, and Alabi, (2007). Data collected from the field through the use of well structured questionnaire were subjected to analysis using the frequency of occurrence, percentage of occurrence and the mean of the population. In other to empirically test the hypothesis of the study, the chi-square was employed.

Table 2: Frequency distribution of respondents according to socio-economic and demographic characteristics

Variables	Frequency	Percentage
Sex		
Male	120	80.00
Female	30	20.00
Age (yrs)		
20 – 30	30	20.00
31 – 40	60	40.00
41 – 50	50	33.33
51 and above	10	6.67
Marital Status		
Single	50	33.33
Married	70	46.67
Widowed/ divorced	30nb	20.00
Level of Education		
No formal education	40	26.66
Primary education	58	38.67
Secondary education	37	24.67
Tertiary education	15	10
Occupation		
Farming	82	54.67
Tailoring	30	20
Civil Servants	20	13.33
Hunters	15	10
Fishermen	3	2

Source: Computed from field Survey Data, 2011.

5. Results and Discussions

The respondents were requested to describe their socioeconomic and demographic characteristics, such as age, marital status, sex, religion, level of education and occupation as presented in Table 2.Results shows that 20 to 30 years were 20%, 31 to 40 years were 40.0%, 41 to 50 years were 33.33%, 51 and above years were 6.6%. This shows that forty percent (40%) 0f the respondents fall within the age bracket between 31 – 40 years. This is where the

youthful energy permits people to exert a lot of agility on the farm. Majority of the sample respondents are male (80%), while female have 20%, on marital status, the result indicate that 46.67% of the respondents are married, 33.33% are single, while 20% are widowed/divorced. The educational level of the respondents showed that 26.66% of the cassava farmers have no formal education, 38.67% have primary education, and 24.67% have secondary education while 10% have tertiary education. On the occupation of the respondents, the result shows that 54.67% of the respondents are major farmers, 20% are engaged in tailoring, 13.33% of the cassava farmers are civil servants, 10% are hunters while 2% of them are fishermen.

The analysis done on the revenue of the respondents before and after the adoption of the improved agricultural technology shows that revenue of farmers after the adoption of innovation are better off than revenue generated before adoption by ₦27,750 on the average per farmer. This is shown as Net revenue in Table 8 (see appendix). In the course of this study, certain features were identified of the cassava farmers in Kogi State, Nigeria. Some of the features are Family size of the respondents, improved varieties used, types of Farm tools/ implements use by respondents, cost of production before and after the adoption of improved technology. These are depicted in Table 3, 4, 5, 6 and 7.(see appendix) From Table 3; 50% of the respondents have family size of 16 and above which give them the highest percentage, they provide cheap labour for farmers especially those who cannot afford hired labour.

Table 3: Family Size of Respondents

Family Size	Frequency	Percentage
1 – 5	10	6.67
6 – 10	20	13.33
11 – 15	50	33.33
16 and above	70	46.67
Total	150	100

Source: computed from field Survey Data, 2011.

Table 4: Type of Improved Varieties used by the Respondent

Cassava Varieties	Frequency	Percentage
TMS 30572	80	53.33
TMS 30555	19	12.67
TMS 30001	10	6.67
TMS 4(2) 1425	10	6.67
LOCAL VARIETIES	31	20.67
TOTAL	150	100

Source: computed from field Survey Data, 2011.

Table 5: Farm Tools/ Implements used by the Respondents

Tools/implements	Frequency	Percentage
Hoe/cutlasses	100	66.67
Tractors	30	20
Animals	5	3.33
Others	15	10
Total	150	100

Source: Computed from field Survey Data, 2011.

Table 6: Frequency Distribution of the Respondents' Operational Cost of Production before and after Adoption

INPUT/OPERATIONS	COST PER HECTAR (N)	COST PER HECTAR (N)
	BEFORE ADOPTION	AFTER ADOPTION
Fertilizer		8000
Land clearing	3000	2500
Cultivation	4000	2500
Planting	1500	1500
Weeding	3000	3000
Harvesting	3500	2500
Processing	2500	2500
Total	17500	22500

Source: Computed from field Survey Data, 2011.

Table 4 shows that 79.33% of the respondents adopted the use of improved variety where 53.33% grow TMS 30572 and 12.67% grow TMS30555. Others grow TMS 3000L (6.67%), TMS 4(2)1427 (6.67%) and local varieties has about 20.67% respectively. From Table 5; the result showed that 66.67% of the respondents use hoes and cutlasses for cassava farm operations while 20% use tractors, 3.33% use animals' e.g. Donkey or cow and 10% use other means. Majority of the respondents who use hoes and cutlasses stated that, the tools are cheap, readily available, easy to maintain while the rest who use tractor and animals opined that they are more efficient and saves time and energy. Majority of farmers do not use tractor due to the high cost of hiring it and the poor economic status of most farmers. This finding is in line with Egwu, (2003) observation that tractors are used by few rich farmers. Table 6; shows the cost of production before and after adoption of the improved technology, where it was observed that the farmers spend less on cassava production before adopting the improved technology. The result also revealed that farmers invested more resources in farming after embracing technological improvement than before then.

Table 7: Revenue of the respondents before and after adoption of the improved agricultural technology.

Operations	Revenue before Adoption (N)	After adoption (N)	Net revenue
Cost of production	16500	22500	Income before adoption
Yield of cassava per hectare	6.5 tones	13.25	16000
Price per tone	5000	5000	Income after adoption
Gross Revenue	5000 x 6.5	5000 x 13.25	43, 750
Total	32500	66250	Difference 43750 – 16000
Net revenue	32500 – 16500	66250 – 22500	= 27750
Total	16000	43750	N 27,750

Source: Computed from field Survey Data, 2011.

Table 8: Chi-square Tests of the Economic Impact of Improved Agricultural Technology on Cassava Productivity in Kogi State

FO	FE= RT X CT/N	FO – FE	$(FO -FE)^2$	$(FO - FE)^2/FE$
20	25.2	- 5.2	27.04	1.073
15	9.8	5.2	27.04	2.759
40	36	4	16	0.444
10	14	-4	16	1.143
20	18	2	4	0.222
5	7	-2	4	0.571
22	21.6	0.4	0.16	0.007
8	8.4	- 0.4	0.16	0.019
6	7.2	-1.2	1.44	0.2
4	2.8	1.2	1.44	0.514
				= 6.952

DF = (r - I), (c - 1), = (4 - 1), (2-1) = 3 , Alfa = 0.05 $x^2t = 2.353$

Chi-square calculated = 6.952 and Chi-square tabulated = 2.352, Since the Chi-square tabulated is less than the calculated i.e $x^2t(2.352)<x^2c(6.952)$, we therefore conclude that there is a significant impact of improved agricultural technology Development on cassava productivity in Kogi State, Nigeria.

6. Policy Implication

The result of this research conforms to the views expressed by Idachaba and Ayoola (1995) that improved agricultural technology has helped in increasing agricultural productivity. As a result of increase in scientific research and improved method of communication, great varieties of ideas have been generated and brought to the door steps of Nigeria rural farmers. These new practices or ideas are termed technologies, techniques or innovations. They are in turn use as the working parameter to link the inputs which enable them to expand their output and earn a stream of income, food, employment etc, thereby increasing the farmers' standard of living and also increases their propensity to save. Lipton,(2001) argues that no other sector than agriculture offers the same possibilities to create employment and lift people out of scarcity and poverty. Indeed the adoption of improved agricultural technologies and subsequent increase in agricultural productivity in different parts of the world explain in no small way part of the regional differences in the reduction of poverty over the last few decades. The Federal Government of Nigeria (FGN) in its commitment to increase food production, raising farm incomes and improve the standard of living of the rural farmers in the country as well as increasing agricultural productivity of the rural farmers, sought technical assistance from international fund for Agricultural Development (IFAD) for a programme to increase productivity of cassava. This is evidenced in the use of improved varieties, better disease control, drought resistant and pest control coupled with better agronomic practices. Other benefits include the introduction of improved processing method and improved storage facilities. Even with the allocation of this fund to agricultural sector over the years and technical assistance from IFAD, evidence has shown that the agricultural industry does not command the respect or maintain the pride of place it was in Nigeria economy in the 1970s.Increased cassava productivity would lead to national food security and vibrant rural economy, which will greatly improve per capita income of the individuals and the country at large. To achieve this, a pragmatic grassroots approach should be taken in active collaboration with the Kogi State Agricultural and Rural Development

Project (KSARDP) that would take advantage of low cost of information dissemination inherent in the particular rural settings of the participants for the purpose of increasing cassava productivity through the adoption of improved agricultural technology. As such, these alliances between the KSARDP and the cassava farmers are needed to form a lasting solution to the problem of food security which is an impediment to economic growth through production.

7. Conclusion and Recommendation

This research work assessed the economic impact of improved agricultural technology on cassava productivity in Kogi State, Nigeria. Questionnaires were used to collect data from the respondents. For the purpose of this study, 150 respondents from six local government areas in Kogi State were selected, using the members of cassava farmers association as sample frame. From the work, it is clearly seen that the improved agricultural technology development has a great economic impact on cassava productivity as well as the socio-economic emancipation of cassava farmers from the shade of poverty. It can be said to be the major panacea through which cassava farmers can increase production, income and welfare. This can be achieved if the government will support and make available for use improved cassava production technologies to cassava farmers. Fertilizer, tractors, agro-chemical and better extension training among others should be made available to Cassava farmers to increase their yield.

In view of the forgoing results and conclusion, the following proposed policy recommendations are made to possibly enhance the adoption of improved agricultural technology development and improve cassava productivity as well as enhancing the farmers' welfare and the economy at large.

- More extension staff should be trained and deployed to the rural areas in order to increase information source and training on better utilization of improved cassava production technologies.
- Improved technology should be made readily available and accessible to farmers' at affordable price.
- Government policies on importation and production of agro-chemicals should aim at providing those chemicals that are most useful, affordable and friendly to the environment.
- Farmers should avail themselves to available improved technologies to increase their production and welfare.
- Credit facilities should be made available and accessible to cassava farmers in the study area (Kogi State).
- There is also need to combine efforts to increase agricultural productivity with those tailored towards enhance farmers' ability to store food, a result marked by the significant impact of improved agricultural technology. The use of improved agricultural technology translates into higher household income, and potentially improved food entitlements and farmers' health as well as nutritional status.
- There is also need to sustain the adoption of improved technologies over time by means of ensuring a positive and significant impact of improved technologies. Measures to sustain adoption of improved technologies include investments on irrigation use, water conservation technology and drought tolerant crop varieties, which raises the need for further research in these three subjects.

Scope certainly exists to enhance the economic impact of improved agricultural technologies, in view of the unequal adoption of such technologies, and low use of other inputs (e.g fertilizer). Besides significant investments on irrigation systems, creating a favourable environment to achieve the so much talked- about Green Revolution, requires substantial investments on infrastructure and credit market, particularly in Kogi State in light of the agricultural potentials in this area. Such investment will foster and sustain the adoption of improved agricultural technologies, with a significant impact on poverty reduction due to the importance of the agricultural sector in Kogi State of Nigeria, which by a large amount is the main source of employment and internal generated source of government revenues.

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