



CONTRIBUTION OF ROOT AND TUBER CROPS IN THE AGRICULTURAL TRANSFORMATION AGENDA IN NIGERIA

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ABSTRACT

Nigeria, since 1960 has witnessed the birth and death of several notable Agricultural programmes fashioned to develop Agriculture, reduce rural poverty and earn foreign exchange. More than twenty agricultural programmes have been introduced by past and present government in Nigeria. Some of these programmes have made positive impact to the economy in boosting food production especially in Root and tuber crops. Currently, Nigeria is the largest producer of most of the root and tuber crops in the world but ninety-five percent of what is produced is consumed internally in unprocessed forms; hence Nigeria continues to import finished products such as starch, flour, sweeteners and adhesives that are made from root and tuber crops, and this is unacceptable. The present agricultural transformation agenda on root and tuber crops is mainly to engineer bulk of the root and tuber crops in the country into value-added products to match the increasing new tastes and needs for root and tuber crops products across the globe. It is also intended to provide job opportunities and generate income for Nigerians. The potential demand of 250,000 tons per year for high quality cassava flour by local and foreign companies, and replacement of bread flour by 40% cassava flour can only be met with root and tuber crops resources.

Keywords: cassava, root crops, productivity, agricultural transformation, Nigeria.

INTRODUCTION

ROOT AND TUBER CROPS

Most crops use for human food, animal feed, religious and traditional ceremonial events in Sub-Saharan Africa centre on root and tuber crops. Root crops are the edible energy-rich underground plant structures developed from modified roots while tuber crops are those crops in which the edible energy-rich storage organs develop wholly or partly from underground stems (Okigbo, 1989). Thus the storage organ of root crops is of root origin while that of the tuber crop is of stem origin. They are grown all over the Sub-Saharan region of Africa all the year round. The major root crops are cassava and sweet potato while the major tuber crops are yam, cocoyam, potato and ginger.

The productivity and growth rate of root and Tuber crops in Africa and Nigeria especially has been increasing tremendously for the past two and half decades, although such increase has not been meeting with the rising food demand due to high population pressure and poor infrastructural facilities to accelerate processing into food forms. Contributors to this trend in food production include the root and tuber crops sector with increasing annual output and growth rates. Food and Agriculture organization (FAO, 2009) estimated a yearly output of 45 million metric tons for cassava, 32 million metric tons for yam, 1.3 million metric tons for sweet potato, 0.731 million metric tons for potato, 5.0 million metric tons for cocoyam and 0.223 million metric tons for ginger in Nigeria. Growth rate of root and tuber crops shows some upward improvement (Table-1).

Table-1. Mean annual outputs in million metric tons and growth rates of some root and tuber crops.

Year	Cassava annual output (MMT)	Growth rate (%)	Yam annual output (MMT)	Growth rate (%)	Irish potato annual output (MMT)	Growth rate (%)	Cocoyam annual output (MMT)	Growth rate (%)
1975-79	1766	10.8	6518	11.2	102	4.7	1696	13.5
1980-84	2724	10.8	4998	1.7	183	3.8	1187	6.0
1985-89	14542	80.8	6715	19.5	228	3.6	2292	9.64
1990-96	20784	6.1	18263	16.6	557	20.6	7247	30.85
1997-98	34092	2.4	25102	2.1	105	3.9	1450	6.5
2009-11	45000	-	32000	-	-	-	5000	-

Source: APMEU, (1996), FAO (2009) and FAO, (2010)



Production and growth rates of some root and tuber crops in the past 25 to 30 years ago were drawn by expansion in cultivated area rather than yields. Currently, both production and growth rate of cassava, yam, sweetpotato, potato, cocoyam and ginger have expanded in areas cultivated and also yields due to innovation in technologies resulting in high yielding, pest and disease tolerant varieties of root and tuber crops. The result of the National survey conducted by the Central Bank of Nigeria (CBN) showed that the increase recorded in agricultural production during the estimated period was attributable largely to sustained government support for the agricultural sectors (CBN, 2004). The subsidy on the supply of fertilizer and other inputs was maintained. Purchases under the strategic grain reserve programme shored up prices and reduced price fluctuations, thereby sustaining farmer's confidence. The reconstruction activities and the building of new dams also encouraged increased land-space for farming activities.

ECONOMIC IMPORTANCE OF ROOT AND TUBER CROPS

The economic importance of root and tuber crops in the overall economy of the sub-Sahara countries cannot be overemphasized. Yam, cassava, potato, ginger, cocoyam, sweet potato, and minor root and tuber crops (Arrow root, turmeric, sugar beet, risga, etc.) play vital roles in the food basket of Nigerians. Apart from being principal food sources, they constitute the single most important occupational group in Nigeria. FAO (1966) reported that 78% of the adult male population was engaged in Agriculture, forestry and fishing. Root and tuber crops generate income for Nigeria. Food crops such as cassava and yam contribute about 40% of household income with the recent development and release of Provitamin A cassava varieties, TMS 03/1368, 1371, 1412 and NRCRI, 2011. Nutritional status of resource poor farmers are bound to improve with increased consumption of these provitamin A cassava varieties and malnutrition rate is bound to slow down in Nigeria.

NIGERIA'S AGRICULTURAL PROGRAMMES

Nigeria, in her fifty years as an independent nation has witnessed the birth and death of several notable Agricultural programmes fashioned to develop Agriculture, reduce rural poverty and earn foreign exchange. A few of these programmes made positive impact to the economy while others could not. To boost food production, some of the introduced programmes included the following (Obiechina, 2003): National Accelerated Food Production Programme (NAFPP) in 1972, Operation Feed the Nation (OFN) in 1975, Agricultural Credit Guarantee Scheme (ACGS) in 1977, River Basin Development Authority RBDA in 1978, Green Revolution (GR) in 1980, National Directorate of Employment (NDE) in 1986, Rural Agro-Industrial Scheme (RAIDS) in 1990, Directorate of Food, Roads and Rural infrastructure (DFRRI) in 1986, Nigeria Agricultural Credit Bank (NACB) in 1973, National Agricultural Land Development Authority (NALDA) in 1991, Agricultural

Projects Monitoring and Evaluation Unit (AMPEU) in 1984, National Tree Crops Development Unit NTCAU, in 1984, Agricultural Development Programme (ADP) in 1975, Nigerian Agriculture Insurance Co-operation (NAIC) in 1990, National Accelerated Industrial Crops programme (NAICP) in 1981, Special Rice Programme (SRP) 1997, Agricultural Research Council of Nigeria 2007, Sasakaw Global (SG) 2000, Universities of Agriculture, and Agricultural Transformation Agenda 2011.

THE AGRICULTURAL TRANSFORMATION AGENDA AND CONTRIBUTIONS OF ROOT AND TUBER CROPS

In early years of Nigerian independence, cash crops such as Cocoa, Rubber, Cashew, Groundnut, Oil palm etc, were major crop where the economy revolved, but today there is a shift to alternatives for biofuel, pharmaceutical starch and derivatives using root and tuber crops. However, the young Agricultural Transformation Agenda Programme rests its oasis on the fortunes of root and tuber crops. Root and tuber crops have continued to play a significant role in the Agricultural production and revolution in Nigeria. Nigeria is the largest producer of most of the root and tuber crops in the world with a yearly output of 45 million metric tons for cassava, 32 million metric tons for yam, 1.3 million metric tons for sweet potato, 0.731 million metric tons for potato, 5.0 million metric tons for cocoyam and 0.223 million metric ton for ginger. The growth rates of root and tuber crops show some upward improvement of between 2 to 80% from 1975 to 2011 (APMEU, 1996; FAO, 2009).

It is obvious from the above estimates that the resource for the Agricultural Transformation Agenda could be found extensively in root and tuber crops. The primary objective of the Transformation Agenda with respect to root and tuber crops is mainly to engineer bulk of the root and tuber crops in the country into value-added products to match the increasing new tastes and individual needs for root and tuber crops products. Nigeria produces root and tuber crops in large quantities. Ninety-five percent of what is produced is consumed internally in limited value forms; hence Nigeria continues to import starch, flour, sweeteners and adhesives that can be made from root and tuber crops.

The above scenario limits the propensity of Nigeria to export and compete in products markets in the world. The strategy of the Agricultural Transformation is to turn the root and tuber crops sector in Nigeria into a major player in both local and international starch sweetener, ethanol, high Quality cassava flour, high quality starch and chips markets by adopting improved production and processing technologies. This will stimulate new food firm along the value chain, reduce drudgery in production, and stimulate commercialization and marketing. This is assured by the development of new varieties of root and tuber crop especially cassava and yam. The new varieties of root and tuber crop including the recently released Pro -vitamin A cassava, early maturing, enhanced starch and high quality flour varieties



will automatically expand the tempo of the transformation Agenda. The new varieties of root and tuber crops have high yields. This inherent high yields will definitely assist in meeting the volume of raw materials needed to

transform and make the industries produce at full capacity. The characteristics of the newly developed improved root and tuber crops are shown in Tables 2-7.

Table-2. Attributes of 17 cassava varieties released to farmers for cultivation in Nigeria.

Variety	Branching habit	Canopy development	Ecological adaptation tolerance	Pest and disease yield (t/ha)	Fresh root yield (t/ha)	Dry matter (%)	Garri yield (%)	Starch yield (%)	HCN in products (mg/1000g)
TMS 90257	Profuse	Moderate	Wide	High	43	25	23	23	15.5
TMS 84537	Profuse	Moderate	Wide	High	35	28	18	27	6.3
TMS 82/00058	Profuse	Moderate	Wide	High	35	28	21	26	6.4
TMS 82/00661	Profuse	Moderate	Wide	High	39	30	22	26	4.1
NR 8212	Profuse	Moderate	Wide	High	27	37	25	21	High
NR 8082	Profuse	Profuse	Wide	High	32	32	22	19	High
TMS 50395	Moderate	Moderate	Wide	Moderate	36	29	24	12	High
TMS 30001	Moderate	Moderate	Wide	Moderate	16	28	23	22	Low
NR 8208	Profuse	Moderate	Wide	Moderate	26	32	25	23	High
NR 8083	Profuse	Moderate	Wide	High	31	43	36	25	High
NR 83107	Profuse	Moderate	Wide	High	22	31	22	19	High
TMS 81/00110	Profuse	Moderate	Wide	High	28	31	24	25	4.5
TMS 91934	Moderate	Sparse	Wide	Moderate	32	34	26	21	High
TMS 30572	Profuse	Profuse	Wide	Moderate	27	34	25	24	750
TMS 4(2)1425	Moderate	Profuse	Savannah	Moderate	26	36	25	22	31
TMS 30555	Moderate	Profuse	Wide	Moderate	17	32	24	20	High
NR 41044	Moderate	Profuse	Forest	Moderate	37	34	25	23	High

Table-3. Characteristics of Pro-Vitamin A cassava variety.

UMUCASS 36 (TMS 01/1368)	UMUCASS 37 (TMS 01/1412)	UMUCASS 38 (TMS 01/1371)	UMUCASS 39 (NR 03/0211)	UMUCASS 40 (NR 03/0155)
High Pro-vitamin A	High Pro-vitamin A	High Pro-vitamin A	Early maturing	Early maturing
Very suitable for Garri and Fufu	Very high yielding	Very suitable for Garri and Fufu	Very high yielding	Very high yielding
Very suitable for high quality cassava flour	Very suitable for Garri and Fufu broadly adapted	Very suitable for high quality cassava flour	Suitable for high quality cassava flour high starch yield	Very suitable for Garri and Fufu tolerance to drought

**Table-4.** Special of *D. rotundata* and *D. alata* cultivar.

	Names of cultivars	Special characteristics
1	<i>D. rotundata</i> poir cv Nwopoko (DRN 006)	High dry matter, good food quality when pounded. Yield high 30-40t/ha, fairly resistant to anthracnose. Widely adapted, but best in the Guinea savannah.
2	<i>D. rotundata</i> cv (DRN)	High food quality for pounding, boiling, roasting etc, resistant to Nematodes. Yield 30t/ha, high dry matter. Widely adapted, but best in the Guinea savanna.
3	<i>D. rotundata</i> Cv Okwocha (DRN 005)	Best in forest zones, Stores very long, resistant to pest, long dormancy, yield 15-20t/ha, good for genetic improvement for storage.
4	<i>D. rotundata</i> cv Ekpe (DRN 001)	Early maturing, widely adapted to Riverine areas, forest zone. High yielding 40t/ha.
5	<i>D. rotundata</i> c.v Abii UD prunosa (DRN 004)	Very resistant to pest and diseases, High yielding 40t/ha, but poor food quality. Good for breeding as male parent.
6	<i>D. rotundata</i> cv Akali (DRN 003)	Round shape, amenable to mechanization, good eating quality. Stores well 4-5 months.
7	<i>D. alata</i> cv Um.680	Widely adapted but best for Guinea Savannah. Very high yield 50t/ha, resistant to anthracnose, matures early 200-240 days. Good for livestock feed, high multiplication ratio.
8	<i>D. alata</i> (DRN 087) "Ominelu"	High yielding 50t/ha. Produces bulbils, early maturing, poor food quality but good for livestock feed.

Table-5. Quality attributes of three hybrid Yam varieties.

Characteristics	TDr 89/2565	TDr 89/02677	TDr 89/02461
Type of variety	OP Local Landrace	OP Local Landrace	OP Local Landrace
Adaptation	Forest, S.G. Savanna	Forest, S.G. Savanna	Forest, S.G. Savanna
Days of maturity	210-240	210-240	210-240
Potential yield(t/ha)	29	27	30
Pest and disease tolerance	Virus leaf blight, Anthracnose	Virus leaf blight, Anthracnose/Tuber rot/Nematode	Virus leaf blight, Anthracnose/Tuber rot
Content (on dry Wt)			
Protein (%)	5.62±0.07	5.69±0.04	3.30±0.04
Starch (%)	83.55±2.15	74.4±2.88	65.53±1.04
Sugar (%)	1.29	1.09	1.34
Ash (%)	2.38±0.27	1.94±0.04	2.69±0.13
Tuber dry matter (%)	35.4	25.8	26.7
Days of dormancy	90-100	90-120	90-120

Source: (Orkwor, *et al.*, 2001), S.G= Southern Guinea, OP= open pollination.

Table-6. Mean root yields (t/ha) of sweet potato in rain forest and Southern Guinea (S.G) Savanna Ecologies.

Variety	Rain forest		Southern Guinea Savanna	
	1995	1996	1995	1996
TIS 87/0087	14.3	18.4	38.9	27.5
TIS 8164	19.9	18.3	44.2	30.8
TIS 2532.OP.1.13	18.2	23.5	38.4	31.8
TIS 82/0070.OP.175	-	20.6	-	18.1
TIS 8504.OP.1.62	-	21.2	-	25.7

**Table-7.** Characteristics of 7 released Potato varieties.

Potato variety	Skin colour	Blight resistance	Crop maturity	Tuber dry matter (%)	Tuber yield (t/ha)	Common use form
Nicola	Cream	Tolerant	Medium	18.6	26.6	Fries
Vento	Cream	Tolerant	Medium	19.4	24.8	Fries
Romano	Light red	Resistant	Medium	18.4	20.1	Fries
Kondor	Red	Resistant	Medium	20.1	26.1	Chips
CIP 389659-13	Cream	Susceptible	Late	19.7	25.8	Fries
CIP 390855-7	Cream	Tolerant	Medium	19.8	24.8	Fries
RC 767.2	Cream	Tolerant	Medium	21.5	25.1	Chips

The potentials of root and tuber crops in the Agricultural transformation Agenda cannot be over-emphasized. Root and tuber crops have the complimentary capacity to key into the existing government action plan of diversifying the economy of Nigeria. This will drive the economy into multiple facet economy in addition to petroleum resources.

Root and tuber crops will add value to the Agricultural Transformation Agenda by stimulating commercialization and marketing of Nigerian food crops beyond the shores of Nigeria and compete favourably in terms of volume of goods and services in international trade, to stimulate balance of payment. The trend in Nigeria's export is shown in Table-8.

Table-8. Indices of average world prices (C.I.F) of Nigeria's major agricultural export commodities (1990=100) (Dollar-based).

Commodity	2006	2007	2008	2009	2010
Cocoa	216.9	276.0	348.2	520.4	764.5
Coffee	83.9	282.7	284.0	207.3	218.9
Copra	144.6	123.0	173.7	154.6	169.1
Cotton	69.7	154.0	126.1	155.7	188.2
Palm oil	147.6	223.9	337.6	381.5	501.3
Soya bean	123.2	159.4	261.1	245.2	260.4
All commodities	206.0	413.6	514.8	572.8	727.2

Source: Public ledger and Financial times (London)

The role of root and tuber crops in the Agricultural Transformation Agenda could be in form of reduction in the amount of imported industrial raw materials (sweeteners, ethanol and wheat flour) imported into the country. The volume of these industrial raw materials

imported and market will drastically reduce. Root and tuber crops such as cassava, yam, cocoyam, sweet potato and ginger play significant roles in the food economy of Nigeria. The value of major imports of goods including food and animal are shown in Table-9.

Table-9. Value of major imports by S.I.T.C. Sections (₦ Million).

Year	Food and live animal	Beverages and tobacco	Crude materials inedible	Mineral fuels	Animal and Veg. Oil and fats	Chemicals	Manufactured goods	Machinery and transport equipment	Miscellaneous Manufactured goods	Miscellaneous transactions	Total
2000	113,630.5	6,740.8	44,296.6	12,516.6	14,444.6	288,594.2	289,261.3	234,075.8	38,518.8	2,941.2	985,020.4
2001	160,209.1	13,670.8	62,454.3	17,650.2	20,365.6	308,198.8	406,734.1	327,206.7	54,308.2	4,778.3	1,371,409.1
2002	144,297.6	9,503.9	75,763.3	21,112.7	21,112.7	298,318.1	473,478.8	378,826.5	82,229.3	3,718.9	1,512,095.3
2003	206,648.3	18,830.1	105,211.6	28,924.7	34,185.8	422,165.2	650,365.2	498,815.9	115,481.2	4,607.4	2,080,235.3
2004 1/	178,817.1	21,846.7	101,970.4	26,709.9	39,307.6	451,618.4	584,645.4	458,917.1	117,210.2	6,072.0	1,987,045.3
2005 2/	171,817.1	24,545.3	147,271.8	49,090.6	61,363.2	599,540.8	795,903.1	543,882.2	73,635.9	12,272.6	2,479,322.5
2006 2/	174,229.4	25,019.1	1487,306.0	50,038.2	63,452.0	608,401.0	816,692.4	552,572.3	75,961.6	13,413.9	2,528,086.0

Source: National Bureau of Statistics/Central Bank, Nigeria.



The root and tuber crops in the Agricultural Transformation Agenda might provide job opportunities and generate income for Nigeria. Primary beneficiaries (farmers) constitute the single most important occupational group in Nigeria. FAO (1966) reported 78% of the adult male population who were engaged in Agriculture, forestry and fishing. Also food crops including cassava and yam constitute about 40% of the household income in Africa (Nweke, 1992) in the time past and will increase more in the Agricultural

transformation period, thereby doubling rural income in Nigeria.

The volume of raw material such as wheat flour, sugar imported by processors in their production will excessively drop as a result of substitution with the high quality cassava flour products generated from cassava. Table-10 shows the volume of starch, flour, sweeteners, ethanol estimated to be generated in-country to reduce volume of imports.

Table-10. Estimated demand of cassava in the industrial and export markets, acreage required and estimated number of jobs created (assumes one direct job per hectare for Production, and one direct job in the processing and other downstream sectors).

Value-added chain	Estimated demand	Fresh root equivalent to meet estimated demand (Metric tons)	Acreage required (25 tons/ha)	Number of job created (one direct job on-farm per ha and one off-farm)
Starch	230,000 tons	1,150,000	46,000	92,000
Flour	250,000 tons	1,000,000	40,400	80,000
*Sweeteners	190,000 tons	95,000	38,000	76,000
**Fuel Ethanol (E-10)	0.5 billion Liters	3,571.428	142,857	285,714
High Quality garri for export and supermarkets	455,000 tons	2,730,000	109,200	218,400
Total		12,758,429	510,337	1,020,674

Source: Action plan for Cassava Transformation in Nigeria: Working document, 2012.

There will also be decongestion of our sea ports resulting from reduction of foreign ships and Jetties berthing for available raw materials generated internally from processed root and tuber crops. This will also go a

long way to reduce piracy and thuggery in our sea ports thereby reducing corruption resulting from transactions. Table-11 shows estimate of Ocean Shipment contained in the Nigerian Ports Authority presently.

Table-11. Ocean shipment.

Year	Inward	Outward		Non-Oil shipment ('000tons)			Total
	Number of ships entered	Net registered tonnage (Million)	Number of ships cleared	Net registered tonnage (Million)	Import	Export	
2000	3,333.0	20.9	3,338.0	21.6	15,991.1	8,349.4	24,240.5
2001	3,181.0	20.5	2,936.0	18.9	21,552.0		30,998.0
2002	2,688.0	17.5	2,812.0	18.2	21,982.0	7,988.0	29,982.0
2003	10,879.109.0	18.0					
2004	13,288,917.0	18.5	23,358.879.0	17.8	18,575.0	607,769.0	626,885.0
2005	13,551,854.0	17.6	26,051,234.0	18.0	20,108.8	534,148.0	40,256,362.9
2006	-	-	-	-	-	-	

Source: Nigerian ports Authority and Bureau of Statistics (N.B.S)

The estimation of increasing income by at least US\$ 450 every year in 1.8 million farm families by the Federal Government of Nigeria through doubling of production, processing and marketing of root and tuber crops in their growing area over a period of four year can

be achieved by utilizing the potential resources and products derivable from root and tuber crops (cassava, yam, sweet potato, potato, ginger). Tables 12 and 13 shows the export of Nigerian ginger in the world market.

**Table-12.** Distribution of exports from major suppliers of dried ginger (tons).

Year	India	Nigeria	Sierra Leone	Jamaica	Singapore	Fiji
1967	4340	1083	930	725	1050	295
1968	2230	1724	1560	460	740	-
1969	1200	3111	670	280	590	420
1970	2240	2665	440	305	1380	1645
1971	5280	2214	600	360	720	705
1972	7010	1990	500	350	2720	-
1973	6050	1112	348	479	-	-
1974	5083	634	-	336	-	-
1975	4681	662	-	286	-	-
1976	4786	1232	-	535	-	-
1977	4461	5823	-	213	-	-
1978	8359	-	-	172	-	-
1979	11796	75	-	-	-	-

Source: (Eze and Asumugha, 1990)

Table-13. Volume, value and price of Nigerian ginger exports.

Year	Volume (tons)	Price (₦/tons)	Value (₦)
1967	1,083.2	164.31	177,986
1968	1,723.7	210.86	363,458
1969	3,110.8	277.35	862,776
1970	3,664.7	342.95	1,256,842
1971	2,214.1	191.12	424,942
1972	1,989.9	179.12	356,424
1973	1,112.2	284.27	316,170
1974	634.4	412.74	261,846
1975	662.4	326.10	261,003
1976	1,232.4	317.88	391,192
1977	5823.0	153.39	893,192
1978	-	-	-
1979	75.0	663.28	49,743
1980	-	-	-
1981	-	-	-
1982	353.7	297.55	164,744
1983	1168.4	110.03	128,557
1984	0.3	1,000.00	300
1985	27.0	357.99	9,655
1986	218.4	1,415.23	309,029

Source: (Eze and Asumugha, 1990)

The utilization of root and tuber crops sector in the Agricultural Transformation Agenda will spin or spur

establishment of food, pharmaceutical and petroleum industries because of ample availability of raw materials



accruing from product of root and tuber crops especially, cassava, potato and sweet potato. The potential demand of 250, 000 tons per year for high quality cassava flour and replacement in bread flour by 10 or 40% cassava or yam, or sweet potato flour and for use in adhesive industry can only be met with root and tuber crops resources. These will in-turn boosts the tempo of Agricultural Transformation Agenda of the present government.

Meeting the need for dried cassava chips value-chain has a potential demand of 900, 000 tons per year with 300, 000 tons for regional food markets, an estimated 80,000 and 540, 000 ton per year destined for China export market can only be accomplished by harnessing the potential of root and tuber crops mainly cassava, sweet potato, potato, and yams.

Nigeria's recent proposal to adopt the policy of blending gasoline with 10% ethanol (the E-10 policy) could be achieved by harnessing the potential resources in root and tuber crops (cassava, potato, sweet potato, yam etc). The potentials in root and tuber crops can reduce the over dependence on natural petroleum, which will in turn reduce oil bunkering, lost of lives and youth restiveness and militancy in Nigeria with secondary blessings of peace and co-existence among various tribes in Nigeria.

CONCLUSIONS

The role of root and tuber crops undoubtedly will foster revolution in the Agricultural sector resulting in the growth of the economy of Nigeria.

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