

Storage as A Limiting Factor in Nigeria's Attainment of Food Security

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Abstract

The issue of serious food and nutrition problem is now commonly associated with less developed countries. Food is understood as involving interconnected domains with questions of agriculture, socio-political, market and distribution, employment, ecological, roles of women and just to mention a few. It is surprising that most of the problems which international institutions like the World Bank, Food and Agriculture Organization, Economic Commission for Africa, Organization for Economic Cooperation and Development, International Fund for Agricultural Development and governments of developed countries have to deal with supporting the developing countries in the last two decades have revolved around the inability of agricultural sector to provide adequate food and nutrition for their populations. Nigeria government has only been paying lip service to the issue of food security as it is evident in weak policy making in the area of agriculture. For Nigeria to achieve food security, different challenges like political, social, ecological/climate change, institutional weakness, the role of women in food production among others must be taken seriously. It is recommended that all the stakeholders in agriculture: policy makers, scientists, extension workers and farmers be brought together to discuss the challenges confronting food production/security and forage the way forward. Government should consider implementing the views of the stakeholders one after another and continuity of projects and programmes initiated by donor agencies.

Keywords: Security, Agricultural, Availability, Utilization, Values, Poverty, Postharvest.

1. Introduction

The Nigeria government have tried many ways, initiated lots of policy and programmes which is aimed at restoring the country's agricultural sector to its pride [1]. The Nigeria agricultural sector used to be one of the pillars of the country's economy and this was achieved in a sustainable way. The different ways, policies and programmes put in place to promote investment and diversification in the agricultural sector have not been able to yield good or desired results. The huge potential of investment and export diversification in order to get the Nigeria agricultural sector to add to the economy as it does in the before (1960s) have remain locked and untapped, because of a number of constrained and factor that must be addressed [2]. Food security is defined as a condition where all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life [3]. For food security is the ability of the countries, regions or households to meet target levels of food consumption on a yearly basis[4]. In a similarly

vein, the Committee on World Food Security posited that food security connotes physical and economic access to adequate food for all household members, without undue risk of losing the access. The Food and Agricultural Organization also defined food security as a state of affairs where all people at all times have access to safe and nutritious food to maintain a healthy and productive life [5]. This implies: availability, accessibility, and proper utilization. Food security means ensuring that sufficient food is available; maintaining sufficient supplies through domestic production at relatively stable levels; allowing access to food for those in need of it; and ensuring biological utilization of food. This implies adequate storage against spoilage, disease and ensures nutrient balance. In addition, the World Bank (2007) looked at food security as access by all people at all times to enough food for an active, healthy life. Food security is thus people oriented and it implies a situation in which all households have both physical and economic access to adequate food for all members and households are not at risk of losing such. Articulates food security system definition as the

availability and accessibility of foodstuff in desired quality to all consumers throughout the year [6,7]. While acknowledging that the food security concept took its roots around the mid-1970s in the discussions of International food problems at a time of global food crisis he adopted the definition of the World Food Summit in 1974 to say, food security is the availability at all times of adequate world food supplies of basic food stuff to sustain a steady expansion of food consumption and to offset fluctuation in production and prices. Carter opined that food security may be defined as the ability of food-deficit regions or countries, or households within these countries, to meet target levels of consumption on a yearly basis [8]. They noted that what constitute target consumption is being referred to as two central issues of a country's food policy. For Adisa, food security can be defined simply as access by all people at all times to enough food for an active and healthy life [9]. Accordingly, Eboh described it thus: food security simply refers to the ability of individuals and households (especially the rural and urban poor) to meet staple food needs all year round"[10]. Continuing, Eboh further states that the above description is essentially intragenerational food security as opposed to inter-generations to meet their food needs, on season and off season.

2. Concept of Food Security

Almost 240 million people, or better put, one out of every four persons in the sub-Saharan Africa, lack access to adequate food. Hike in prices of food items and drought are forcing the population into hunger and starvation. The population of the world has now crossed the 7 billion mark, but how many will there be to feed? [11]. The term "food security" first emerged in the mid-1970s, at the World Food Conference (1974). During the conference, food security was defined in terms of supply of food -"assuring the availability and price stability of basic foodstuffs at the international and national level" [12]. Since the World Food Conference of 1974, the concept of food security has evolved into what is now generally agreed the standard definition which was adopted during the World Food Summit in 1996. The World Food Summit, 1996, agreed that food security "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" [5]. From this definition, four components of food security are identifiable: availability, access, utilization and stability of food. Based on the practical guide of Food Security Information for Action, all four components must be satisfied simultaneously to meet the objectives of food security. Based on the four components can be delineated as follows [5,13].

- **Availability:** There has to be physical, social and economic access to sufficient and nutritious food by all people and at all times. Such food must satisfy the dietary needs and preference of the people. It is the amount of food physically available in a region or place. To a great extent, food availability depends on the level of local production, imports, stock levels and net trade in food items.

- **Access:** This refers to economic, social and physical access to food by all people at all times. That an adequate amount of food

is available at the regional, national or international level does not imply it is accessible at household level. It must be locally accessible and affordable.

- **Utilization:** Generally, utilization refers to the pattern in which the body makes use and benefits from the various food nutrients. Utilization is determined by food quality, nutritional values, preparation method and storage as well as feeding pattern.

- **Stability:** this refers to the stability of food availability, accessibility and utilization over time. All three components must be present simultaneously at all times. A person who has adequate access to quality food today is still considered food insecure if he has periodic inadequate access to food which may cause his nutritional level to deteriorate. Variation in weather conditions, political and economic instability, and price fluctuation are some factors that may impact on food security status. Food security sits on the top of the list of targets of Millennium Development Goals (MDGs). Though, over 60 countries made great success in their effort to meet the MDG hunger target of halving the population of food insecure people between 1990 and 2015, food security has remained one of the greatest challenges in sub-Saharan Africa, [11]. Some hunger hot spots have raised special concerns particularly in Africa. Some 39 nations were experiencing grave food shortage and needed food aid from other nations around the world as at 2006. 25 of these highly food insecure countries were from Africa.

As opined by IFAD (2011), in spite of Nigeria's abundant agricultural resources and oil wealth, poverty remains prevalent in the country and has spiralled since the late 1990s. Over 70 per cent of Nigerians are now classified as poor, and 35 per cent of them live in absolute poverty [14]. Poverty is expressly severe in rural areas, where up to 80 per cent of the population lives lower than the poverty line and social services and infrastructure are inadequate. The country's poor rural women and men depend on agriculture for food and income. About 90 per cent of Nigeria's food is produced by small-scale farmers who cultivate small plots of land and depend on rainfall rather than irrigation systems. The deprived clusters eke out a subsistence living but often go short of food, particularly during the pre-harvest period. The productivity of the rural population is also hindered by ill health, particularly HIV/AIDS, tuberculosis and malaria, low GDP, low per capital income, high cost of importation of food items, and government neglect of agricultural sectors all of which has strained food security and culminated into food insecurity in Nigeria. Thus, ensuring food security is not just a necessity in Nigeria, but remains the only way to guarantee the continued survival of her teeming population.

Over that food security remains an elementary and basic requisite for national development and as such, has been used by different people to convey different thoughts [15]. The duo further reiterate that the rapid annual population growth in Nigeria, particularly in the last decades has seen food insecurity spiralling to become the norm in many homes, a trend which has furthered the intensity of poverty and lack of access to food. They also submit that there

is an interplay of population growth, bad policies of government, lack of infrastructural development, rural-urban drift, lack of incentives, poverty of peasants as well as under-capitalization to fuel the fangs of food insecurity in Nigeria.

From the foregoing, it is deducible that Nigeria is not immune to food security challenges. To be sure, circa 70 percent of the Nigerian population live on less than N100 (US\$ 0.70) per day, thus entrenching suffering, hunger and poverty culture [16]. In spite of its status as oil dependent, Nigeria remains an agrarian economy. The sector provides over 40% of gross domestic product (GDP) with between 60 and 70% of the population productively engaged in farming. Yet, enormous sub-national differences exist. For instance, in the southeast, 22% of the people live in rural areas with most of them engaged in non-farming activities [17]. Out of about 79 million hectares of arable land it possesses, Nigeria has been able to cultivate a mere 32 million hectares of land. In the same vein, over 90% of agricultural production is rain-fed while smallholders, mostly subsistence producers account for 80% of all farm holdings. Both crop and livestock production are virtually below potentials. This shortfall is as a result of maladies such as low fertilizer, inadequate access to quality seeds, inefficient production systems as well as low uptake of high quality seeds. Despite a seven percent growth rate in agricultural production (2006–2008), Nigeria's food import bill has constantly risen. The growing population is dependent on imported food staples, including but not limited to wheat, fish and rice [16].

As observed by IAASTD, the findings on level of agriculture in sub-Saharan Africa as documented in the international assessment of agricultural knowledge, science and technology shows that agriculture in Nigeria not only contributes to a small extent to global warming through bush burning and other poor land management practices, but that it also bears first and foremost the full impact of climate change waves [16]. However, not to be oblivious of government's past efforts, it is worthy to note that strategies have been put in place to address food supply through agricultural production, though with little or no successful outcomes. The following companies as noted by were instrumental to the food production drive [18].

- The national Grains Production Company.
- National Root Crops Production Companies.
- North-east, Western and National Livestock Production Companies.
- The Nigerian National Shrimp Company.
- The Nigerian National Fish Company.

The afore-mentioned companies were established in 1989 by the Federal Government to engage in direct food production. They targeted cassava, millet, maize, sorghum, wheat and rice. There was also establishment of eleven (12) River Basin Development Authorities for development of river basins for the sake of making Nigeria self-sufficient in food production through agriculture. Other transient programmes adopted includes Green Revolution and Operation Feed the Nation (OFN). These were also targeted at re-

vamping agriculture, give it a new face and buoy up land owners to embrace farming as a way of life beyond the hitherto way of treating it as a mere occupation [18]. However, these programmes favoured capital intensive and largescale commercial farmers more, at the expense of poor peasants. This process led to what Ogbuide termed "Proletarianization of Peasantry" and created brief-case farmers who corruptly enriched themselves.

The issue of food security has been on the front burner for long and statements about several countries in Africa that are food insecure. We have been confronted with horrific photographs of starving children in countries lying on the Horn of Africa, countries such as Somalia, Ethiopia, some parts of Kenya, among others. These frightening photographs depict an avoidable disaster. Africa's agricultural system is backward, and worsened by high global food prices. In Nigeria, food accounts for a large, and increasing, share of family budgets for poor and urban families. If prices of staple foods soar, poor people bear the brunt. The Food and Agricultural Organisation (FAO), an agency of the United Nations (UN), once raised alarm that Nigeria, Morocco and Bangladesh faced imminent food crisis. The report stated that the world food situation was in dire straits.

As clothing and shelter serves as the basic necessities of life, food remains the most vital because of its centrality to human existence. It is a known fact that the ruthless expedition for food has shaped human history, provoking wars, driving migration and underpinning the growth of nations. The recent escalation of food prices call for sober reflection, due to challenges facing the globe is worsening food crisis period unheard of in the last 30 years and the potential of leading to catastrophe. This vital issue has taken the centre-stage among world leaders, thereby increasing the concern for the world's ability to feed its 6.5 billion people, to avert worldwide unrest and political instability as reported in most countries (FAO, 2007).

Consequently, various international organizations and individual countries embarked on aggressive food security crusades to remedy the situation in order to make food affordable to all. The Food Security assessment in 2005 proves that 750 million people were food insecure in 70 low-income countries. Asia and Commonwealth of Independent States experienced a 30% drop in the number of hungry people. In Latin American and Caribbean countries has varied slightly over time, but there has been a discernible trend across the region as a wholly. Despite the strong growth in food production, Sub-Saharan Africa is the only region where hunger has risen in the last decade. The challenge today is that high food prices will cause increase in food security and widespread food crisis in many developing countries. Poor people in developing countries spend between 50-80% of their income on food meet consumers need. Any increase in food prices will reduce food consumption and increase hunger. In Nigeria the prices of rice, corn and wheat record high roof-tops recently [5].

This global food crisis has been attributed to a number of factors

including climate change, population growth, increased demand for bio-fuels, failure to improve crop yield, high oil prices, leading to increased input loss for producers and traders. The structural problems like under-investment in agriculture and dominance in supply chain of food and agricultural policies sky rocket prices of food. Rapid urban growth for instance, is raising concerns about food supply. Meeting the food demand of a rapidly increasing global population is emerging as a big challenge to mankind. The population is expected to grow to 9.1 billion people by the year 2050, and about 70% extra food production will be required to feed them [19-21].

Most of this population rise is expected to be attributed to developing countries, several of which are already facing issues of hunger and food insecurity. Increasing urbanization, climate change and land use for non-food crop production, intensify these concerns of increasing food demands. In the last few decades, most of the countries have focused on improving their agricultural production, land use, and population control as their policies to cope with this increasing food demand. However, postharvest loss (PHL), a critical issue, does not receive the required attention and less than 5% research funding has been allocated for this issue in previous years [22-25]. Approximately one-third of the food produced (about 1.3 billion ton), worth about US \$1 trillion, is lost globally during postharvest operations every year [26]. "Food loss" is defined as food that is available for human consumption but goes unconsumed [27,28]. The solutions to reduce postharvest losses require relatively modest investment and can result in high returns compared to increasing the crop production to meet the food demand.

Postharvest loss includes the food loss across the food supply chain from harvesting of crop until its consumption [27]. The losses can broadly be categorized as weight loss due to spoilage, quality loss, nutritional loss, seed viability loss, and commercial loss [29]. Magnitude of postharvest losses in the food supply chain vary greatly among different crops, areas, and economies. In developing countries, people try to make the best use of the food produced, however, a significant amount of produce is lost in postharvest operations due to a lack of knowledge, inadequate technology and/or poor storage infrastructure. On the contrary, in developed countries, food loss in the middle stages of the supply chain is relatively low due to availability of advanced technologies and efficient crop handling and storage systems. However, a large portion of food is lost at the end of the supply chain, known as food waste. "Food waste" can be defined as food discarded or alternatively the intentional non-food use of the food or due to spoilage/expiration of food (Food and Agriculture Organization of United Nations, 2014). In 2010, estimates suggested that about 133 billion pounds of food (31% of the total available food) was wasted at retail and consumer level in the United States. Among different agricultural commodities, the studies estimated that on a weight basis, cereal crops, roots crops, and fruit and vegetables account for about 19%, 20%, and 44% losses respectively [26,30]. On a calorific content basis, losses in cereal crops hold the largest share (53%). Cereal grains, such as wheat, rice, and maize are the most

popular food crops in the world, and are the basis of staple food in most of the developing countries. Minimizing cereal losses in the supply chain could be one resource-efficient way that can help in strengthening food security, sustainably combating hunger, reducing the agricultural land needed for production, rural development, and improving farmers' livelihoods.

Postharvest loss accounts for direct physical losses and quality losses that reduce the economic value of crop, or may make it unsuitable for human consumption. In severe cases, these losses can be up to 80% of the total production [31]. In African countries, these losses have been estimated to range between 20% and 40%, which is highly significant considering the low agricultural productivity in several regions of Africa [32]. According to the World Bank report, sub-Saharan Africa (SSA) alone loses food grains worth about USD 4 billion every year [33]. These losses play a critical role in influencing the life of millions of smallholder farmers by impacting the available food volumes and trade-in values of the commodities. In addition to economic and social implications, postharvest losses also impact the environment, as the land, water and energy (agricultural inputs) used to produce the lost food are also wasted along with the food. Unutilized food also results in extra CO₂ emissions, eventually affecting the environment. A report from the Food and Agriculture Organization of the United Nations (FAO) using the life cycle perspective, estimated about 3.3 tonnes of CO₂ equivalent emissions due to food that was produced but not eaten, without even considering the land use change [34]. The blue water footprints (water use during life cycle of food) for the wasted food globally was estimated to be about 250 km³ [31,34]. Similarly, the land used to grow the food is another valuable resource that goes to waste due to these losses. A study conducted on rice postharvest losses in Nigeria estimated that the lost paddy accounted for 19% of the total cultivated area [35]. On the global scale, about 1.4 billion hectares of land was wasted by growing food that was not consumed in the year 2007, an area larger than Canada and China [34].

Considering the criticality of PHL reduction in enhancing the food security, it becomes very important to know the pattern and scale of these losses across the world, especially in developing countries, and identify its causes and possible solutions. Although losses occur at each stage of the supply chain from production to consumer level, storage losses are considered most critical in developing countries. This paper provides a comprehensive review and discussion on the status of storage losses of major cereal crops, major factors that lead to these losses and possible solutions. Technology interventions play a critical role in addressing the issue of PHL, and several efforts have been made to develop and disseminate these technologies for smallholders in developing countries. However, there is a lack of compiled evidence-based information on the effectiveness of these technologies for various crops. This paper discusses in detail the technology interventions, especially the use and effectiveness of hermetic storage in reducing storage losses particularly for smallholders in developing countries.

There exists a plethora of definitions on food security in the literature. Carter (1989) has this to say about food security; food security may be defined as the ability of food-deficit regions or countries, or households within these countries, to meet target levels of consumption on a yearly basis. They noted that what constitute target consumption is being referred to as two central issues of a country's food policy. For Adisa 1992, 'food security can be defined simply as access by all people at all times to enough food for an active and healthy life [9]. Accordingly, Ebon 1995 described it thus: food security simply refers to the ability of individuals and households (especially the rural and urban poor) to meet staple food needs all year round'[10]. Continuing, Ebon (1995), states that the above description is essentially intra-generational food security as opposed to inter-generations to meet their food needs, on season and off season. According to the 1996 World Food Summit, food security is the people's right to define their own policies and strategies for the sustainable production, distribution and consumption of food that guarantees the right to food for the entire population on the basis of small and medium sized production, respecting their own cultures and the diversity of peasant, fishing and indigenous forms of agricultural production, marketing and management of rural areas, in which women play a fundamental role. Food security is also seen as a state of affairs where all people at all times have access to safe and nutritious food to maintain a healthy and active life [36].

Abdullahi, adds that food is not only a basic need; it also provides the physiological foundation upon which other considerations and human activities are structured. He noted that for us in Nigeria, food security is both a national objective and a challenge. Food security is not simply having sufficient and adequate quantities of our various staple foodstuffs but it also entails access to the entire citizenry to these food items at affordable prices. It further means that not only must we engage in mass food production, but also, we need to ensure that most Nigerians have sufficient purchasing power to acquire food items that guarantee good feeding and nutrition.

3. Lack of Development

Lack of development in general is a problem when it comes to Agriculture in Nigeria. The lack of development includes: social development (development relating to people and the country), economic development (development relating to finance and wealth of the country), and environmental development (development relating to quality of the air, water, soil etc), and political development (development relating to political system). Identifying and tackling development constraints in the Nigeria agricultural system will help create a climate to improve performance, and will help promote and accelerate the growth in this sector. In some of the main factors affecting development in Nigeria was discussed and some of these factors will be discussed briefly below [2].

4. Marketing Problem

Marketing involves the conveying of agricultural product from farmers to consumers. Some of the problems of marketing affect-

ing the Nigeria agricultural system include poor transportation means, poor packaging and poor quality. If you have poor packaging system (making product look good and attractive to customers) and your competitor have a better packaging system than you, then customers are more likely to buy from your competitor even if the qualities are the same. Good roads are needed in order to effectively transport goods from one place to another. Unfortunately, the overall marketing system of the country is primitive. Departments that have been assigned to build roads and railways for transportation takes many years and sometimes up to a decade to get a network constructed because of corruption. Even the little road and rail constructed normally crumbles due to poor maintenance [2].

5. Storage and Processing

The lack of storage and processing facilities affect both national food security and household food security. Even when there is a lot of harvest and the production of farm products seem enough, because of lack of good storage it will still lead to food scarcity as the food will not be available or be in a good condition when it's time for consumption. Good storage and processing are required to ensure that food is available in good condition whenever it's required. Simple and effective methods for storing perishable food like tubers, fruits and vegetables are not really developed and well known in Nigeria when compared to that of grains [2]. Storage is a problem for Nigeria as a large number of food products perish, because of the lack of storage and processing facilities. The traditional methods of storage used contain flaws, like having low bases, which therefore becomes easily accessible to rodents and having wooden floors which are an easy target for termites and also some of the storage are non-moisture proof surfaces which could get damaged by water. Due to the inadequate storage and processing system, farmers lose heavily and especially when it's time for profuse harvesting. Safe places to store products from farms are not efficient and are inadequate. Improved storage systems and techniques have been developed by experts from different institutes but these systems have not been adopted and sometimes not even known to farmers.

6. Lack of Good Infrastructure

In this case infrastructure will include physical structures, such as health and educational facilities, social services (stable electricity and safe water) and effective communication systems. Agriculture in Nigeria suffers greatly because of the lack of developed infrastructure. For example in the rural area where most of the farmers operate without good infrastructure in place, is a major problem, as it affects investment, trade, and agricultural production. This problem is mostly caused by the government, as the government favours urban development over rural development by a great margin. The lack of infrastructure continues because of bad political leadership, poor governance, government neglect, poor maintenance culture and poor funding. Electricity, safe water and health facilities are often not enough for those living in the rural area, as the urban area is favoured more by the government. For example people living in the rural area can be without electricity for up to a week on a regular basis and even the urban area does not have

stable electricity. Some places in the villages have one tap for water which does not always work because of lack of electricity, so water used in the farm and houses are gotten from the rivers, and this could take hours to fetch as the river could be far from the houses and the farms.

7. Unstable Prices

One of the problems affecting external and internal investment in Nigeria is the escalating cost of important farm tools and machines. The average cost of tools and machine such as cutlass, hoe, tractors and combine harvester have been increasing for many years. These unstable prices are caused by the unstable macroeconomic policy which then lead to inflationary pressures and high interest rate and then lead to a volatile exchange rate [2]. All these have the tendency to cause rising prices in fuel, transportation, farm inputs and therefore increase cost of production.

8. Agricultural Labour

The traditional system used in Nigeria affects the use of farmland because of the availability of labour. In Nigeria the agriculture system is mainly done without machines and thus human labour becomes important in the production system, accounting for about 90% of the farm operations. While under a semi-mechanized system human labour is still up to 70% of the farm operations [37]. So labour could be and is affected by the continuous migration of able bodied young men to the urban area which in turn causes labour shortages and in time when labour is required for land preparation and harvesting. The main cause of this migration is the perception by young men that farm labour cannot support them and their families [38].

9. Population

The Nigeria Population in 2011 was about 162 million, at present about 190 million and it is estimated to be about 230 and 430 million people in 2050, and as of 2015 52.2% of the population lived in the rural area while 47.8% lived in the urban area [39]. Nigeria is seeing a growing population and could be the third largest most populated country in some years while more than half of the population earn less than US\$ 2 per day [16].

As Nigeria population increases, so does the food security challenges, and this will grow with its population. At the current rate in which Nigeria population grows, Nigeria remains unable to feed its population. Due to over population, the traditional method of fallowing is shortened and there is not enough time for the soil to regenerate its properties, putting pressure on the land. There is increase in demand of livestock which also leads to overgrazing.

As stated earlier Nigeria's urban population is more than its rural population, and it's estimated that the urban population will continue to grow more and more as there is mass migration from the rural area. The urban population is relying on market food supplies and are not into food production. Nigeria population are mainly youths, and they are mostly moving to the urban area. This is making it hard to employ and educate the next generation farm-

ers. Due to the problems mention above, lack of farmers, growing population, low income and people not being interested in food production or being a farmer anymore, is making the unsustainable farmers get away with their practices.

10. Challenges of Food Security in Nigeria

Attaining food security in its entirety poses a huge challenge in a country like Nigeria, as a result of a wide spectrum of problems. More than 90 per cent of agricultural production in Nigeria is rain-fed with about 79 million hectares of arable land, of which 32 million hectares are cultivated [16,40]. Both crop and livestock production remains below potentials. Despite a seven percent growth rate in agricultural production (2000 to 2008), the growing population is dependent on imported staple food (e.g. rice, beans) exemplified by increase in food import bill. First and foremost, the primary cause of food insecurity in developing countries is the inability of people to gain access to food due to widespread poverty and unemployment, which also inhibits purchasing power and prevents assured access to food supplies.

Secondly, global food prices have risen dramatically in the last few years and are forecast to rise further or become more volatile [41]. Food price volatility has exerted considerable pressure on global food security, and many Nigerians depend on market for their food supply and vulnerable to high food prices. Related to high food prices is a high cost of input which limit yield and production levels that many time lead to suboptimal input utilization. For instance, fertilizer consumption in Nigeria is one of the lowest in sub-Sahara Africa at 7kg per hectare [40]. Thirdly, the inherent characteristics of climate that manifest themselves as changes of climate over a period time affect food security significantly in unpredictable ways as a result of their detrimental effect on pests, crops diseases, crop production, animal husbandry, and humans. Changing climatic conditions affect both the physical and the economic availability of certain preferred food items. Their impacts on income-earning opportunities can affect: the ability to buy food, the availability of certain food products, and price. Changes in the demand for seasonal agricultural labour, consequent upon changes in production practices, will in turn affect income-generating capacity.

Fourth, farmers in Nigeria also have limited access to credit, and less than 10 per cent of irrigable land is being irrigated. Fifth, the global economy is knowledge-driven and food system efficiency is dependent heavily and directly on agricultural technological innovations and innovations in relevant sectors. Nigeria's adult literacy level is 54.5 percent (NBS, 2009). However, the rural poor who are the active stakeholders in food availability account for 33.4 percent and are mainly involved in subsistence farming. The violence has also affected the state's trade in Kola. The upsurge in violence has made it difficult for farmers in Kano to market their produce due to persistent insecurity in the capital city. Consequently, lots of Kolanut remain unsold, according to Yaya Haliru, a Kolanut trader. Although many farmers in the state were expectant of a bumper harvest this year, many of them dread the situation whereby they

would not be able to find any market for their crops. “If the current situation persists, it will severely hamper crop sales for many farmers,” stated Auad Bako, a large scale grocer.

The crisis in the North has forced some of the crop farmers and pastoralists to abandon their lands and relocate to the neighbouring countries of Niger, Chad and Cameroun. In March, the National Emergency Management Agency (NEMA) said about 65 per cent of northern farmers had migrated to the South because of the insecurity they faced. The agency warned that the country faced a famine by the end of this year because most of the small-scale farmers and mechanized farmers in the Nigeria’s northeast are threatened by terrorist attacks. “The attacks on these farmers who produce beans, onions, pepper, maize, rice, livestock and catfish in the Lake Chad area for the southern states, have forced them to migrate since the Boko Haram insurgency broke out in Borno State in July 2009”, it said.

A countrywide food crisis, therefore, looms, considering NEMA’s disclosure. Since most of the foodstuffs consumed and traded in Nigeria are grown in the north, the agency warned about an impending famine. Incessant bombings and other violent attacks on local markets perpetrated by both the Boko Haram sect and Nigerian armed forces pose grievous risks to northern farmers, livestock breeders and dealers in farm produce, forcing them to migrate to new locations far from their farmlands, while placing additional burden on the transportation of food and farm produce to other states. Consequently, prices of food stuffs have skyrocketed, particularly in the southern part of the country.

Finally, the apparent inconsistency in government’s targeted policy intervention and implementation strategies further compounds the problem of food security. For instance, weaknesses and threats to Agricultural development in Nigeria include: (a) Poor access to credit, technical inputs, machines and farm implements (i.e. fertilizers, seeds, pesticides, tractor, plow, harvesters etc) by farmers (b) Degradation of agricultural natural resources especially soil and water bodies. (c) Poor infrastructure (i.e. rural roads, water supply, storage facilities and market infrastructure) (d) Bad and inconsistent government policy (e) Poor budget allocation to agricultural sector (f) Poor and inadequate irrigation facilities (g) Uncontrolled grazing and livestock migration in some areas and (h) Poaching and settlement within protected areas and bush fires. For the genuine transformation of Nigeria agricultural sector in order to make it relatively more attractive to people (especially the youth and unemployed), it is recommended that all tiers of government (Federal, State and Local), as well as public and private organizations should sincerely adopt policies and strategies that will address and reduce the above weaknesses and threats to agriculture.

At the production stage, certain factors affect the quantities and types of food produced. Likewise, food security activities like land clearing, crop production, animal husbandry, food processing and preservation and food distribution which lead to the production and release of GHG (such as carbon dioxide, methane, and nitrous

oxide) cause global warming and impact on climate change.

11. The Nigerian Government Responses to Food Security Challenges

Majority of the rural populace depends on agric-related activities for their livelihood, the appraisal on the past shows that successive administrations in Nigeria had initiated programmes towards ensuring food is availability and accessible for the teeming population. The sustenance of idea is to fulfil their mandates has remained a dream. It includes Farm Settlement Scheme, National Accelerated Food Production Programme (NAFPP) by Gen. Yakubu Gowon; Operation Feed the Nation by Murtala/Obasanjo administration; River Basin and Rural Development Authority; Green Revolution and World Bank funded Agricultural Development Project (ADP) by Shehu Shagari and Babangida’s Directorate for Food, Road and Rural Infrastructure (DFRRI). Despite these efforts, agriculture has been constrained by numerous challenges like rural- urban migration, wavering policy formulations, implementation, insufficient infrastructural support poor input distribution system, focus on oil economy; pricing system; over dependence on rainfed farming; poor capacity utilization, low investor’s confidence; environmental degradation’ poor access to funds; poor socio-economic status of farmers, insufficient technological transfer system, corruption and poor commitment to implementation of agricultural policies. Therefore, for Nigeria to transform as one of the 20 leading economies in the world by 2020, an agricultural revolution should be the catalyst to its industrialization. Besides, the targets of the MDGs of reducing hunger and poverty and sustainable development can only be attained through increased attention to agriculture, food security and sustainable water resource development by the flaws of the past, The current global food predicament by late Yar’Adua cum Goodluck administration took a proactive measure by outlining agriculture as part of his agenda and vision 2015 of curbing hunger and poverty to improve the lives of 140 million Nigerians. Over N134 billion approved for Agriculture in the 2008 budget is a clear testimony. The Federal Government constitutes National Economic Council and Federal Executive Council for practical and positive intervention towards eliminating hunger. So far, the intervention result on the release of N80 billion from the Natural Resource Development Fund for importation of 500,000 metric tons of rice from abroad and 11,000 metric tons of grains to complement the local output.

As part of the palliative schemes to keep hunger away, Federal Government approved the release and distribution of 65,000 metric tons of assorted food from the Strategic Food Reserve to cushion the effect of low yield during 2007 season while stocking food items in the reserves to guarantee the required level of food security, with a view to adopt a policy of guaranteed Minimum Price (GMP) of food commodities. This strategy will enhance food security through preservation and storage of items in the rural areas nationwide.

Livestock development is not out as fisheries production was promoted in the determination to address general concern on agricul-

ture in Nigeria. In the crop sector, government is refocusing on the production of major key crops in which the country has comparative advantage; access to credit facilities by farmers is one of the major constraints facing agriculture development in the country of which the Federal Ministry of Agriculture and Water Resources has secured approval for a sum of \$39.0 million for rural financing project to provide credit facilities to small-scale farmers. The importance of land as a factor of production shows that the existing land tenure system in the country lacks organization in terms of documentation thus render illegal secure of land as a means of collateral for credit facilities.

Natural disasters affect everyone on a global scale. Hardly would one find a society or settlement that has not in one way or another been affected by the destructive side of the forces of nature, be it earthquakes, floods, volcanic eruptions, forest fires, tomatoes, or even tidal waves known as tsunamis. All across the world, the effects of these so-called acts of God turn the fortunes of many of the affected victims and leave destruction and misfortune in their wake. Floods are among the most devastating natural disasters in the world, claiming more lives and causing more property damage than any other natural phenomenon. Floods affect and displace more people than any other disaster; it also causes more damage to property. The destructive power of flood became more argument to Nigerians following the recent floods.

The flooding has left tens of thousands homeless and destroyed property and economic activity to the tune of over N2 billion in Adamawa, Benue, Taraba, Bayelsa, Rivers, delta, Edo, Anambra out as to the actual causes of the debate, but what is incontrovertible is that the effects of climate change and poor disaster management are now national priorities. However, despite the trail of woe that has visited affected states and the attendant effects of the flood-including food price inflation, insecurity, loss of income for millions of households there appears to be an emerging phenomenon never before seen in Nigeria. This phenomenon is commonplace in developed countries where multi-billion dollar companies, the military and civil society have honed their disaster management skills and are able to synchronise their aid machinery with that of the various governments to achieve rapid response and give instant succour to victims. One easily remembers how the United States government achieved a low mortality rate in the aftermath of Hurricane Sandy as an example of clock-work-like collaboration between state governments, the Federal Government and the Military Climate Institutions.

12. Food Security

As noted by, the idea of food security was presented for the first time at the World Food Conference in 1974 viewed solely from the perspective of having adequate availability of food on a national scale [42]. Today, it is a condition in which all people have access at all times to enough food of an adequate nutritional quality for a healthy and active life. To the writer, there are four dimensions to this: (i) availability of sufficient amount of food which is a func-

tion of food production (ii) stability of supply over time which depends on the ability to preserve/store produced food and supplement available food through imports if necessary (iii) access to the available food which depends on income levels and its distribution and (iv) food utilization which encompasses procurement, ingestion and digestion all of which are dependent on nutritional quality, education and health.

According to, food security has to do with having at all times an adequate level of food and food products to meet increasing consumption demand to mitigate fluctuation in output and price [43]. Meanwhile, Ladele and Ayoola, see food security as a function of food production level, that is, high level of food production is equals to food security [44]. However, to, food security entails producing food that will go around every citizen both in quality and quantity. To achieve this, agricultural production needs to be enhanced with adequate knowledge of the environment, climatic condition, the market and its operation, and be aware of price and price mechanism, good transportation system, storage, fashion modality to check glut and be well prepared in case of disasters [45]. Defined sustainable food security as when people have physical and economic access to sufficient food to meet their dietary needs for a productive healthy life at present as well as in the future [46]. This definition outlines some indices for measuring the extent or degree of food security to be achieved by any country and the indices are adequate national food supply, nutritional content, accessibility, affordability and environmental protection.

Adds that food is not only a basic need; it also provides the physiological foundation upon which other considerations and human activities are structured [8,46]. He noted that for us in Nigeria, food security is both a national objective and a challenge. Food security is not simply having sufficient and adequate quantities of our various staple foodstuffs but it also entails access to the entire citizenry to these food items at affordable prices. It further means that not only must we engage in mass food production, but also, we need to ensure that most Nigeria have sufficient purchasing power to acquire food items that guarantee good feeding and nutrition.

Food security for a household means access by all members at all times to enough food for an active, healthy life.

Food Security Includes a Minimum of:

- The ready availability of nutritional adequate and safe foods and
- An assured ability to acquire acceptable foods in socially acceptable ways, that is without resorting to emergency food supplies, scavenging, stealing or other cropping strategies. In the World Bank Policy Study (2006) food security is defined as access by all people at all times to enough food for an active healthy life. To the Economic commission for Africa (2009) food security involves not only food availability through storage, and trade but also more importantly food access through domestic or home production [18]. The main goal of food

security therefore, is for individuals to be able to obtain adequate food needed at all times, and to be able to utilize the food to meet the body's needs. Food security is multifaceted.

As observed by, food security has been promoted by the United Nations as the most basic human need and as a central indicator of absolute poverty and physical wellbeing. Food security refers not only to an adequate aggregate supply of food, but also means that all people at all times have both physical and economic access to basic food [47]. This requires not just enough food to go around. It requires that people have ready access to food. This is measured using two indicators: (1) food supply is measured as the mean daily per capita supply of calories and protein and (2) the child hunger rate is measured by the percentage of children under age 5 who are undernourished.

According to there are four major elements of food security; food availability, food access, food utilization, and not losing the excess [48]. Again, the exploitation by middle men i.e. middle men's share of total market margin indirectly leads to loss of interest in farming and subsequently food insecurity in the country. The dearth of knowledge in techniques for storage and or turning fruits and vegetable force farmers to sell produce at ridiculous price at harvest to avoid post – harvest losses, this lessens their income, reduce their purchasing power and subsequently their lack of interest in crop production [49]. Food wastage has also been indicated as a bane of food security in Nigeria, according to [50], Nigeria experienced food wastage of 0.81 million metric tonnes between 1995 and 2000 and this would reduce greatly if storage facilities are in place. Food security cannot be achieved in a culture of wastage; [51] maintained that food wasted at ceremonies in Nigeria on weekends in a month is enough to feed the state for a month. Export of staple food has also been indicted by [50] as a cause of food insecurity, the export of staple food crops should be de-emphasized. The prospect for increased agricultural production and food security in Nigeria is good because of these factors; the abundance of land for crop production, livestock and forestry products, and large domestic and international markets. Agricultural production and food security will require a comprehensive strategy to reduce some important constraint as discussed earlier.

Food security exists at both the macro and micro levels. National Food Security (NFS), the macro dimension, is possession by a nation of the capacity to procure enough food through production or imports to feed its population. This is a necessary condition but not a sufficient condition for Household Food Security and Individual Food Security since food availability on a national scale does not preclude the lack of adequate access to such food by many of the inhabitants due to weak markets, poor infrastructure and information system, and inequality in resource and income distribution. Various composite indices have since been developed to measure Food Security incorporating all the dimensions of food security. Popular among these are the Aggregate Household Food Security Index (AHFSI) by the United Nation's Food and Agricultural Organization (FAO) and the Food Security Index (FSI) of the United

States Agency for International Development (USAID) [42].

13. Low Technology for Processing and Storage

The use of modern technologies in the production and distribution of agricultural products is very low in Nigeria so the sector depended more on manual labour for farm activities. This is because of lack of innovation in local technology, particularly as it relate to mechanization of agriculture to improve productivity. Additionally, local farmers can hardly afford imported technologies and lack maintenance capacity [16]. Inadequate or lack of facilities to preserve food items such as cereals, yam, beans, etc. can result in wastage thereby further deepening the insecurity level of food. Also, lack of food processing apparatus sometime leave farmers with no choice than to consume significant fraction of their harvest within short period. Food processing is an important aspect of agriculture that prevents wastage of food items that cannot be easily stored in their original form by transforming them into other form that can enable their preservation. For an instance, mangos, citrus and pineapple can easily be preserved when converted into fruit juice. To achieve a sustainable food security, effort must be made to avert any wastage [52]. Modern agriculture has become so highly industrialized and dependent on energy. Mechanized farmers are very reliant on consistent power supply which has eluded us has become a mirage for successive government to achieve. Now, much of the agricultural products we consume are produced in farms located far away and processed other distant location before being imported via air, water or land. The whole of these processes requires a lot of power and fuel to keep food price low and affordable for the common man [53]. However, with escalating prices of petroleum products, there have been calls for diversification to increased energy efficiency. One key alternative is biofuel and other agriculture-based energy production. This alternative will create more completion for food item particularly in developing nation and depending on how the process is managed mat increase food insecurity [53].

14. Strategies for Achieving Food Security in Nigeria

Going by its definition, food security however will not be achieved by simply in-creasing the production of food. Even when food is sufficiently available, a poor hungry man will remain food insecure as long as he cannot afford to buy it [54]. Hence, all four components viz.; availability, accessibility, utilization and stability must be present. Efforts to combat food insecurity will therefore, not only make food available but also ensure that that people can consistently afford to make it ready for consumption. [55] in "The role of agriculture in the economic development of Nigeria" stated that Nigeria is blessed with abundant fertile agricultural land and favourable climate as well as enviable human resources. How then can food security be objectives be met in Nigeria? The panacea lies in improving agricultural productivity; enhancing science and technology; building farmers capacity; facilitating access to the market; and good governance amongst others [52]. In this case, the strategies for achieving food security are categorized into economic, social, environmental and technological strategies.

14.1 Economic Strategies

- Promoting decent employment in the agriculture sector: this is particularly effective in the rural areas. A great proportion of the rural population depends on agriculture for survival, yet they are the most food-insecure part of Nigeria. Like in other developing nations of the world, rural farmers in Nigeria are highly informal with casual approach to farming activities. This makes them highly vulnerable to exploitation. Policies and programmes should be implemented to facilitate equitable market place for the informal farmers such as training and monitoring schemes.
- Promoting the non-farm economy in the rural areas: again the rural population who are most susceptible to food insecurity are the targets here because the Nigerian urban economy is mostly non-farm based. As important as agriculture is to the rural people, there is need for diversification. While some rural farmers may begin to enjoy the dividends of access to the transforming equitable agricultural market enabling them to find their way out of poverty and food insecurity, others may not be so successful. The whole rural economy cannot be based on agriculture. Some may need to exploit other non-farm opportunities which may as well be economically viable such as paid employment or trading. The government needs to provide orientation program and the enable environment for diversification of rural economies.
- Provision of credit and incentives: according to, access to credit facilities has been shown empirically in various studies to have improved farmer's productivity [56]. It is important for small-holder farmers to have access to credit facilities particularly during the sowing period to enable them to enable them afford quality seeds, pesticides, fertilizers as well as hire/purchase of equipment needed for production. Fund may also be needed for labour support during harvest and for storage facilities [57]. Other incentives such as subsidy on fertilizers can also help improve farmers' productivity.

14.2 Social Strategies

- Social networking and organized farmers cooperation: this is another important factor identified in that can significantly improve the livelihood of small-holder farmers through inter-connecting and cooperating with one another [56]. This helps protect the interest of the most vulnerable farmers in a group and can serve as base for human resource development enabling the weaker farmers cope with risks [58]. It can serve as a viable capacity building platform for farmers and other social groups to form a force and gain access to credit facilities, inputs, markets and other resources [57].
- Accessible education: this is indeed a mechanism that facilitates productivity in any field of career [56]. Lack of or inadequate education is the bane of farmers in Nigeria particularly in the rural settlement. This is mostly not because of their lack of interest but because they lack access to it. The government needs to make education affordable for the low income urban and rural people. This will improve their ability to navigate opportunities and technical know-how in employing farm im-

plements.

- Provision of infrastructure: even in the most developed urban centres, lack of basic infrastructures as access roads, electricity and portable water can have immense impact on the economy. For farmers to be productive these basic amenities need to be accessible. Electricity for an instance cannot be compromised to power storage facilities of sometime farm equipment's. Road and transport give them access to the market and thus improving their economy.

14.3 Environmental Strategies

- Improved management of industrial effluents in their research of Impacts of industrial effluents on plant and soil in Bangladesh showed that industrial effluents significantly reduce deplete the nutrient content of soil which reduces the growth, yield, and nutrition of agricultural products [59]. In Nigeria, oil spillage, gas flaring and other industrial effluents have consistently constituted a scourge for the agricultural sector, crippling productivity. There is a need for an improved monitoring system of industrial compliance to Environmental Management Plan (EMP) and follow-up program to reduce impact on agricultural productivity.
- Regulation of the use of fertilizers and other agro-chemicals: the importance of fertilizers and agrochemicals in today's agricultural practice cannot be overemphasized. However, they also have their associated environmental consequences. Where nitrogen from fertilizers washes into water bodies it causes eutrophication killing aquatic lives. Phosphorus can also make algae to accumulate in water bodies depriving fishes of oxygen leading to suffocation and thereby affecting the supply or availability of fish for consumption [60,61].
- Measures should be taken to control the usage of fertilizers and pesticides by farmers through trainings and orientation programs.

14.4 Technological Strategies

- Crop rotation and diversification: crop rotation, mixing and diversification is an important practice that can improve quality and yield of agricultural produce (Oni et al., 2009). This technique basically help improves soil nutrients and can be used to control pests and diseases. This system should be encouraged amongst farmers.
- Irrigation system: also observed that irrigated farms in the dry savanna agro-ecological zones give higher productivity than non-irrigated farms in the same region [56]. This system will be particularly useful in most part of the northern Nigeria.
- Promotion of mechanized farming system: noted that the despite the use of indigenous CRP rotation system in Africa, Asia and the Latin Americas, food insecurity has been on the rise as these techniques are not enough to meet the demand of the fast growing populations [47]. There is the need for mechanization of agriculture in Nigeria to improve production through the use of equipment's, machineries and implements. Although, some large scale farmers have been using

the mechanised farming system, there is the need to promote mechanized farming amongst small-holder farmers. To achieve an overall inclusive agricultural mechanization, the Nigerian government needs to engage other public and private corporations as well as financing institutions [62].

- Agricultural biotechnology: although agricultural biotechnology which involves genetically modified foods is still not generally accepted due to unresolved safety issues. It represents one of the success stories of science and technology in recent times which has an immense potential to significantly reducing the global food security challenges [47].

15. Conclusion

Although food insecurity is a global phenomenon, it is more prevalent in the developing nations including Nigeria. Fortunately, Nigeria is blessed with abundant fertile land for agriculture and enormous human resource. Nigeria has a rich history of agricultural practice but it all soon changes with the discovery of oil in the now unenviable oil-rich Niger-delta region of the nation. The prospect of huge financial resource that could be generated from the oil resource distracted the nation from its agricultural blessing as all attention was diverted. The so-called financial returns from the oil resources are consistently manipulated and diverted by government officials and alas it is the common man who suffers the consequences. Hunger, starvation and malnutrition are ravaging the nation.

Food security can, however, still be restored in the country but some factors are still militating against the restoration such as insufficient production, gender inequality, inefficient policies and corruption, conflicts and civil insecurity, climate change and natural disasters, low technology for processing and storage amongst others. To surmount this challenges, the government must go back to the drawing board to provide enabling environment through promoting decent employment in the agricultural sector and non-farm sectors as well as providing credit facilities to serve as platform for the most vulnerable to cope with the economic realities particularly in the rural areas. While social networking and cooperation among small holder farmers will give them a voice, the government needs to provide basic infrastructures such as access road and electricity and make education more accessible to build farmers capacity. Oil spillage and other industrial effluents constitute a major source of pollution of soil and water and other components of the environment, thereby reducing agricultural productivity. There is the need for government to develop a robust monitoring mechanism to control indiscriminate discharge of effluent. Lastly, modern science and technologies must be adopted to improve agricultural productivity. Agriculture has remained an important aspect of any economy. Viable agricultural programmes and activities in any nation are capable of sustaining the food supply and reserves needed for the welfare of the citizens. But in Nigeria, Agriculture is despised. Able bodied young man and woman in Nigeria do not have interest in Agriculture. Both the educated and the non- educated roam the nooks and crannies of the cities in the urban areas looking for non-existent white collar jobs. As a re-

sult of poor attitude to Agriculture, there is also this disequilibrium in the production, demand and supply of food. We discover that a lot of what we eat is not produced here.

It is also discovered that when food is not properly utilized by an individual, it affects the behaviour of such individual and also affect his output towards national development. Besides, government must cultivate local initiatives by promoting grassroots awareness on the importance of cooperative farming which will result to greater gain of food production and government should provide a platform for interaction with the local farmer in order to discover their problem and provide the solution. Therefore they are need for bottom-up approach in making agricultural policies [63-68].

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