

# Nigeria's grain resource structure and government sustainable policy: a review

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**Abstract:** Nigeria is rich in several food grain resources that empower the country with a large capacity to develop a food-grain policy. The current food-grain resource structure of Nigeria is reviewed in terms of production, milling, storage structure and issues confronting the sector growth, sustainability, policies and frameworks towards the actualization of food production efficiency. Total food-grain consumption (wheat, maize, sorghum and rice) decreased by 1.2 Mt in 2011-2013. Local consumption of wheat, and rice marginally increased by 191,000 and 500,000 t respectively in 2011-2013, that of maize and sorghum decreased by 1.5 Mt and 350,000 t respectively at the same period. About 76% of the total food grain consumption was produced locally in 2011/2012 while 73% was produced locally in 2012/2013. In 2011/2012, only 0.023% of wheat and 53.3% of rice was locally produced while 0.022% and 52.5% was produced in 2012/2013. The short fall in supply was met through importation. Challenges were found to exist, not only in low production capacity in the case of wheat but generally from low milling and storage capacity, which is less than 50% of the country's total installed milling capacity. Challenges were also found to exist from energy production and distribution pattern, which alienates the grain hubs of the country, causing them to seek for costly alternative energy sources for drying, milling and storage. Dependence on import to fill the shortfall in local production is a problem. In addressing these challenges, the government plan was to treat food-grain production as a business by integrating food-grain production, storage and processing by value chain and adopting import-substitution measures to drive sector growth. For all this to work, it must follow a sustainable framework to enhance economic growth and reduce poverty.

**Keywords:** grains, storage structure, sustainable policy, grain reserves, Nigeria

**Citation:** Ndukwu, M. C., O. A. Akani, and K. J. Simonyan. 2015. Nigeria's grain resource structure and government sustainable policy: a review. *AgricEngInt: CIGR Journal*, 17(3): 441-457.

## 1 Introduction

The world is plagued with climate change and the uncertainty of weather condition all the year round. Adverse weather condition in many countries has been the bane of agricultural production. Nigeria is not immuned to this weather problem as recently shown in 2012 by the flooding of the banks of the river Niger and its tributaries up to the delta region. Also, the continuing insecurity caused by activities of various

militant groups like the Boko Haram Islamic sect in the Northern Nigeria continues to deter Nigeria's agricultural productivity and food availability (U.S. Library of Congress, 2014). Therefore, the ability of various countries especially those in Sub-Saharan Africa to feed its population is the major issue confronting them at the moment. Although agricultural production contributed about 40% to the country's GDP and grew by 4.0% in 2012 (Central Bank of Nigeria Annual Report, 2012), a lot of food is still imported, causing the country to lose a lot of foreign exchange. The rebased Nigerian economy in 2013 continues to show that since 1970 the economy is mainly dependent on proceeds from crude oil and natural gas (Central Bank of Nigeria Annual Report, 2012). This over-reliance on crude oil

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**Received date:** 2015-01-29      **Accepted date:** 2015-06-26

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has exposed the economy to the global market forces, making it very vulnerable without any sector of the economy acting as a buffer to absorb the shock if global oil prices crashes (Ohunakin, 2013). A typical example is the unsustainable spending profile that led to near economic collapse when global petroleum prices and stocks crashed in 1986 and 2008 -2009 (Suleiman, 2010; Nigeria-Economy, 2005). The consequence was external borrowing, mainly from the Paris club, which raised its debt profile. This is because the huge proceeds earned from crude oil were not diversified for meaningful and sustainable development in other sectors like agriculture. Therefore, poverty and hunger continued to rise and people remain deprived of adequate food supply. Nevertheless, with the rebased (gross) Domestic Product (GDP), growth rate has increased by 1.7% from 2005 - 2012 (Central Bank of Nigeria Annual Report, 2012; Central bank of Nigeria, 2012) rate, the government is privatizing important sectors of the economy, promoting public-private partnerships and encouraging strategic alliances with foreign firms, for infrastructure development and technology acquisition in critical sectors such as security, power generation, transportation, healthcare and agriculture (U.S. Library of Congress, 2014; Central Bank of Nigeria, 2011; National Bureau of Statistics, 2011). The targeted objective is turning the country from net importer to net

exporter of several products. In achieving the target above, the government has developed an economic blue print called vision 20:2020, which believes that it will transform the country and place it among 20 most developed economies in the world. The high share of grains in the overall food consumption of Nigeria reflects the adoption of grains in meeting food energy requirements both in the rural and urban areas in these policies. This, however, led the government to the process of restructuring grain production, processing and storage and will cover the whole value chain, starting from planting and harvesting, transportation, post harvest processing, distribution and storage. Nigeria is a major grain consumer, which accounts for about 80% of food ration in the country. Nigeria alone, accounts for 30% to 40% of all grain imports into West African sub region (Inter-reseaux (Development rural) bulletin, 2014). Between 2000 and 2008, these annual grain imports represented an average annual cost of \$939 million and recently this has increased exponentially causing a drain in the country’s foreign exchange reserve (Inter-reseaux (Development rural) bulletin, 2014). Nigeria imported nearly \$1 billion worth of wheat in 2011-2012, with the USA accounting for 70% of the market share as is shown in Figure 1a. The country also imported nearly \$1.5 billion worth of rice as is shown in Figure 1b from 2011 – 2012 (U.S. Library of Congress, 2014).

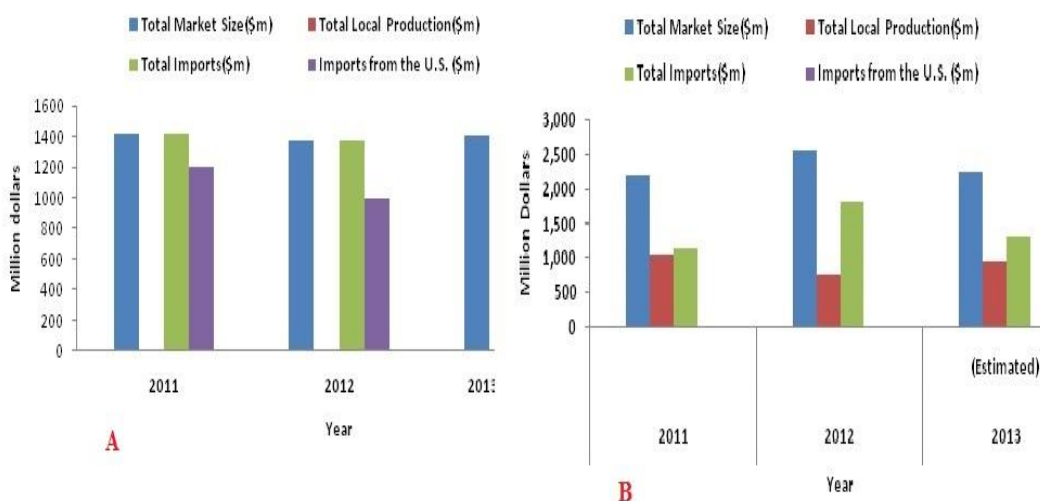


Figure 1 Overview of U.S.A export to Nigeria 2011-2013 (A) - wheat (B)-rice (BICO reports, 2012)

This trend is worrisome and the consequence is that the country has a large agri-food trade balance deficit, which attained nearly \$1.5 billion in 2002-2004. Despite the widespread vegetation pattern in the country, which can accommodate the production of different kinds of grain, successive governments lacked the political will to invest in grain production. Nigeria therefore, continues to be a substantial net importer of grains. Grain production is left in the hand of peasant farmers who toil with little resources and the result most of the times is not encouraging. What is produced is lost due to spoilage or sold at give away price due to the rush to sell because of inadequate facilities for proper processing to attract higher price or poor storage facilities. The situation is worst during the period of glut when the excesses, which could have been used to fill in the shortfall at other periods, are allowed to waste or even fed to animals. This stems from moribund storage structure and inappropriate distribution pattern of the strategic grain reserves in the country. Therefore, developing economies like Nigeria, with a population of around 170 million people and constituting 2.4% of the world population (U.S. Library of Congress, 2014) require a robust access to reliable and advanced grain milling and storage structure. Adequate and sustainable grain supply will guarantee the nation's economic stability by reducing poverty level, improving health conditions and enhance productivity (Ajayi and Ajanaku, 2007; Kalu and Tomasz, 2010). Importation of grains depletes the nation's foreign reserve and expands the country debt profile with the population kept in abject hunger and under development. In view of this, there is a need to provide adequate information that is vital to the realization of government vision (20:20:20) for economic stability. In this paper the current problem facing grain production, milling, storage and utilization in the country as well as the efforts by the government to sustain local production where summarized. In

addition, issues confronting growth and expansion of grain processing, storage and distribution where explained alongside with policies and frameworks needed for the actualization of food (grain) efficiency and conservation.

## 2 The ecological grain distribution zones

The ecology and climate of Nigeria from south to north shows that different kinds of grains can thrive in the country (Badmus and Ariyo, 2011). Figure 2 shows the country's ecological zones with rainfall heaviest in the southern states, peaking in June-July and the forests and savannas benefits from the abundant rainfall and relatively short dry seasons here (U.S. Library of Congress, 2014). The major grain grown here are rice and maize. The far northern part, with a longer period of dry season and low rain falls, lies mostly in the Sudan Savanna and the arid Sahel zone. This region produces grains massively, which include millet, cowpeas, and sorghum (guinea corn). Maize is also cultivated, as well as rice in suitable lowland areas. The wheat area covers mainly the Sudan/Sahelian zones of Borno, Yobe, Bauchi, Jigawa, Kano, Zamfara, Katsina, Sokoto, Kebbi and Adamawa states, where commercial wheat production is possible through the use of expensive irrigation (Lyddon, 2011). Between the arid North and the humid South is the Guinea Savanna region (referred to as the middle belt). This area produces grains such as, sorghum, millet, cowpeas, and maize, with rice as an important crop in some places. The middle belt's southern edge represents the lower limits of the northern grain-dominated economy. Maize production in the Savanna middle belt benefits from heavier rainfall, which frequently permits two crops a year. According to the International Grains Council (World-grain.com news update, 2013), the country's total grain production in 2010-2011 was down by 700000 t from 28 Mt in 2009-2010.

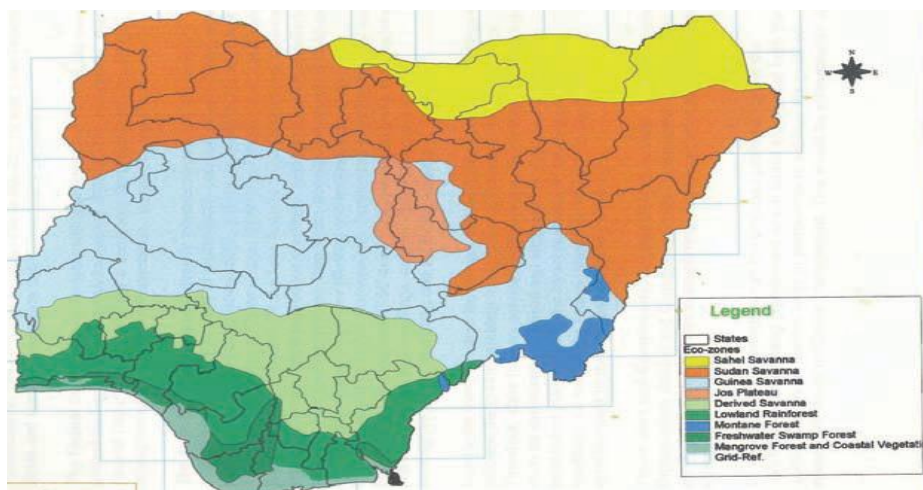


Figure 2 Nigerian ecological zones (FAO Country report, 2008)

### 3 Grain production and consumption (1970 -2013)

It has been noted that grains constitute 80% to 90% of the per calorie intake of most Nigerian's (Fafchamps et al., 2003). In fact as at 1977-1983, sorghum and millet combined accounted for 80% of the country's total grain production and intake before the emergence of maize in 1984 (Simons, 1976; Reference book, 2006). During this period, sorghum alone contributed about 50% of the country's calorie intake and 73% in the Savannah region (Simons, 1976). However, the demand for rice, much of it imported, increased dramatically during the bumper period of late 1970s because of increased revenue from crude oil that enhanced the spending profile of most Nigerians. Despite this, local production did not improve until 1988 when the local production jumped from 808,000 t in 1987 to 2.081 Mt in 1988 (Reference book, 2006). The total production of grains increased from 3106-7394.7 t for millet, 4053-10593.5 t for sorghum, 1443-10369.6 t for maize, 19-59.1 t for wheat and 884-4462.2 t for beans from the 1970 figure in 2005/6 (Reference book, 2006). The rise in grain productions is due to the extension of cultivated area than to any significant improvement in yields. This is because yields either stagnated or progressed at a very slow pace, putting the average yield per hectare at

1.0-1.5 t over the 2000-2006 period. However, between 2011 and 2012, the growth rate of 0.1% was recorded for sorghum, -0.4% for millet, 0.4 % for maize, 0.0% for rice, -3.4 % for wheat and -0.2 % for beans as is shown in Figure 3 (U.S. Library of Congress, 2014) and this is as a result of decrease in cultivated area because of insecurity caused by insurgency, adverse weather condition and consumer preference for imported grain.

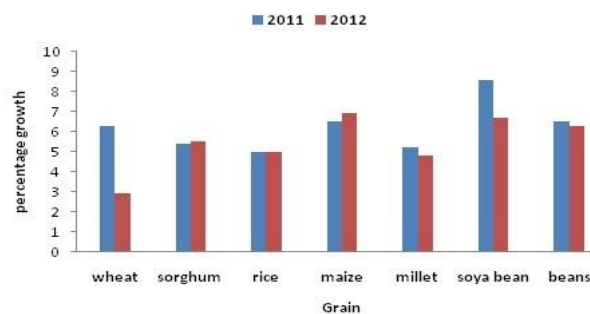


Figure 3 Growth in Production of grains (per cent) 2011 -2012: ( U.S. Library of Congress, 2014)

Recently, wheat consumption has continued to dominate the spending profile of Nigerians among various food grains. Changing consumer taste is also, driving this expansion of demand for wheat. The demand for wheat is projected at 4.2 Mt in 2013/14, up from 4.1 Mt in 2012/13 (Fafchamps et al., 2003). However, the nation is facing a herculean task in meeting its wheat demand through local production.

Nigeria's wheat production (85,000 t) fell further by 10.5% in 2012/13 from 2011/12 production figure and this represents a fall of 564.7% from the peak production of 565,000 t in 1988 (Reference book, 2006). This figure is less than 0.023% of local consumption in 2013.

Maize (corn) production has increased from 2.4 Mt in 1961 to 7.7 Mt in 2012 as is shown in Table 1. In 2007, the paddy rice production of six states of Niger, Kaduna, Benue, Taraba, Ebonyi, and Kwara constituted more

than 60% of total domestic rice output (USAID, 2009). The percentage contribution of various states to the national rice output in 2004 is shown in Table 2. In 2008, Nigeria produced approximately 3.3 Mt of milled rice and imported roughly 1.6 Mt, including the estimated 800,000 t that is smuggled into the country on an annual basis (Nigeria Federal Ministry of Agriculture and Water Resources, 2008).

**Table 1 Production, supply and demand data statistics of maize in Nigeria (USDA Foreign agricultural services, 2011)**

Maize Nigeria	2011/2012		2012/2013		2013/2014	
	Market year begin Oct. 2011		Market year begin Oct. 2012		Market year begin Oct. 2013	
	USDA official;	New post	USDA official;	New post	USDA official;	New post
Area harvested	5510	5150	4160	4160	4250	4250
Beginning stocks	266	266	266	266	146	146
Production	9250	9250	7630	7630	7700	7700
MY imports	100	100	100	100	100	100
TY imports	100	100	100	100	100	100
TY imp. from USA	26	20	0	0	0	0
Total Supply	9616	9616	7996	7996	7946	7946
MY export	100	100	50	50	100	100
TY export	100	100	50	50	100	100
Feed and residual	1700	1700	1700	1700	1800	1800
FSI Consumption	7550	7550	6100	6100	5900	5900
Total Consumption	9250	9250	7800	7800	7700	7700
Ending stocks	266	266	146	146	146	146
Total distribution	9616	9616	7996	7996	7946	7946

1000HA, 1000MT, MT/HA

**Table 2 Nigerian rice production by states (Ezedimma, 2005)**

Production system	Major states covered	Estimated share of national rice area, %	Average yield, t/ha	Share of rice production, %
Rainfed upland	Ogun, Ondo, Abia, Osun, E Kiti, Delta, Niger, Kwara Kogi, Sokoto, Kebbi, Kaduna, FCT And Benue	30	1.9	28
Rainfed lowland	Adamawa, Ondo, Ebonyi, Ekiti, Delta, Edo, Rivers, Bayelsa, Cross River, Akwa Ibom, Lagos, All Major Valleys E.G Shallow Swamps, Of Niger Basin, Kaduna Basin, And Inland Of Abakiliki And Ogoja	52	2.2	43
Irrigated	Adamawa, Ebonyi, Cross River, Akwa Ibom, Lagos, Niger, Kaduna, Sokoto, Kogi, Benue, Kebbi, Kano, Enugu, Kwara, Borno, Ogun State	16	3.7	28
Mangrove swamp	Ondo, Delta, Edo, Rivers, Bayelsa, Cross River, Akwa Ibom, Lagos	1	2.0	<1

The volume of rice produced increased by 96.3% between 1970 and 2013, reaching 7.5 Mt in 2012 (Inter-reseaux (Development rural) bulletin, 2014). Almost all the grains produced in the country are consumed as is shown in Figure 4 and Figure 5, while

the remaining is smuggled across the border to Niger, Cameroun, Chad and Benin Republic. Figure 4a showed that rice consumption is far more than the locally milled equivalent. This explains the high importation of rice into the country to cushion the deficit.

Generally, grain consumption in West Africa has increased since 1980 as is shown in Figure 4b. Though Nigeria still remains the largest producer of food grain in sub-Saharan Africa, her production and processing capacity is below the total consumption in the country. The mean output levels for rice, sorghum, millet and maize, within the last 10 years, stood at 3,758,000, 9,928,000, 7,360,000 and 9,342,000 t, respectively (Kassim, 2011). The shortfall in grain supply is filled

with cheap import, mainly from Thailand, India and Vietnam. Despite this, domestic production of grains generally has continued to grow (Figures 4, Figure 5 and Figure 6). The nation is now faced with the challenge of stifling sales of locally produced grains especially rice by the imported ones. Since the lifting of importation of rice by the federal government in 1996/97, Nigeria has turned to a dumping ground for rice in Africa.

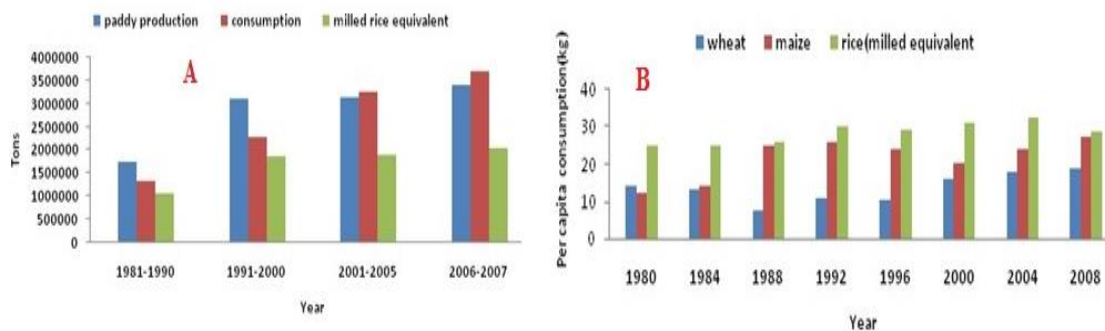


Figure 4 Comparison of (A) consumption and domestic production of rice production (B) Per Capita Consumption of Wheat, Maize, and Rice in West Africa sub region (Walkenhorst, 2007; FAO2009 a and b)

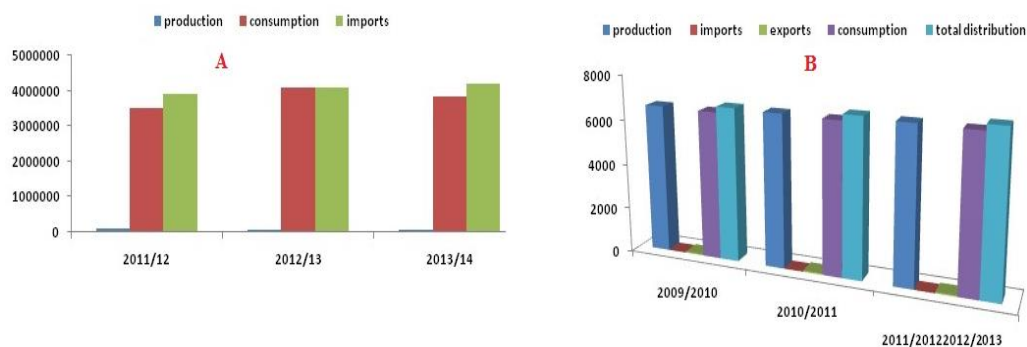


Figure 5 Nigeria production, consumption, imports and exports, marketing years 2011/12–2013/14 (t) (A) Wheat (B) Sorghum (USDA, 2013)

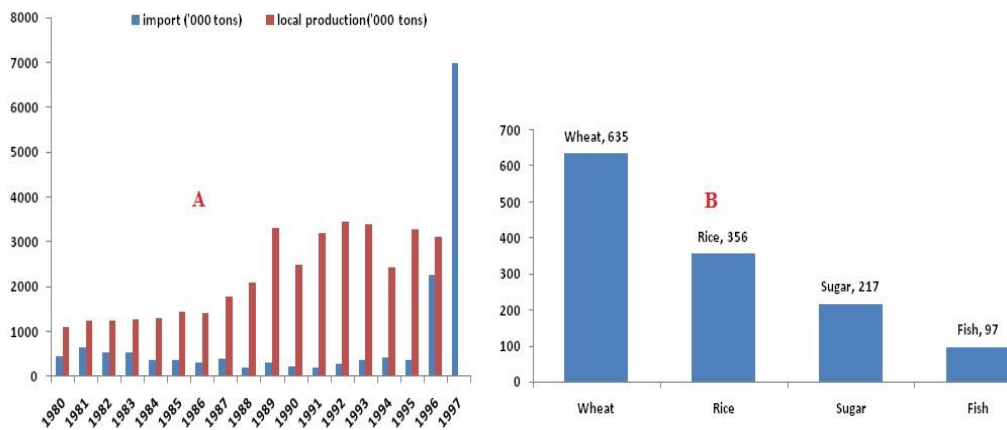


Figure 6 Nigeria's (A) Rice imports and local production in 1980-1997 (B) top 4 food imports 2012 (Imolehin and Wada, 2000; Central bank of Nigeria report, 2013)

### 3.1 Grain milling capacity

Small mills dominate the processing of domestic grains in the country. In the heavy grain production zones (such as Bida in Niger State, Abakiliki in Ebonyi State and Laffia in Nasarawa State), there are clusters of small mills that attract both traders and buyers and ultimately serve as milling, parboiling and marketing hubs (USAID, 2009). There are also classes of medium-sized mills that are typically integrated with relatively large-scale paddy rice production operations in

these areas. Under the former Nigerian Grains Board (NGRB), there were three Rice Mills in the country located at Badeggi in Niger state, Sokoto and Makurdi respectively. Out of the three Mills, Badeggi Rice Processing Company Limited appeared to be the biggest in terms of supportive facilities and it is the only surviving gigantic modern rice mill in the country today among the three with an installed capacity of processing 120 t (Table 3) of paddy rice per day on three shifts of 8 h per shift per day (Badeggi Rice Mill, 2013).

**Table 3 Installed milling and storage capacity of some major grain milling companies in Nigeria (Badeggi Rice Mill, 2013; Oyedepo, 2012)**

Company	Products	Installed capacity (Mt/d)	Location	Storage Capacity (Mt)
Badeggi Rice Mill	Rice	120	Niger State	-
Dangote Flour Mill	Wheat	Over 4800	Lagos, Kano, Calabar Ilorin	200,000 Within the Compound
Honeywell	Wheat	2610	Lagos	42500
BUA	Wheat	1000	Lagos, Kano, Ilorin And Calabar	60,000 Within the Compound
Grand Cereals	Maize, Sorghum, Soy Beans and Ground Nut	158	Jos	16000
Flour Mills And Subsidiaries	wheat	Over 8000	Lagos, Maiduguri , Oyo, Portharcourt, Calabar, Niger , Kano	Over 200,000 Within And Outside the Compound
Sunseed	Wheat	160	Kaduna And Adamawa	4000 Within the Compound
OLAM/Crown Flour Mill	Wheat	2380	Lagos And Warri	Over 18000
Ideal Flour Mill	Wheat	3080 As At 2008	-	-

However a number of major rice importers in the country have invested in milling industry. Examples of these private sector initiatives are: Veetee Rice in Ogun State; Olam in Lagos, Benue, Nasarawa and Kwara States; and Stallion in Lagos. As part of a backward integration program, some of the companies have developed nucleus estates that would use local farmers as out growers to supply rice to the mills. Maize in Nigeria is banned for export and very few quantities are imported through informal cross border smuggling, usually from Benin Republic. Most of the maize produced is utilized in brewing and poultry feeds. These companies have their own mill and it is difficult to ascertain their milling capacity since they mill for personal use in further production. However, various

small-scale milling points are scattered all over the country. Records of the involvement of large milling companies in the milling of maize in Nigeria are very scanty. They are mostly involved in wheat milling and currently there are about 21 wheat milling companies in the country (Nigeria's Flour Milling Industry, 2008) with total installed capacity of 22,000 t/d in 2008. Flour Mills of Nigeria controls about 38% of the market share. Other top producers by installed capacity include Dangote Flour Mills (18%), Honeywell, Ideal Group and Crown Flour with 7%, 14% and 8% respectively. Nigeria's wheat installed milling capacity increased in 2012-2013 to about 8 Mt (wheat equivalent), up from 6.6 Mt the prior year. However, local capacity utilization of installed milling capacity is put at about 50%

(Agritrade news analysis, 2014). Large mill distribution and storage facilities are unevenly distributed as is shown in Table 3, resulting in long distance hauling of grains by transporters to be milled or milled products to the various distribution and sales centers through the various dilapidated roads. This is very costly and discourages farmers as the cost involved does not add up to the profit envisaged. Therefore because of the constraints encountered in getting the grains to the nearest mills most of them are wasted and sometimes fed to animals. Although small milling centers are common in most rice producing communities but they face problem of energy supply for operation. These problems of processing for sale and the attendant wastage and seasonal shortage led various governments in Africa to establish strategic grain reserves.

### **3.2 Challenges to grain production, expansion and sustainability**

#### **3.2.1 Insurgency and herdsmen**

Nigerian grain hub is located mostly in the area affected by problem of insurgents. Nigerian goal of achieving sustainability in grain production for now is challenged by the activities of the Boko Haram Islamic sect in the North Eastern region, with ecology for wheat production. The farmers are under the threat of insecurity posed by this sect. Also the farmers and the herdsmen are constantly in conflict over grazing parts which most often lead to fatal exchanges. The herdsmen and their cattle destroy large grain farms and with most of this farms uninsured, everything will be lost.

#### **3.2.2 Quality of locally processed grain**

Most Nigerians prefer the polished rice imported into the country than the local rice. This is because of low processing quality of locally produced rice as they contain so much of stones and impurities. The country is faced with the problem of destoning machines in most rice producing areas. According to (CIA World Fact book, Nigeria, 2012), one can find well over 50 mills, but no destoner in some part of the country. This is a source of worry as so much money is spent in rice importation to satisfy the local choice. Relying on the import of staple food like grain on the global markets fuels domestic inflation and puts pressure on the local currency. Grain seats at the top of Nigerian food imports that worth about 11 billion dollars if fish is added (Figure 6b). According to a report by the Federal Ministry of Agriculture in 2014, Nigerian food import is growing at a rate of 11% per annum. This situation is unhealthy for an economy that is characterized by a high level of unemployment and low technological capacity.

#### **3.2.3 Issue of post harvest grain Losses**

Food and Agriculture Organization (FAO) estimates that 32% of all food produced in the world was lost or wasted in 2009 with cereals/grain contributing about 26% of the global share (Figure 7a) (FAO, 2011). About 4.5 Mt of this losses occurred in sub-Saharan Africa (Figure 7b) and with Nigeria producing and consuming more than 50% of the food in sub-Saharan Africa, this translates to nearly 2.25 Mt of food lost in 2009, with grains accounting for about 26% of it (Inter-reseaux (Development rural) bulletin, 2014; Lipinsk et al., 2013).



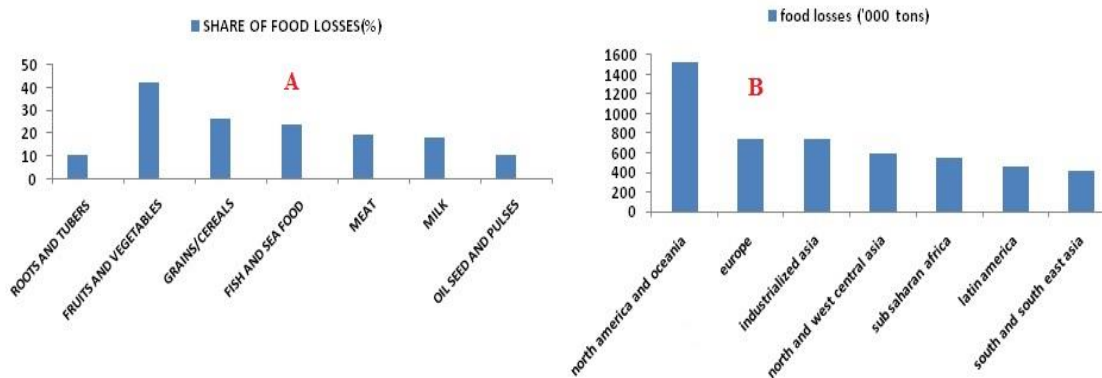


Figure 7 Share of food losses or wasted in 2009 A- by percentage kcal B- by region (Lipinsk et al., 2013)

Food loss and waste have significant negative economic and environmental impacts. Economically, they represent a wasted investment that can reduce farmers' incomes and increase consumers' expenses. Environmentally, food loss and waste inflict a host of impacts, including unnecessary greenhouse gas emissions and inefficiently used water and land, which in turn can lead to diminished natural ecosystems and the services they provide (Lipinsk et al., 2013). A major problem with grain production in the country is lack of adequate storage facilities. Experience has shown that food production is not synonymous with food availability if not matched with good storage system. On average, 30% of grain output in the country is lost due to spoilage, contamination, attacks by insects and rodents, and physiological deterioration in storage

(postharvest losses). This high loss translates to loss of revenue for the farmers (Lyddon, 2011). Government large-scale grain procurement and storage is vulnerable to waste, fraud, and abuse (The partnership for child development (PCD), 2013). The resultant effect is that during the period of glut most produced grain are either not processed or fed to animals or allowed to rot away, allowing imported grains to fill this gap in future. Therefore, what should be most worrisome to the government is stopping or reducing significantly postharvest grain losses in the country. This becomes imperative because a robust sustainable domestic food grain production will improve the standard of living, reduce poverty and boost the economy by contributing immensely to the sectors growth of the GDP (Figure 8).

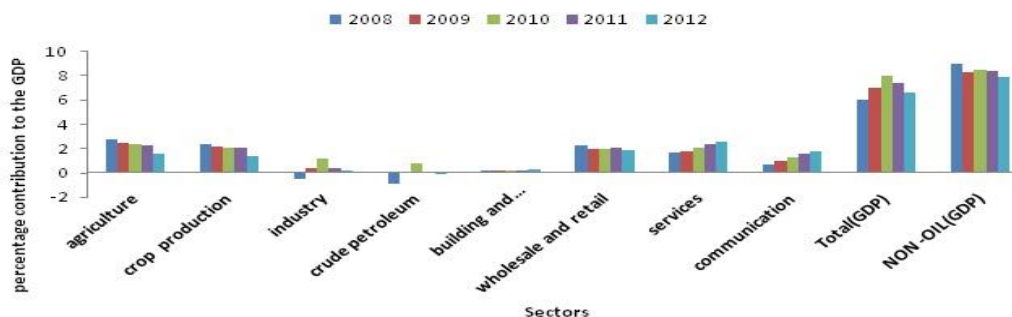


Figure 8 Sector's Contribution to Growth Rates of GDP at 1990 Constant Basic Prices (percentage points) (U.S. Library of Congress, 2014)

### 3.2.4 Inadequate, poor distribution and poor management of grain storage facilities (Nigerian Grain Reserves)

Storage is an essential phase between harvesting, processing and consumption (Asoegwu and Asoegwu, 2007). Traditional grain storage with cribs, rhombus,

gourds, sacks, by hanging on roof tops, trees and fire places and barns have not provided adequate protection from rain, insects and rodents, resulting in 20%-65% loss annually. Nigeria established strategic grain reserve in

1989 with initial stock level of 60,000 t (IFPRI, 2008) (Figure 9) but as at 2014, due to poor management, the level of targeted stock is hardly met.

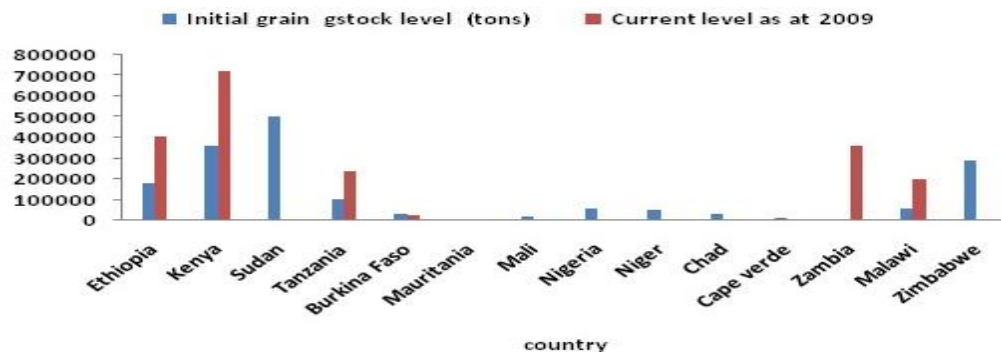


Figure 9 Statuses of African strategic grain reserves as at 2009 (Badeggi Rice Mill, 2013)

The Nigerian strategic grain reserve is part of the national food storage program launched in 1987 (Federal ministry of Agriculture and Rural Development (FMARD), 2014). The core objective is to stabilize prices during scarcity and period of glut. Despite concerns regarding their use and management, grain reserves are being recommended by some experts to checkmate high food prices, with a potential to smoothen price volatility as well as reduce the impacts of other food security shocks (FAO). If properly located and distributed will absorb the excesses and serves as a storage facility during the period of glut in production and the market. Recent calls have been made by governments and development partners for renewed attention to strategic grain reserves in light of draughts in Eastern and Sothern Africa. Grain stocks need careful and steady attention with good management skill and require good storage facilities. The stock should be equipped with good rotating mechanism and operated frequently for quality and health reasons. In practice, this is rarely done because most grain stores in Nigeria suffer from poor design, low capital allocation, lack of electricity to power the agitators and dearth of professionalism in terms of management skills. Currently, commodities in the national strategic grain reserves are corn (8,735 t), sorghum (7,227 t), millet

(2,299 t), soyabean (9,800 t) and paddy rice (6,000 t) (USDA, 2014).

According to Borokini (Lipinski et al., 2013), the existing Strategic Grains Reserve Complex in Nigeria has a storage capacity of 325,000 t in 2009. However in 2011, the national food reserve agency was expected to have completed the construction of steel silo storage with capacity for over 1 Mt of grain, primarily maize, sorghum and millet, at 10 sites in key production areas but the facts on ground does not suggest this. The latest commissioned 25,000 t grain storage reserves in Dusinguwa, Katsina State is an addition to the countries, dilapidating grain reserve complexes littered all over the country, as is shown in Nigeria grain reserve map (Figure 10). The various grain reserves established in the country (Figure 10) have not been functioning efficiently due to poor management, fraud and initial design problems. The FAO queried the decision to use steel instead of concrete bins in the construction of silos in many parts of the country. This is because of their greater susceptibility to moisture migration and thus their unsuitability for long-term storage of grain in the humid climate of Nigeria. Moisture migration and condensation in grain stock result in spoilage and is the shortcoming of metallic silo cells. When metallic silos were used, an estimated 25% to 30% post-harvest loss was recorded for maize, 37% for sorghum and 30% to 50%

for cowpeas (Anonymous, 2014). Modern silos and warehouses of concrete, wood, mud and composite and

sizes to handle between 5-2500 metric tons of grains are therefore required in several parts of Nigeria.

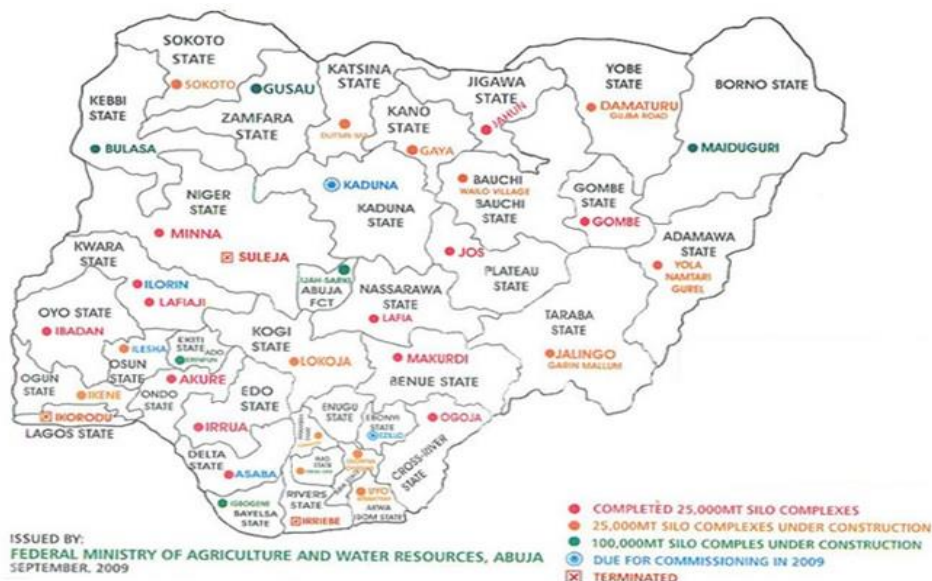


Figure 10 Grain reserve location map of Nigeria (Borokini, 2013)

### 3.2.5 Low energy utilization in agriculture

The energy utilization in grain processing can be viewed collectively with the entire agricultural sector. Virtually all energy resources are available for grain processing and storage. However solar energy still remains the dominant energy used in rural areas mainly for initial grain drying. Energy utilization in the country is measured in terms of energy intensity. Abam et al (2014) stated that whereas the cost and demand for energy in all sectors of the economy is growing rapidly at 7% per annum that of agriculture is shrinking with dire consequences for agricultural production and processing (Figure 11a). The energy intensity of the agricultural sector decreased by 79.6% from 0.003 toe per US\$ 1,000 in 1990 to 0.001 toe per US\$ 1,000 in 1998 and its contribution to the total energy intensity between 1990-2011 is a paltry 1.2% (Abam, 2014). It is correct to assume that the majority of energy consumed in agriculture in Nigeria is mainly on grain processing involving large and medium scale enterprises in the milling of grains and little from households, which uses mostly solar in the initial drying of grains. The energy intensity of the agricultural sector with grain

processing dominating, can be used to measure the sector performance and technological capacity utilization, because agricultural mechanization involves the use of all level of machines in agricultural cultivation, irrigation, harvesting, processing and storage. Energy is also consumed in transportation of grains from the rural communities to the urban centers where they are processed and mostly sold. The total contribution of agriculture to the total energy intensity within these years was 1.2%, indicating an abysmal energy use (Abam et al., 2014). This shows the state and level of capacity utilization of agricultural machines littered all over the country including grain processing machines. The intensity of energy use in the agricultural sector was very low Vis-à-Vis grain processing between 1998 and 2011. To worsen the situation, electricity and fuel supply in recent years has been epileptic and costly. Private generation of power through available non-renewable energy resources and its utilization in grain processing is not cost sustainable in rural areas. Nigeria energy consumption relies heavily on unsustainable non renewable energy, mainly crude oil and natural gas (Figure 11b). Renewable energy

resources are mostly, inefficient hydropower from various aging dams. The rural communities where much of the initial grain processing is done, energy supply in terms of fuel or electricity is inadequate or nonexistent. This stems from the fact that most of the states in the country are not linked to the national

electricity power grid. Some derive their power from small power stations located at Afam, Egbin, Sapele and Ugheli. Mechanized grain processing, milling and storage in particular require a lot of energy (renewable and non-renewable).

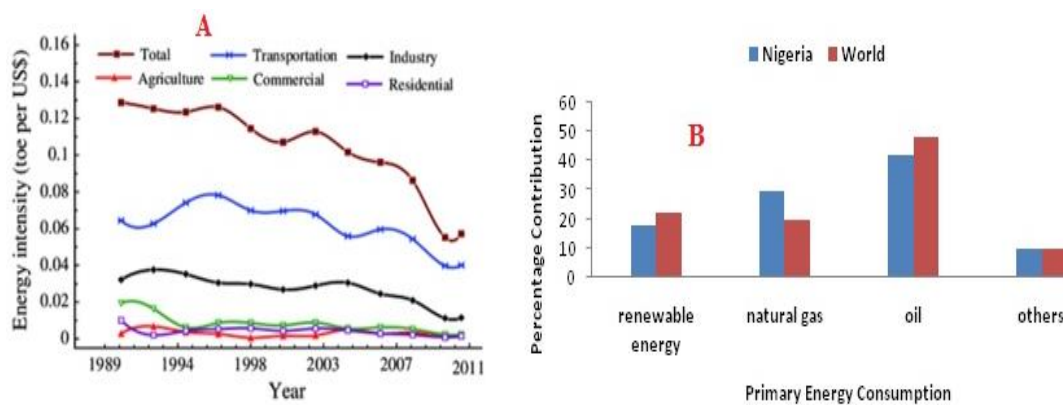


Figure 11 Energy intensity by sectors (A) and consumption (B) in Nigeria and the world (1990–2011) (Nigeria–Economy, 2005; CIA World Fact book, Nigeria, 2012)

### 3.2.6 Unfavourable energy distribution pattern to grain producing area

Government emphasis has been on the supply of energy to the urban centers and industrial areas while neglecting the agro-producing rural communities thus; causing an energy inequality within the country's energy demand profile. This limits the grain processing, milling and storage capacity of these communities in view of the high cost of sourcing alternative private energy generation, leading to the loss of a large quantity of unprocessed grains. The current urban-centered energy strategy is inadequate, as instances of rural and sub-rural energy demand and distribution do not get to the center phase of the country's energy expansion plans (Oyedepo, 2012). A situation where energy carrier to agricultural communities is mostly single phased is not suitable for agro-processing and related industries, which are usually equipped by three-phase powered machines. This current situation should be reviewed. For sustainable food grain supply, sufficient and dependable energy supply system for all types of energy carriers to the rural communities will be necessary. The energy distribution pattern of the government, need to change to

give more consideration to the rural communities. This will ensure adequate availability of energy in the rural areas for grain processing, milling and storage. Hence, for sustainable development, the energy demand and supply chain must be repositioned to attain a reasonable equilibrium (Abam et al., 2014). Nigeria has enough energy resources to meet with the challenges of energy demand. The current dependence of agro rural communities solely on wood and traditional biomass for their energy need should be replaced with a robust and cheap energy supply system to enhance productivity. According to Chel and Kaushik (Chel and Kaushik, 2011) sustainable agricultural system is based on the prudent use of renewable and/or recyclable resources. A system which depends on exhaustible resources such as fossil fuels cannot be sustained. Potentials of alternative energy sources (renewable energy) in the sector are largely unexplored due to inadequate research, knowledge and technology to harness them.

### 3.2.7 Poor policy, policy summersault and poor policy implementation

Nigeria's efforts at exploiting its grain growing potential are challenged by inconsistent agricultural

policies, poor marketing channels, and weak farming organizations and motivation. In 1987, the government initiated the Accelerated Wheat Production Program in order to encourage local wheat production. This programme led to a decline in wheat importation that year and government was encouraged to outrightly ban wheat imports into the country. Wheat production figures from that year increased from 139,000 t in 1992 (Reference book, 2006), whereas the estimated total national demand stood at about 3.7 Mt per year, as the report stated. The government lifted the import ban on wheat in 1993. Nigeria's wheat production figures then declined to 33,000 t, that year given that local production was no longer viable because of cheap wheat from USA flooding the local market. Also the Nigerian government in September 2008 lifted the import ban on maize and imports are allowed at 5% tariff with the thinking that the country has attained self sustainability in maize production. The government believes that importing maize into the country is not profitable, therefore local consumers, brewers and poultry farms have relied on domestic supply for their needs. This is against the import substitution policy the previous governments have adopted. At the same time, government lifted import ban on sorghum also in 2008 and a tariff of 5% was imposed too. In 2008, Nigeria released its National Program for Food Security (NPFS), laying out dozens of constraints to food security and adopting a "value chain approach" to address these constraints. The vision of the NPFS is "to ensure sustainable access, availability, and affordability of quality food to all Nigerians and to be a significant net provider of food to the global community. The NPFS lists rice as the second most important food security crop. It is important both for consumption and as a source of revenue for small farmers in rural areas. In order to achieve the above set goal, the government introduced the National Rice Development Strategy (NRDS). The NRDS recognizes the importance of the value chain approach, but is government-driven and does not reflect

coherent incentives to upgrade private-sector participation to respond to the challenge (USAID, 2009). This policy failed to achieve the set objective because emphasis was on production without facility for storage. By 2010, rice importation continued to increase, prompting the government to introduce new tariffs (effective July 1, 2012) which brought a 30% levy on imported brown rice and a 100% levy on imported polished/milled rice (effective December 31, 2012), with intention to ban rice imports within two years. The new tariffs resulted in increased stockpiling by importers and increased cross-border trade in rice (with Benin and Cameroon) during the second half of 2012.

#### 4 Current government intervention policy

**Wheat:** According to world grain bulletin published in 2011, the first major Government of Nigeria intervention on food grain production was on wheat production in 1959 and was necessitated by the development of irrigation schemes for Northern Nigeria and increase local demand of flour (Lyddon, 2011). The report indicated that the same year, there were increased research in promoting local wheat production resulting in the introduction of some improved (and high) and early-yielding local wheat varieties for better bread making. The Lake Chad Research Institute of Nigeria collaborated with the International Maize and Wheat Improvement Center (CIMMYT) to do so (World-grain.com news update, 2013). However, the government targeted to plant 212,000 ha of wheat by 2014, with expected production of over 1 Mt and a projection to expand the cultivated area to 215,000 ha by 2015 with an anticipated output of 1.2 Mt. This goal, though still a mirage but if met, would allow the country to meet about 68% of its wheat needs by 2015. However, the country is seeking for alternative route to reduce wheat import and consumption through a policy compelling cassava flour inclusion in wheat flour as from 2012. Inclusion starts with a 10% cassava flour inclusion rate which is expected to increase steadily to

40% by 2015. As a part of the plan, the government has imposed import tax (levy) of 15% on wheat grain (which has increased the effective duty from 5% to 20%). A 65% levy was also imposed on wheat flour imports bringing the effective duty to 100% since mid-2012, as a part of this new policy. The government also introduced fiscal incentives to local industry to stimulate increased domestic production and processing of cassava.

**Rice:** According to the Central Bank of Nigeria annual report of 2012, as part of the rice transformation plan, the government is to establish three new rice processing mills in Ebonyi, Niger and Kebbi States, with a combined annual capacity of 90,000 t of milled rice. Also, the Federal government secured a low interest financing facility to support private sector operators for the establishment of 100 large-scale integrated mills for improved rice production (estimated at over US\$ 800 million). The rice processing mills would have a combined capacity of 2 Mt per year. As an incentive to these companies, the government has granted a concessionary duty of 5% on brown and paddy rice that will initially allow them to import these supplies until such a time that they can source sufficient domestic supplies to operate their mills at full capacity. In order to encourage the companies, the government is procuring 385.5 t of milled rice to be distributed to out-growers at no cost under the transformation action plan from twelve large mills located in Bauchi, Benue, Cross River, Ebonyi, Enugu, Jigawa, Kano, Nasarawa and Zamfara states (Central Bank of Nigeria Annual Report, 2012).

## 5 Government grain transformation action plan

One of the major strategies to meet food grain demand is through the adoption of a government-enabled, private sector-driven approach. The Federal Ministry of Agriculture and Rural Development have drawn a contingency plan to improve grain production. Part of the plan is for government to (1) treat food grain

production as a business by Integrating food grain production, storage and processing by through value chains approach where the country has comparative advantage and adopting import-substitution measures to drive sector growth; (2) investment-driven strategic partnerships with the private sector; (3) investment drives to unlock potential of the states in grain production (joint initiatives with state governments); (4) to make Nigeria self sufficient in grain production and ensure availability of adequate numbers of integrated mills and seed companies; (5) new incentives for private sector (0% duty on all agricultural machinery and equipment) (Nigeria's Agricultural Transformation Agenda (ATA), 2014). This strategy has resulted in the growth of seed companies in the country from 11 to 70 in 2012. The need for affordable agricultural financing is being tackled while the new CBN financing framework for agriculture, will unlock \$3.5 billion of loans from banks at attractive interest rates to farmers. The government has also developed other agricultural policies and programs as a component of the vision (20:2020). They include Federal Government Agricultural Transformation Action Plan (ATAP) supported by the World Bank (\$2.2 billion) and International Fund for Agricultural Development (IFAD, \$80million) under the Growth Enhancement Support Scheme (GESS), designed to give farmers timely access to agricultural input (Central Bank of Nigeria Annual Report, 2012). A breakdown of the figure indicated that US\$ 150 million was earmarked for the Commercial Agricultural Development Project (CADP); US\$150.0 million for the Fadama Development Project; US\$500.0 million to finance the agricultural value chain, while the balance of US\$400 million was for financing irrigation infrastructure. Other supporting are Bill and Melinda Gates Foundation (US\$5 million), United State Agency for International Development(USAID, \$ 100 million), UNDP (\$ 1.5million), DFID (£37 million) and OPIC (US\$250million). A large part of this fund will go into

procurement opportunities for farm inputs and provision of storage facility (U.S. Library of Congress, 2014).

## 6 Conclusion

Nigeria is the largest and most populated country in Africa; a fast-developing nation but is lagging behind among food grain producing countries in the world especially wheat and rice. Total food grain consumption (wheat, maize, sorghum and rice) decreased from 24.95 Mt in 2011 to 23.74 Mt in 2013 (Imolehin and Wada, 2000). While the local consumption of wheat, and rice increased marginally by 191,000 and 500,000 t respectively in 2011-2013, that of maize and sorghum decreased by 1.5 Mt and 350,000 t respectively at the same period. About 76% of the total food grain consumption (wheat, maize, sorghum and rice) is produced locally in 2011 while 73% was produced locally in 2013. This high percentage is deceptive because maize and sorghum are massively produced locally and almost have equilibrated with the local demand. Only 0.023% of wheat and 53.3% of rice were locally produced in 2011/2012, while 0.022% and 52.5% respectively of these were produced in 2013. This short fall in food grain production is met through food grain importation from USA and Asia. Nigeria would have attained sustainability and even exported food grain especially rice, beans, maize and sorghum if the basic processing, milling and storage needs of the rural farmers have been met. The country is still lacking in terms of providing sufficient energy to run her grain sub agricultural sector despite the high demand for food grain. Most of the challenges facing the country in sustainable supply of food grains for local consumption were found to exist not only in low production capacity in the case of wheat but generally from low milling and storage capacity, which experts has said to be less than 50% of total local production capacity. Further challenges were found to also exist from poor energy production and distribution pattern which alienates the grain hubs of the country causing

them to seek for costly alternative energy source for drying, milling and storage of grains. Nigeria is endowed with vast deposit of renewable and non renewable energy resource. Dependence on foreign grain resources to fill the local production gap, poor utilization of the available grain reserve to checkmate wastage during glut, low private sector participation in bulk grain milling and inconsistent government policies are serious challenges. In a bid to address these problems government has put in place an ambitious strategy for sustainable growth in food grain supply. One of the strategies is to treat grain production; processing and milling as business by incorporating private sector participation by value chain where the country has comparative advantage. This policy is expected to be implemented in a sustainable way to achieve the required equilibrium in demand and supply of food grain in the country. This will reduce food losses and there by boost the country's production capacity.

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