Journal of Agriculture and Crops
ISSN(e): 2412-6381, ISSN(p): 2413-886X
Vol. 2, No. 7, pp: 62-82, 2016
URL: http://arpgweb.com/?ic=journal&journal=14&info=aims

Effects of Food Safety and Food Security on the Economic Transformation of Nigeria

Osundahunsi O.F. Department of Food Science and Technology, Federal University of Technology, P.M.B 704, Akure, Ondo State, Nigeria

Abu T. F.A.* Department of Food Science and Technology, Federal University of Technology, P.M.B 704, Akure, Ondo State, Nigeria

Enujiugha V. N. Department of Food Science and Technology, Federal University of Technology, P.M.B 704, Akure, Ondo State, Nigeria

Abstract: Food safety and food security is a determinant of the well-being of the citizens of a country and how it translates to the development and transformation of the economy in a country specifically Nigeria was critically examined. Recent FAO figures indicate that over 60% of the world undernourished people live in Asia, and a quarter in Africa. Also there are 22 countries, 16 of which are in Africa, in which the undernourishment prevalence rate is over 35%. Hunger, food insecurity (chronic or transitory), malnutrition involving micronutrient malnutrition (MNM) and protein energy malnutrition (PEM) are some of the issues arising from food insecurity. Lack or absence of minerals and vitamins like Iodine, Iron and Vitamin A affects the growth and development of humans. The study revealed that several factors contributing to food insecurity includes wars, natural disasters, unemployment inadequate technological deployment and high post-harvest losses. Steps were taken to examine how agriculture contributes to food security, effects of various policies by past and present government on the food security and food safety situation in Nigeria. Also the emerging issue in combating food insecurity especially the use of biotechnology was further explained. Useful recommendations for enhancement of food security and safety includes: reduction of post-harvest losses through proper utilisation, processing and packaging of agricultural products, food fortification and supplementation to combat micronutrient and protein energy malnutrition, increased use of biotechnology; formulation of good agricultural policies including creation of agric cooperatives and the new Nigerian Agricultural Transformation Agenda (ATA) that can lead to transformation of the economy.

Keywords: Food safety; Food security; Biotechnology; Malnutrition; Hunger.

1. Introduction

The number of people without enough, adequate and safe food to eat on a regular basis remains stubbornly high, at over 900 million [1] and is not falling significantly. Also according to a World Food Program estimate, hunger affects one out of seven people on the planet. In 2010, FAO estimated that more than one (1) billion of the world's people did not have enough food to lead healthy and productive lives. Ironically, the highest proportion of the food insecure live in rural areas where food is produced, yet they are net food buyers rather than food sellers.

Over 60% of the world undernourished people live in Asia, and a quarter in Africa. The latest FAO figures indicate that there are 22 countries, 16 of which are in Africa, in which the undernourishment prevalence rate is over 35%.

Food security is described simply as: "availability at all times of adequate world supplies of basic food-stuffs" [2]. Achievement of food security in any country is typically an insurance against hunger and malnutrition, both of which hinder economic development. This is why all developed and some developing countries make considerable efforts to increase their food production capacity. Approximately one billion people worldwide are undernourished, many more suffer from micronutrient deficiencies, and the absolute numbers tend to increase further, especially in Sub-Saharan Africa [3]. The World Bank proposed a definition of food security which remains current today, broadening the emphasis from food availability to include access to food, and narrowing the focus from the global and national to households and individuals: "access by all people at all times to enough food for an active, healthy life" [4].

*Corresponding Author

According to Integrated Food Security Strategy [5], this definition has different but inter-related components: food availability, the effective or continuous supply of food at both national and household level which is affected by input and output market condition, as well as production capabilities of the agricultural sector; food access or effective demand, the ability of nations and household to acquire sufficient food on sustainable basis and addresses issues of purchasing power and consumption behavior; reliability of food, the utilization and consumption of safe and nutritious food and food distribution, refers to equitable provision of food to points of demand at the right time and place. This spatial/time aspect of food security relates to the fact that a country might be food secure at the national level, but still have local pockets of food insecurity, at various periods of the agricultural cycle [5]. The opposite of food security is food insecurity [6]. This refers to lack of access to an adequate diet which can be either temporary (transitory food insecurity) or continuous (chronic food insecurity). Food insecurity continues to be a key development problem across the globe, undermining people's health, productivity, and often their very survival [7]. Since the attainment of food security in any country is usually an insurance against hunger and malnutrition, both of which slow down economic development [8], all developed and developing countries must provide policies and strategies to increase their food production capacity. Generally, a country is food-secure when a majority of its population has access to food in sufficient quantity and quality consistent with decent existence at all times [9]. It has been documented since the 1980s, that the achievement of food security requires paying attention to supply-side, which can be secured through agricultural production, commercial imports or food aid and on the demand-side food has to be safe, nutritious, and appropriate to meet food preferences [6].The situation in Nigeria, like any other African country is not different, Recent estimates put the number of hungry people in Nigeria at over 53 million, which is about 30 percent of the country's total population of roughly 150 million; and 52 percent live under the poverty line and the figure will have become higher since the recent flooding in certain parts of the country. Besides being the leading economy in Africa, Nigeria account for over 20 percent of sub-Saharan Africa population. These are matters of grave concern largely because Nigeria was self-sufficient in food production and was indeed a net exporter of food to other regions of the continent in the 1950s and1960s. The discovery of crude oil and rising revenue from the country's petroleum sector encouraged official neglect of the agricultural sector and turned Nigeria into a net importer of food. By 2012 the federal ministry of agriculture estimated that Nigeria was spending over $3billion annually on food imports which is roughly N450 Billion; when juxtaposed in relation to our annual budget.

Food safety: describes proper handling, preparation and storage of food in ways that prevent food borne illness. This includes a number of routines (TQM, HACCP, GMP and GAP) that should be followed to avoid potentially severe health hazards. Food can transmit disease from person to person as well as serve as a growth medium for bacteria that can cause food poisoning. Food safety can also be referred to as the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to the intended use [10]. Food safety is a global issue, both developing and industrialized countries suffer large numbers of food borne illness and consumers are becoming increasingly concerned about the safety of food. One consequence of the increased incidence of food borne diseases is much distrusts by the consumer on the food business and food chain; e.g. the farming practices that emphasize excessive use of pesticides through to additives and flavourings used by processors. In all, food safety is simply ensuring that food produced is sold and safe for consumption.

Food security: refers to the availability of wholesome, safe for consumption food and one's access to it. A household is considered food secure when its occupants do not live in hunger or fear of starvation. Therefore, there is a strong, direct relationship between food safety and food security to confer a healthy life. Food insecurity on the other hand exists when people are undernourished as a result of the physical unavailability of food, lack of wholesome or access to safe food/ or inadequate food utilization. Food security exist when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Food security for a household means access by all members at all times to enough food for an active, healthy life. Food security entails producing food that will go round every citizen both in quantity and quality. To achieve this, agriculture production needs to be enhanced with such issues as; adequate knowledge of the environment, climatic condition, the market and its operation; types of insecticides and pesticides, crop treatment, prices and its mechanism.

1.1. Indices of Food Insecurity

The indicators of food insecurity include:

a. Inadequate production, stock holding/ storage processing and distribution or marketing

b. At house hold, lack of adequate income to secure access to food

c. In the developing world as a whole, about 840 million people, that is 20% of world population were chronically undernourished. Lacking economic or physical access to sufficient food to live a healthy and productive life [11].

d. In sub-Sahara Africa, 215 million (38-43%) is said to be a flash-point or locus of hunger.

e. Child malnutrition is another indicator of food insecurity, it is estimated that 28 million sub Saharan African children are underweight.

f. Micro nutrient deficiencies are also wide spread which result in poor health and productivity especially in Iron, iodine and Vitamin A [12]

g. Many have not shown symptoms of insecurity but have poor incomes such that price fluctuation, loss of employment or retirement without receiving pension and gratuity could tip them into food insecurity zone.

1.2. Micronutrient Deficiency/Malnutrition

More than 2 billion people in the world today suffer from micronutrient deficiencies caused largely by a dietary deficiency of vitamins and minerals.

The public health importance of these deficiencies lies upon their magnitude and their health consequences, especially in pregnant women and young children, as they affect fetal and child growth, cognitive development and resistance to infection. Although people in all population groups in all regions of the world may be affected, the most widespread and severe problems are usually found amongst resource poor, food insecure and vulnerable households in developing countries. Poverty, lack of access to a variety of foods, lack of knowledge of appropriate dietary practices and high incidence of infectious diseases are key factors. Micronutrient malnutrition is thus a major impediment to socio-economic development contributing to a vicious circle of under development and to the detriment of already underprivileged groups. According to Allen et.al 2006, it has long-ranging effects on health, learning ability and productivity and has high social and public costs leading to reduced work capacity due to high rates of illness and disability.

Overcoming micronutrient malnutrition is therefore a precondition for ensuring rapid and appropriate national development. A goal which the FAO and WHO have been working to achieve and in doing so have adopted four main strategies which are; improving dietary intakes through increased production, preservation and marketing of micronutrient-rich foods combined with nutrition education, food fortification and supplementation, global public health and other disease control measures.

Each of these strategies has a place in eliminating micronutrient malnutrition. For maximum impact, the right balance or mix of these mutually reinforcing strategies needs to be put in place to ensure access to consumption and utilization of an adequate variety and quantity of safe, good-quality foods for all people of the world. Underpinning these strategies is the realization that when there is a dietary deficiency in any one nutrient, there are likely to be other nutrient deficiencies as well. Consequently in the long-term, measures for the prevention and control of micronutrient deficiencies should be based on diet diversification and consumer education about how to choose foods that provide a balanced diet, including the necessary vitamins and minerals.

These guidelines are meant to assist countries in the design and implementation of appropriate food fortification programs as part of a comprehensive food-based strategy for combating micronutrient deficiencies. Fortification of food can make an important contribution to the reduction of micronutrient malnutrition when and where existing food supplies and limited access fail to provide adequate levels of certain nutrients in the diet. To ensure that the target population will benefit from a food fortification program, an appropriate food vehicle must be selected that is widely consumed throughout the year by a large portion of the population at risk of a particular deficiency. In order to reach different segments of the population who may have different dietary habits, selecting more than one food vehicle may be necessary. Fortification of a staple food affects everyone, including the poor, pregnant women, young children and populations that can never be completely covered by social services. In addition, fortification reaches secondary at-risk groups, such as the elderly and those who have an unbalanced diet.

Food fortification is usually socially and religiously acceptable, requires no change in food habits, does not alter the characteristics of the food, can be introduced quickly, can produce nutritional benefits for the target population quickly, is safe, and can be a cost-effective way of reaching large target populations that are at risk of micronutrient deficiency.

Worldwide, the three most common forms of MNM are iron, vitamin A and iodine deficiency. Together, these affect at least one third of the world's population, the majority of who are in developing countries. Of the three, iron deficiency is the most prevalent. It is estimated that just over 2 billion people are anaemic, just under 2 billion have inadequate iodine nutrition and 254 million preschool-aged children are vitamin A deficient. From a public health viewpoint, MNM is a concern not just because such large numbers of people are affected, but also because MNM,

being a risk factor for many diseases, can contribute to high rates of morbidity and even mortality. It has been estimated that micronutrient deficiencies account for about 7.3% of the global burden of disease, with iron and vitamin A deficiency ranking among the 15 leading causes of the global disease burden [13].

In the poorer regions of the world, MNM is certain to exist wherever there is under nutrition due to food shortages and is likely to be common where diets lack diversity.

PEM

Up until the 1980s, efforts to alleviate under nutrition in developing countries were focused on Protein–Energy Malnutrition (PEM). While PEM certainly remains an important concern, we have since come to appreciate the significance of micronutrient malnutrition in terms of its effect on human health and function. As a result, the past two decades have seen an increase in activities that seek to understand and control specific micronutrient deficiencies [13].

Efforts to control iodine deficiency in Nigeria was given new impetus in the last when it was recognized that iodine deficiency was the most common cause of preventable brain damage and mental retardation in childhood.

More recently, following recognition of the essential role played by industry – in particular, the salt, food and drug industries – stronger links with the private sector have been forged. This is reflected by the implementation of several public–private coalitions aimed at addressing the main micronutrient deficiencies, which include the Global Alliance for Improved Nutrition and The Global Network for Sustained Elimination of Iodine Deficiency.

1.3. Strategies for the Control of Micronutrient Malnutrition

The control of vitamin and mineral deficiencies is an essential part of the overall effort to fight hunger and malnutrition. Countries need to adopt and support a comprehensive approach that addresses the causes of malnutrition and the often associated "hidden hunger" which rest intrinsic in poverty and unsustainable livelihoods. Actions that promote an increase in the supply, access, consumption and utilization of an adequate quantity, quality and variety of foods for all populations groups should be supported. The aim is for people to obtain from their diet all the energy, macro and micronutrients they need to enjoy a healthy and productive life.

1.4. Increasing the Diversity of Foods Consumed

Increasing dietary diversity means increasing both the quantity and the range of micronutrient-rich foods consumed. In practice, this requires the implementation of programs that improve the availability and consumption of, and access to, different types of micronutrient-rich foods (such as animal products, fruits and vegetables) in adequate quantities, especially among those who at risk for, or vulnerable to, MNM. In poorer communities, attention also needs to be paid to ensuring that dietary intakes of oils and fats are adequate for enhancing the absorption of the limited supplies of micronutrients.

The importance of animal source foods for dietary quality is increasingly being recognized, and innovative approaches to increase their production and consumption in poorer regions of the world are currently being explored [14]. Efforts are also underway to help poorer communities identify, domesticate and cultivate traditional and wild micronutrient-rich foods as a simple and affordable means of satisfying micronutrient needs.

For infants, ensuring a diet of breast milk is an effective way of preventing micronutrient deficiencies. In much of the developing world, breast milk is the main source of micronutrients during the first year of life (with the exception of iron). Exclusive breastfeeding for the first 6 months of life and continuation into the second year should thus be promoted. Moreover, all lactating women should be encouraged to consume a healthful and varied diet so that adequate levels of micronutrients are secreted in their milk. After the age of 6 months, it is important that the complementary foods provided to breast-fed infants are as diverse and as rich in micronutrients as possible [14].

1.5. Food Fortification

Food fortification refers to the addition of micronutrients to processed foods. In many situations, this strategy can lead to relatively rapid improvements in the micronutrient status of a population, and at a very reasonable cost, especially if advantage can be taken of existing technology and local distribution networks. Since the benefits are potentially large, food fortification can be a very cost-effective public health intervention. However, an obvious requirement is that the fortified food(s) needs to be consumed in adequate amounts by a large proportion of the target individuals in a population. It is also necessary to have access to, and to use, fortificants that are well absorbed yet do not affect the sensory properties of foods. Fortification of food with micronutrients is a valid technology for reducing micronutrient malnutrition as part of a food-based approach when and where existing food supplies and limited access fail to provide adequate levels of the respective nutrients in the diet. In fact, ready to eat cereals and vitamins C fortified drinks are the largest vehicle foods.

1.6. Difficulties in Implementation and Effectiveness of Food Fortification

Concerns may be raised about the possibility of overdose or a reluctance to fortify on human rights grounds where consumer choice may be an issue. There may be reluctance on the part of the food industry to fortify out of fear of insufficient market demand for fortified foods or concern about consumer perceptions that the food product has been altered. Food fortification also raises production costs through such expenses as initial equipment purchases, equipment maintenance, and quality control and assurance facilities. Economically marginalised households may not have access to such foods and other vulnerable population groups, particularly children under five years of age, may not be able to consume large enough quantities of the fortified food to satisfy an adequate level of their daily requirements [15].

1.7. Supplementation

Supplementation is the term used to describe the provision of relatively large doses of micronutrients, usually in the form of pills, capsules or syrups. It has the advantage of being capable of supplying an optimal amount of a specific nutrient or nutrients, in a highly absorbable form, and is often the fastest way to control deficiency in individuals or population groups that have been identified as being deficient.

In developing countries, supplementation programmes have been widely used to provide iron and folic acid to pregnant women, and vitamin A to infants, children under 5 years of age and postpartum women. Because a single high-dose vitamin A supplement improves vitamin A stores for about 4–6 months, supplementation two or three times a year is usually adequate. However, in the case of the more water-soluble vitamins and minerals, supplements need to be consumed more frequently. Supplementation usually requires the procurement and purchase of micronutrients in a relatively expensive pre-packaged form, an effective distribution system and a high degree of consumer compliance (especially if supplements need to be consumed on a long-term basis). A lack of supplies and poor compliance are consistently reported by many supplementation program managers as being the main barriers to success.

2. Food Security Issues

Food security has been described as an important aspect in any consideration of wealth and economic sustainability of a nation. It is generally defined as access by all people at all times to enough food for an active and healthy life [4]. Important aspects to be considered in food security issues include the availability of food stuff, the quality of the diet, the stability of supplies over time and space and access to food produced [16]. The World Health Organization [17] recommends an intake of between 2500 –3400Kcal of energy per person per day. It is recommended that an individual should consume between 65-86g crude proteins per day out of which 35g (or 40%) must be animal protein. While many developing countries have energy intake that is far below the minimum recommended daily per capita intake, the world today faces the greatest challenge of overcoming inadequate consumption of protein (especially animal protein), vitamins (vitamin A, C and folic acid) and minerals (iron) which may result in various deficiency symptoms (diseases).

Increased resource use and improvements in technology and efficiency have increased global food production more rapidly than population in recent decades [18]. World food and agricultural production, based on current trends, will therefore be sufficient to meet demand in the decades ahead. However, the world still faces a serious food crisis, at least as perilous and life-threatening for millions of poor people as those of the past. Although there is variation in the estimate of the food insecure people all over the world, available statistics show that a large proportion of the world population have problem of food insecurity. It was observed that more than eight hundred million people still remained food insecure [18, 19].

Food insecurity remains a global threat and human tragedy. [20].

The largest absolute numbers of undernourished people are in Asia, while the largest proportion of the population that is undernourished is in Africa, south of the Sahara In terms of proportionality, this was estimated at 34 percent in Africa and 23 percent in South Asia [21]. Though nutrition insecurity is generally being reduced worldwide, the problem is actually growing worse in Africa.

2.1. Consequences of Food Insecurity

Food insecurity and hunger are forerunners to nutritional, health, human and economic development problems. They connote deprivation of basic necessities of life. As such, food security has been considered as a universal indicator of households' and individuals' personal well - being. The consequences of hunger and malnutrition are

adversely affecting the livelihood and well - being of a massive number of people and inhibiting the development of many poor countries [22].

Malnutrition affects one out of every three preschool-age children living in developing countries. This disturbing, yet preventable state of affairs causes untold suffering and presents a major obstacle to the development process. It is associated with more than half of all child deaths worldwide. It is therefore the bane of a major waste of resources and loss of productivity which are common occurrences in developing countries. This is because children who are malnourished are less physically and intellectually productive as adults. As such, malnutrition is a violation of the child's human rights [23].

Over150 million children under five years of age in the developing world are underweight. In sub - Saharan Africa, the number of underweight children increased from 29million to 37 million between 1990 and 2003 [24]. Furthermore, poverty, hunger and malnutrition have been identified as some of the principal causes of increasing and accelerated migration from rural to urban areas in developing countries. Unless these problems are addressed in an appropriate and timely fashion, the political, economic and social stability of many countries and regions may well be seriously affected, perhaps even compromising world peace [12]. This is because hunger and poverty can provide a fertile ground for conflict, especially when combined with factors such as unequal difficulty in coping with disasters [24]. Hunger and malnutrition are the major causes of deprivation and suffering targeted by all other Millennium Development Goals (MDGs). This is illustrated by Diouf [25] as follows: Hungry children start school later, if at all, drop out sooner and learn less while they do attend, stalling progress towards universal primary and secondary education (MDG 2).

Poor nutrition for women is one of the most damaging outcomes of gender in equality. It undermines women's health, stunts their opportunities for education and employment and impedes progress towards gender equality and empowerment of women (MDG 3).

As the underlying causes of more than half of all child deaths, hunger and malnutrition are the greatest obstacles to reducing child mortality (MDG 4).Hunger and malnutrition increase both the incidence and the fatality rate of conditions that cause a majority of maternal deaths during pregnancy and childbirth (MDG 5).

Hunger and poverty compromise people's immune systems, force them to adopt risky survival strategies, and greatly increase the risk of infection and death from HIV/AIDS, malaria and other infectious diseases (MDG 6).

Under the burden of chronic poverty and hunger, livestock herders, subsistence farmers, forest dwellers and fisher folk may use their natural environment in unsustainable ways, leading to further deterioration of their livelihood conditions.

Empowering the poor and hungry as custodians of land, waters, forests and biodiversity can advance both food security and environmental sustainability.

2.2. Agricultural Issues Concerning Food Security in Nigeria

The ultimate aim of agricultural production is to get agricultural products to the consumers in the form that will be useful to them. Food items including meat, fish, milk and products, eggs and products, fruits, vegetables, cereals, legumes, roots and tubers are some of the common agricultural products consumed by people in Nigeria.

Although agriculture contributes 42 percent of the GDP, provides employment and a means of livelihood for more than 60 percent of the productively engaged population, it receives less than 10 percent of the annual budgetary allocations (3.2 billion in the 2013 expenditure projections).

2.3. Realizing Agriculture's Potential to Reduce Hunger and Food Insecurity; Getting Agricultural Policies Right

Moving from the global dimension to focus on the national level, there is general consensus on agriculture's positive contribution to food security through its role in increasing the availability of affordable food and the incomes of the poor. There is however, a notable lack of consensus over the steps needed to achieve this. In looking at this aspect of the hunger and food security debate, two key questions emerge:

1. Should policy makers focus on self sufficiency or on increasing the ability of their countries and people to access the food they need?
2. What agricultural strategies will have the greatest impact on alleviating hunger and food insecurity?

Essentially agriculture's contribution can be framed in two key criteria:

1. Increasing the availability of food at prices that poor people can afford.
2. Providing improved jobs and incomes that will give poor people the means to access food. To these two agriculturally 'specific' issues a further third dimension should be added: the extent to which increased incomes result in improved nutritional outcomes for individuals and these are considered below.

2.4. Increasing the Availability of Affordable Food

In many developing countries and for the developing world as a whole, increased production of staple foods has comfortably outstripped population growth since the mid- 1960s when the Green Revolution began to be adopted widely. Only in sub-Saharan Africa has the population grown faster than food supplies during the past 30 years.

At the individual country level, increased production of food grains can lead to a dramatic reduction in prices. This is of great benefit to the poor, both in urban and rural areas where many people buy and grow their own food.

Elsewhere however, especially in Africa and mainly Nigeria, increasing production has been a double-edged sword for food security because increases in yields have not been substantial enough to protect producers from falling prices. There are a number of reasons for this, including thinner (and therefore more volatile) markets and higher transport costs that result in surpluses flooding local markets.

2.5. Generating Sufficient Income To Allow People To Access Food

In looking at the other side of the hunger equation; improving access to food through increasing incomes: – it is, for analytical simplicity, helpful to look at the impact of increasing agricultural productivity in three main areas:

• Direct impact on farmers' incomes, including those of smallholders;

• Impact in terms of increasing rural employment opportunities and rural wage rates including those in the non-farm rural economy; and

• Wider impact on economic growth and poverty reduction more generally

2.6. Higher Incomes for Farmers, Including Smallholders

Evidence shows that agricultural growth has increased farmers' (including smallholders') incomes from agricultural production and immediate downstream processing enterprises.

Thus, IFPRI argue that in Zimbabwe, there was a 'smallholder green revolution' during the 1980s in maize and sorghum production in which yields more than doubled and 95% of crop area was planted with improved varieties [26]. Lele and Agarwal [27] cite evidence from Kenya, arguing that small and large scale farmers exist alongside one another, grow the same crops, and sell them in the same markets at similar prices.

Real wages have risen [28], although many of the additional off-farm jobs are linked to the expansion of farming. Thus, we know that both small- and large-scale farmers can achieve higher incomes as a result of agricultural growth.

2.7. Increased Employment Opportunities and Higher Wages In Rural Areas

Accelerated agricultural development particularly increasing agricultural productivity typically creates more jobs and, depending on levels of unemployment and underemployment, pushes up wage rates both on- and off-farm.

On farm, increasing agricultural productivity increases demand for labour in preparation, planting, weeding and harvesting and can result in higher wage rates. While intensification may involve some labour-economizing measures, the ability to double and even triple-crop the land has been shown to consistently increase the demand for labour, even if unit labour use falls [29]. Leavy and White [30] note that in rural Africa, employment opportunities exist not only on large commercial farms but also in the smallholder sector in which there is an active labour market.

Agricultural development also generates new and better-paid jobs off-farm for the poor through linkages between agriculture and the wider rural economy. The combination of extra jobs within and outside farming can have strong effects on rural labour markets, pushing up wages and improving the ability of the poor to buy food.

2.8. Impact on the Wider Economy and Growth

Looking to the impact on the wider economy, cross-country comparisons find a strong relationship between progress in agriculture, broader economic growth (i.e. that in the nonagricultural sector) and progress in reducing poverty throughout the economy. Generally, the countries that increased agricultural productivity most rapidly have also witnessed the most significant reductions in poverty. Ashley and Maxwell [31].

2.9. The Impact of Commercialization on Food Security

Since the 1980s, there has been concern that the commercialization of agriculture, that is, more production for the market and less for subsistence, could undermine food security and poverty reduction. In some cases, this concern results from a narrow preoccupation with household-level self-sufficiency as central to food security, and a lack of recognition of agriculture's role in ensuring access to food. There are other concerns though, including:

- Market prices vary over seasons but poor households often sell their crops at the lowest price because of an urgent need for cash for credit payments, school fees, medical bills, etc;
- Since women do not market commercial crops, they lose control over income and household food supply.
- Crops produced for market are seen to offer a less direct route to improved nutrition than stable production of staple foods.
- This tends to lead to
- Increased staple food production: – risk aversion prevented smallholders from specialising completely in high-value crops and they continued to grow subsistence staples;
- Increased demand for farm labour and use of hired labour; and
- Generally higher incomes and better child nutrition – but with low elasticity from incomes to child nutrition (i.e. a relatively large increase in income is required for a more modest increase in nutrition).

When commercialization left smallholders worse off, it was more often the result of bad policy rather than a function of commercialization itself [32].

2.10. The Impact of Cash Cropping on Food Security

One particular manifestation of commercialization is cash cropping. Whilst commercialization can include market-oriented production of staple food crops (for example maize, wheat or rice), cash cropping involves crops produced for cash that have a higher value than those consumed for food within the household. It also tends to require a greater degree of specialization [33]. Cash crops in farming systems was generally more likely to have a positive impact on household-level food security when cash crops:

- are grown by both men and women;
- are farmed in combination with marketable food;
- generate regular rather than periodic cash flows with early rather than delayed income flows; and are processed locally.

2.11. Hunger, Undernourishment and Food Insecurity.

Despite a dramatic increase in global food availability and substantial progress in poverty reduction, hunger, food insecurity and undernourishment remain at unacceptably high levels and progress in addressing this dimension of poverty has been disappointingly poor. The consequences of undernourishment are severe and their reach is wide. While only one of the Millennium Development Goals (MDGs) has a specific target for hunger, which is defined as 'uncomfortable or painful sensation caused by a lack of food. Hunger can be experienced temporarily by people who are not food insecure, as well as by those who are' [34]. The term is used to refer to the MDG and people's experience of food insecurity. In contrast, 'food security' is a term more useful for policy analysis and understanding the underlying causes of hunger. Most people accept that agriculture, or at least the part that produces food is linked to hunger and food insecurity, but that the link is not necessarily direct or linear. Most also accept that producing more food will not necessarily alleviate hunger. The world already has more than enough food to feed its population adequately. The problem is that of adequate distribution to the population that needs the food.

2.12. The Implications of Hunger for Poverty Reduction and the Mdgs

The consequences of undernourishment are severe. Most directly it causes malnutrition, which leads to higher rates of child mortality and morbidity, affects the development of children in their early years and reduces labour productivity of adults. When young women are malnourished, it raises the chances of maternal mortality and makes it probable that they will give birth to babies of low weight that are at risk of early death or likely to show slow early growth. Female babies of low weight are likely to become undernourished young women. Thus the cycle of nutritional deprivation can transmit disadvantage across several generations [35, 36].

Less directly, hunger and food insecurity may force people to undertake risky activities (e.g. prostitution, crime or migration) in a desperate bid to find food and work. Frequently, where mass migration takes place, it is the spread of diseases like measles and diarrhea that leads to mortality, rather than hunger directly [37].

The consequences of hunger and food insecurity also thwart progress towards other MDGs. Malnutrition erodes human capital, affecting people's resilience to shocks and reducing their productivity, with a significant impact on income poverty. In addition, the goal of empowering women is impeded by the damaging alignment of inequality and malnutrition. Improved nutrition can break this vicious cycle because dealing with malnutrition empowers women more than men and improved nourishment of girl's correlates with better school attendance and socio-economic status. Behrman, *et al.* [38].

In contrast, malnutrition compromises maternal health, is directly or indirectly associated with 60% of all child mortality, and hastens the onset of opportunistic infections and AIDS among HIV-positive individuals [39], thus directly frustrating the achievement of MDGs on maternal health, child mortality and combating HIV/AIDS and other diseases.

Underfunding in this regard is central to the crisis of food production, and food security in Nigeria. It is explains the persistence of poverty. The loss of food sovereignty and the dependence on food importation is also making the country quite susceptible to fluctuations in global food crisis. This is why Nigeria was also strongly affected by the global food crisis in 2007/2008 [8]. The connections among dwindling food production capacity, rising food prices, and dependency on food importation are nowhere more clearly demonstrated in recent times than in the Sahel food crisis, which also affects many of the 11 northern states of Nigeria situated in the Sahel belt: The National Emergencies Management Agency [NEMA] says roughly 30 percent of the population [about 15 million people] in this region are food insecure. Other research findings also have established strong correlation between hunger and the rising trends in poverty: Those who are poor lack the basic access to market their goods and they are unable to vary or enrich their diets. Furthermore, poverty and hunger are perpetual urban phenomena, largely due to rapidly shrinking employment opportunities and high costs of living. Compounding the problem is the seemingly irresolvable incoherence in government's policy formulation and implementation strategies. For example, as a response to the recent food crisis in the country Nigeria's federal government, through its federal ministry of agriculture [FMA], facilitated the development of a National Food Crisis Response program [NFCRP]. The Food Security Thematic Group [FSTG] was also established (2009); and the Food and Agricultural Organization (FAO) was invited to provide guidance. Despite demonstrated efforts at building institutions to address hunger and poverty in the country, no further step has since been taken to consolidate set agenda. Only a few months ago, the Nigerian Agricultural Transformation Agenda (NATA) was set up by the Ministry of Agriculture. Recognizing in general that most African countries are failing to allocate no less that 10 percent of their annual budget commitment to agricultural development and food production (in accordance with the Maputo Declaration of 2003), regional organizations on the continent have proceeded on campaigns partly aimed at creating and developing alternative regional and continent wide agriculture policy frameworks. There is the ECOWAS Agriculture Policy [ECOWAP], and the Common African Agriculture Development Program [CAADP]. Under the ECOWAP-CAADP process, each country is to develop and sign an agreement on poverty and hunger alleviation measures with ECOWAS and the AU; and proceed to develop National Agriculture Investment Plans [NAIPS]. Still, commitment to improve food security does not occupy priority place in the policies of participating African countries; and there is a lack of synergy between the NAIP process and the earlier NFCRP. Therefore conscious effort should be made to reverse the trend.

2.13. Poverty

Poverty reduction improves the quality of life of the people and provides them with the means to acquire and maintain their basic needs but the country remains vulnerable to hunger and poverty.

For example, more than 60 percent of Nigerians are living on less than US$1 per day [40]. According to Oguntola [41], the country ranked 20 on the 2006 Global Hunger Index (GHI).Similarly, the nation's rank in the Human Development Index (HDI) remains low, being the 152nd out of 175 countries [42]. The low HDI score reflects the situation of poor access to basic social services in the country. This attests to the insecure status of the nation. These days, corruption is a major cause of poverty in the country.

2.14. The Relationship between Increasing Incomes and Food Security: – The Importance of Other Factors

Changes in food intake and nutrition are not simply or only influenced by income. Empirical work consistently demonstrates that malnutrition is, perhaps surprisingly, only weakly correlated with increasing economic wealth. Evidence indicates that other factors also play a role, although their importance, including the relative importance of income changes varies significantly between places, over time and between different groups in society [43]. The most important of these factors are:

- Women's health;
- Women's literacy;
- Health facilities; and
- Safe water and good hygiene

2.15. Importance of Food Safety in Addressing Food Insecurity

The index for determining food insecurity includes among others, the household ability to buy enough wholesome food, with adequate quality and appropriate nutritional value required by adults and children .All countries need adequate food control programs to ensure that national food supplies are safe, of good quality and available in adequate amounts at affordable prices to ensure an acceptable nutritional and health status for all population groups. The mandatory requirement to use Hazard Analysis and Critical Control Points (HACCP) systems in all countries need to be considered strengthened and utilized by our food control agencies. Food control includes all activities carried out to ensure the quality, safety and honest presentation of the food at all stages from primary production, through processing and storage, to marketing and consumption. Food control is linked to improvement in the health of the population, potential for a country economic development and reduction of spoilage and food losses. According to Ifesan [44], key parameters of food safety include: 1: Prevent contaminating food with pathogens spreading from people, pets and pests.2. Separate raw materials and cooked foods to prevent re-contamination.3. Cook foods for the appropriate length of time and at the appropriate temperature to kill pathogens .4. Store food at the proper temperature. 5. Use safe water and raw materials.

3. Emerging Issues on Food Safety and Food Security

3.1. Biotechnology and Food Production

While agricultural output increased as a result of the Green Revolution introduced in Nigeria in 1987, the energy input into the process and the over reliance on chemical fertilizers, and herbicides, some of which are developed from fossil fuels have made agricultural produce a major source of biological and chemical contamination. Biotechnology may help achieve the productivity gains needed to feed a growing global population, introduce resistance to pests and diseases without costly purchased inputs; heighten crops tolerance to adverse weather and soil conditions, improve the nutritional value of some foods, and enhance the durability of products during harvesting or shipping. New crop varieties and biocontrol agents may reduce reliance on pesticides, thereby reducing farmers' crop protection costs and benefiting both the environment and public health. Biotechnology based agriculture combines elements of ecological agriculture with crop varieties designed to perform well under low-input and stress conditions, uses in organic inputs very judiciously, and engages farmers themselves in analyzing their needs and adapting new varieties and agronomic practices to their own conditions. Greater commitments and new partnerships are needed to sustain and expand this revolution in agriculture to small scale farming families across all Africa. Biotechnology research could aid the development of drought-tolerant and insect-resistant crops, to the benefit of small farmers and poor consumers. Research on genetic modification to achieve appropriate weed control can increase farm incomes and reduce the time farmers spend weeding, allowing more time for the childcare that is essential for good nutrition. This technology may also offer cost-effective solutions to micronutrient malnutrition, such as vitamin A- and iron-rich crops.

At present, there is very little commercial utilization of results from modern biotechnology research in developing countries. As a result, the potential contributions of biotechnology to poverty alleviation, enhanced food security and nutrition in developing countries have received little attention, beyond blanket statements of support or opposition [45].The quality of food and food plants can be modified and optimized to meet the nutritional and health needs of compromised populations prevalent in most of the developing countries. High rates of malnutrition, infectious disease as well as diet-related diseases such as diabetes and hypertension are prevalent in many developing countries. These are as a result of compromised immune function, inadequate sources of nutritious and quality foods and limited access to healthy and suitable foods. Biotechnology and genetic modification techniques have been proposed and applied for the improvement of the quality of various food crops. These have typically been geared towards increasing yields and pest resistance of cash crops. Furthermore, the application of biotechnology techniques for the development of functional food plants with higher levels of bioactive components or increased availability of nutrients would greatly benefit most populations in developing countries and improve the health and nutritional status overall [46]. In certain areas, biotechnology and genetic modification techniques are being optimized for the production and development of healthy foods, and improvement in the levels and activity of biologically active components in food plants (phytochemicals). While there has been some hesitation with regard to the acceptability and adoption of biotechnology products in certain developing countries, achievements such as the development of high vitamin-A rice have greatly increased the acceptability of biotechnology for human food applications among hitherto skeptical consumers. The production of increased levels of beta-carotene (the precursor to vitamin A) in plants is especially important, as its precursor, lycopene has been shown to have physiological chemo-preventive effects with regard to various cancers. Furthermore, lycopene, commonly found in various carotenoid containing plants such as tomatoes and carrots, is an essential ingredient in maintaining eye health and

vision. Modifications that have been targeted and developed by various biotechnology companies include improvement in the oil content and composition of oil seeds such as legumes [47]. Improvement in soybean oil quality includes stabilization of the unsaturated fatty acids by increasing levels of the antioxidant, vitamin E. These successes indicate a relevant and important role for biotechnology in improving food quality and developing functional foods, particularly those targeted for needy populations in developing countries, such as children and pre-natal women [46]. Specifically, the use of transgenic crops results in:- More sustainable and resource-efficient crop management practices that require less energy and fuel and conserves natural resources.- More effective control of insect pests and weeds.- A reduction in the overall amount of pesticides used in crop production, which impacts positively on biodiversity, protects predators and non-target organisms and contributes to a safer environment.- Less dependency on conventional pesticides that can be a health hazard to producers and consumers; the potential health benefits associated with fewer pesticide poisonings from *Bt* cotton in China is an important finding, with significant implications for other developing countries where small farmers may be at similar risk from heavy and over-use of conventional pesticides.– Bt maize, which has reduced levels of the fumonisin mycotoxin provides safer and healthier food and feed products.- Greater operational flexibility in timing of herbicide and insecticide applications, resulting in conservation of soil moisture, structure and nutrients; also, control of soil erosion through no or low-tillage practices as well as improved quality of ground and surface water with less pesticide residues.

Biotechnology can play its appropriate and essential role in achieving food security in Nigeria. The experience of China and South Africa, that are already deriving significant benefits from GM crops, can be shared with Nigeria which faces similar challenges [48].

3.2. Adapting Biotechnology for Increased Crop Production in Nigeria

What is needed in Nigeria is an understanding that goes beyond conventional, orthodox wisdom to work more strategically in developing and implementing effective, international, national and regional policies. Funding for research in general is at a dismal low in Nigeria. The intrusion of intellectual property rights into the arena of crop improvement, while beneficial to the economies of the developed world is making the lives of many researchers even more difficult.

Production of genetically modified crops is not a complex technology and is clearly within the capabilities of national research institutes in many developing countries. Genetic modification of crops using recombinant DNA technology is also within reach of the institutes of the International Institute for Tropical Agriculture (IITA) in Nigeria.

The private sector leads in every aspect of the agricultural biotechnology revolution and activities in the public sector will have to marshal the strength of the private sector through public-private partnerships.

Biotechnology has a beneficial sociological dimension. But then, only those who can see tomorrow are alive today. Pending the time biotechnology fully matures to fruition, in respect of food security and human nutrition, steps must be taken to maximize the use of biotechnology to achieve food security.

3.3. Implications of HIV/AIDS for Agriculture, Hunger and Food Security

The HIV/AIDS epidemic is both a cause and effect of food insecurity. It is understood that prostitution from both male and female sexes results from a need to be secure and the most prominent is food security. Rates of infection, viral loads and opportunistic infections will rise with malnutrition, which lowers immunity. In turn, the epidemic is likely to contribute to food insecurity as those living with the virus lose labour time and capital to the effects of the disease. The general picture is largely agreed, but evidence of the detail and the strength of the socio-economic processes occurring are incomplete. In particular, little is known for certain about how the epidemic may affect farm production within the context of overall economies that are also suffering the impacts of epidemic disease. Losses of labour and labour productivity immediately catch the eye, but the loss of capital as funds are diverted to health care may be equally important. Indeed, it can be argued that since populations of even the worst affected countries are expected to grow, and with them their labour forces, then the potential for reduced capital investment per worker is the more pressing concern both for the overall economy and for agriculture. A tentative conclusion is that HIV/AIDS will have only a limited effect on the supply side of food security the land will not disappear and the rural labour force will increase despite the ravages of the epidemic; but that it will strike hard at people's access to food, and undermine the utilisation of food by those who are HIV-positive [49]. The policy implications in this case point towards the demand for food and how to replenish lost capital. There is an alternative hypothesis by De Waal and Whiteside [50]. They highlight four factors that characterize those affected by the HIV/AIDS epidemic: a) Household labour shortages; b) Loss of assets and skills due to adult mortality; c) The burden of care for sick adults and orphans; and d) The vicious interactions between Malnutrition, HIV infection and

progression. The combined impact of these may undermine the effectiveness of longstanding strategies to cope with the threat of famine, or in some cases coping strategies may be rendered impossible or dangerous. Food insecurity may then degenerate into famine in which households affected by AIDS face outright starvation. However, the hypothesis remains just that and there is no evidence to corroborate the theory.

3.4. Previous Governments' Efforts at Achieving Food Security

Over the years, Nigeria has made several attempts to address the issue of increased food production in both quantity and quality. Some of these attempts have cumulated into several programmes and projects aimed at boosting agricultural production. The central objective of these programmes was to increase food production thereby solving the problem of food insecurity and poverty. Despite successive strategies and programmes implemented in the country, food and nutrition insecurity are still rampant in the country. Food security policies and strategies appears to yield dividends in some cases, however, absence of official bilateral exchange of strengths and weaknesses of other country's food security strategies seems to limit the potentials of policies in ensuring food security. Successive governments came up with different programmes and policies such as;(1) Operation Feed the Nation, mass mobilization and mass awareness programme on food production.(2) The River Basin Development Authority aimed at harnessing the potential of existing water bodies through irrigation services, fishery development and control of flood, water pollution and erosion.(3) Agricultural Development Project aimed at enhancing the technical and economic efficiencies of small-scale farmers.(4) Green Revolution aimed at accelerating the achievement of the general agricultural sub-sector objectives.(5) The National Special Food Security Programme was aimed at offering a practical vehicle for piloting and eventually extending the application of innovative low cost approaches both technical and institutional to improving the productivity and sustainability of agricultural system with the ultimate objective of contributing to better livelihoods for poor farmers on a sustainable basis.(6) The National Fadama Development Project (Fadama I, II, and III) aimed at addressing some of the factors that militate against the full realization of the potential benefit of agricultural production activities. In the 70s the Government introduced the National Food Operation programme and the Nigerian Agriculture and Cooperative Bank was established to fund agriculture and assist farmers. This was followed by Operation Feed the Nation in 1976. The programme was fashioned to revolutionize agricultural sector of Nigerian economy, which was derailing from its normal contribution to the economy. For instance, between 1965 and 1970 the percentage shares of agriculture in total GDP was54.8 (Table 2). This dropped to 38.6 percent between 1971 and 1975 and reduced further to 21.1percent in 1976 to 1980. To make the programme effective, farmers most especially in the rural areas were taught farming practices and agriculture was made compulsory in all secondary schools. In addition, eleven River Basin Development Authorities; (R.B.D.A) were established to facilitate irrigation agriculture as an attempt to expand farmland. Also, farm settlements were established for cash and food crops to reduce food importation. Government's efforts between 1981 and 1985 yielded good fruit as the contribution of agriculture to GDP rose from 21.1% to 35.4%. This was the result of the implementation of Green Revolution Program of Sheu Shagari Administration which complements the R.B.D.A Programme. The Military Administration of General Badamosi Babangida in 1986 came up with rural infrastructure development programme and established the Directorate of Food, Rood and Rural Infrastructure (DFRRI). The programme was to open up rural areas for effective agricultural activities and boost food production. The effort raised the contribution by agriculture to 39.9%. The trend changed since 1991 and the contribution has been decreasing and Nigeria has been depending more on food importation. This was the period of 'essential commodity' and the beginning of high level of corruption in high places in the country. People collect money for contracts which were not executed; fictitious importation of food and machinery for agriculture, the River Basin Development Authorities became conduit pipes for siphoning money. This was the situation until 1999 when a democratic government was sworn in.

The democratic government headed by President Olusegun Obasanjo had so many policies and programs; reorganizing, restructuring, privatizing institutions and agencies and be in partnership with some others to make impact. All these have positive impact on agricultural production and consequent improvement in the contribution of agriculture to total gross domestic product (see Table 3). The table shows a sharp increase in contribution from 24.6 percent between 1996 and 2000 as against 42.20 percent in 2007. Despite all these efforts, not less than 65 percent of Nigerians are food insecure [51]. Virtually all the programs and policies were beautiful and fulfilling but they could not achieve their set objectives because of over dependence on the 'Black Gold' which has become the major foreign exchange earner on which the economy depends. For Example, U. S import from Nigeria in 2007 was US$32.7billion consisted predominantly of oil, whereas U.S. Export to Nigeria for the same period worth $2.2 billion and wheat happens to be one of the major items (Table 4).

As rightly observed by International Labour Organization [52], it is unfortunate that our leaders are more interested in importing even those food items that can be produced in the country e. g. rice (The recent efforts by Taraba, Kwara, Niger and other states along the river Niger and Benue to increase rice production is commendable). This negates Adam Smith's Theory which postulated that a country should not import commodities especially food items that can be produced locally. Rather the government should support agriculture and re-position the economy through creation of conducive environment for agricultural production instead of food importation.

3.5. Nigerian Agricultural Transformation Agenda (ATA).

The new Agricultural transformation agenda of the Federal Government among other objectives, seeks to promote the use of local crops in industrial food production, thus enhancing their use in the food value chain. Recent efforts by the present administration includes but not limited to:

1: The Nigerian Sugar master plan being implemented by the Nigerian Sugar Development Council (NSDC). This is to make Nigeria self-sufficient in sugar production and make for export.

2: The Nigeria Cassava Revolution Plan has the following objectives;

- ✓ To achieve up to 40% substitution of cassava flour in wheat flour that is used in bread production and a subsequent increase in the market for cassava tubers of more than 800,000mt.
- ✓ Create new opportunities for native and modified starch by raising production level to 300,000mt by 2015.
- ✓ To take advantage of new global market opportunities for dried chips by producing 900,000mt of cassava chips for export.
- ✓ To expand market opportunities for the use of cassava as a sweetener (High Fructose Cassava Syrup) in the soft drinks industry by producing up to 200,000mt of high fructose cassava syrup.
- ✓ To take advantage of emerging market opportunities in fuel ethanol by utilizing cassava to produce up to 1.2 billion litres of ethanol, using up to 11 million mt of cassava tubers.

3: The Nigeria Rice backward integration project to help re-invent our Rice mills and create new mills for rice processing. If and when all these measures are fully implemented, a lot of jobs will be created generating a lot of revenue and food security will be achieved.

3.6. What are the Best Agricultural Development Strategies?

There is probably less of a consensus now particularly amongst development agencies on the best (in terms of impact on poverty and hunger) agricultural development strategy than at any time over the past half-century or longer [31]. This is particularly true of Africa, where an unsuccessful model based on improving performance through technology supported by publicly owned development agencies has been replaced by the equally disappointing response of farmers to the liberalization of markets.

Key points in the debate are considered below. Where development efforts should be focused to achieve the greatest return in terms of reducing poverty and hunger?

- Should they be focused on high-potential areas where development options are greatest, or
- In the poorest areas where there are fewer potentials and options, but where poverty is greatest?

Here the debate sees at least three positions:

1. Accept the demise of the peasantry and work with large-scale farmers whose success will act as a catalyst to generate wealth and jobs for those whose farms are not viable. Proponents of this view [53] identify changes in global supply chains as being major new obstacles to smallholders that will prove insufferable for many or most.

2. Work with smallholders, but accept that most innovation, investment and commercialization will come from only that (possibly very small) portion with more land and capital than the average. Some claim that these farmers will then create enough jobs locally, through hiring labour and spending on local goods and services, to boost the welfare of other farm households [54].

3. Focus on the poorest and most disadvantaged smallholders to tackle poverty and hunger and reduce vulnerability directly [26].

Should they focus on less favoured areas? These include poor households in areas of low agricultural potential that are remote from markets and supplies of inputs. There are two positions on this question:

1. In remote areas, employment opportunities in the rural non-farm economy are often limited. Thus, in spite of poor prospects in farming, people are heavily dependent on crops and livestock for their livelihoods. The promotion of and investment in agriculture should therefore be viewed as a safety net provision in itself, irrespective of whether such agriculture is contributing to growth.

2. In many of these cases, food security will be assured more by the ability to buy food, rather than by trying to produce more. The questions posed for such areas are those of jobs and incomes. The difficulty lies in trying to

create jobs where resources and infrastructure are scarce and markets remote. The answer probably lies in a combination of marginal agriculture, forestry, fishing, tourism, public employment in provision of services and physical infrastructure (and its maintenance), public transfers for social protection and regional equity and in migration to work elsewhere [55]. Agricultural development may not, in these areas, be a prime mover in reducing poverty and improving food security.

What is the role of technology? Should development efforts focus mainly on yield-raising technology or on less intensive approaches that minimize variation?

Which is the better option: high-yielding hybrid maize with fertilizer applications or lower-yielding open-pollinated varieties requiring less fertilizer?

Which crops? Should the accent be on crops that will be largely consumed within the household or on income-generating cash crops?

4. How Nigeria Can Attain Food Safety and Food Security

The concept of food problem is complex and goes beyond the simplistic idea of a country's inability to feed its population. Though, the issue of serious food and nutrition problem is associated with less developed countries, the main dimensions of the problems in individual countries have however not been subjected to serious analysis. This has encouraged misleading generalizations about the causes, effects and remedies for the problem [56]. The fight against hunger therefore demands an integrated set of actions which simultaneously addresses the causes of food insecurity.

The root problem of inadequate access to food is poverty. This is in the sense of the failure of the economic system to generate sufficient income and distribute it broadly enough to meet households' basic needs. The problem can be addressed by either giving food directly to the poor (non-market distribution of aid); increasing their incomes so that they have greater entitlement to food through the market (given existing marketing costs); and/or reducing the costs of food delivered through markets by fostering technical and institutional innovations in farm-level production and the marketing system [57]. Educated Nigerian women can do a lot to curtail mortality rate. Some processes are irreversible, yet their speed can be reduced and their completion delayed. Death is one of those irreversible processes. It too can be delayed. And that is the ultimate aim of food security. Food security goes hand in hand with food safety. Without food safety, food security is worse than food insecurity.

- Post conception, women are the biological-reactor vessels for child-bearing and child-suckling, to the exclusion of men, who remain child-like to wives (and girl friends!) in respect of their food and nutrition supplies. Role of women as care givers will ever remain glorified, even if men protest. These known themes, 'food not wasted is food secured' and 'money not wasted is food secured', which Nigerian women are yet to fully understand as is evident in too much food being seen in waste baskets and money spent on food wasted at parties. Precaution precedes prevention and sprouts development and growth of healthy body with a healthy mind – enhancing clarity of thought and efficiency of effort.
- The governance of food safety has long been regarded as the domain of "experts" and professional risk managers, with minimal input from other interested parties such as consumers. However, a number of food safety incidents in Europe for example, related to genetically modified organisms, bovine spongiform encelophathy and dioxins have severely damaged public trust in food safety regulation and management. This exposed a need for improvement in the current approach to food risk analysis.

Major challenges and solutions to food security in Nigeria may be outlined as follows:

(1) Inadequate investment in agriculture: Annual agriculture growth rate should be sustained at no less than 9.5 percent. Budgeted allocation to Agriculture should meet the 10% set target.

(2) Support for small holder farmers: Since over 80percent of farmers are small holder farmers, and over 75 percent of women in rural Nigeria are engaged in agriculture, these must be the major beneficiaries of government financial and other forms of material assistance.

(3) Policy incoherence and inconsistencies: The National Agency for Small Scale Agriculture Development [NASSAD] must endeavor to develop and harmonize its agricultural policies with other agencies active in promoting food production in the country.

(4) Basically, the problem of food security is organically linked to poverty and to low agriculture productivity; with this in view, it is important to address the capacity and production needs of smallholder farmers, and to pay particular attention to those obstacles impeding women farmers' ability to maximize their capacities in food production.

(5) Since food security and sustainable agriculture have become burning issues in the country, plans should be made for a changing global climate and increasing global population. One of the most important environmental challenges

facing the developing world is how to meet current food needs without undermining the ability of future generations to meet theirs thus agricultural production must be sufficient to feed us now and in future. Evidently, the current state of agricultural technology will not suffice to meet the production challenges ahead. Innovative technologies have to be exploited in order to enable sufficient food availability in the future. In the current practice of modern agriculture which relies on high inputs such as fuel-powered tractors, chemical fertilizers and chemical pesticides, deploying a smart mix of farming techniques using genetic engineering of biotechnology and integrating same into the traditional smallholders farming system offer a bright prospect of meeting the growing demand for food by improving both yield and nutritional quality of crops and reducing the impact on the environment.

Other tools of particular importance are the standards regarding food hygiene and food safety (ISO 22000), but there are also other important systems such as quality management (ISO 9001), Environmental management (ISO 14001).

The National Agency for Food and Drug Administration and Control (NAFDAC) is responsible for ensuring the safety of food, agricultural products and drugs which are either imported, exported or produced for domestic consumption in Nigeria. NAFDAC recently completed a detailed analysis of laboratory "sample cycle test". A measurement of how long it takes a laboratory to test a given product and determine if it meets the required safety and quality criteria.

4.1. Food Safety and Food Security through Regulations and Enforcement

One of the simplest measures that any country can have to prevent the spread of food borne illness is to properly establish food safety policy and regulations for enforcing food laws and codes of practices. Development of effective and efficient food safety laws in our country is major to this challenge. It is therefore imperative for the Federal Government to take advantage of the present emerging issues on food trade and promulgate the relevant food safety regulations and codes of practices in Nigeria and focus on agribusiness.

4.2. Transforming the Economy through Food Safety and Food Security

Food security and safety is one of the reliable tools to transform the economies of the citizenry and our rural folks. Compliance with international trade rules and regulations, in particular the WTO agreement on Sanitary and Phytosanitary Measures (SPS) through the establishment and or strengthening of national institutions like Food and Drugs Administration NAFDAC and SON by way of capacity building is one of the means to achieve this goal. The recent creation of a directorate of food at NAFDAC is step in the right direction.

- ✓ Increased Food Cultivation: - This is essential in making food available for consumption at all times and to provide enormous quantities of raw materials for existing and new food and agro processing and production industries. If this is to be a success, mechanized agriculture is the way to go and equipment leasing, sales and maintenance outfits should be encouraged to cater for this sector.
- ✓ Increased Livestock Production: - Production of fish, poultry, cattle, pigs, goats and other livestock must be increased adequately through various programs so as to provide raw materials for abattoirs and slaughter houses that will spring up including the existing ones.
- ✓ Enhancement of production activities/value addition:- Up to 55% agricultural produce in Nigeria never make it out of the farms and several more rotten or get destroyed in transit, at depots and at the markets without consumers and farmers getting value from it. This is worrisome despite the fact that many of our agro products can be enhanced in value by turning into semi immediate, intermediate and final products for industrial and domestic usage.
- ✓ Improved and Regulated Agricultural Imports and Supply sector:- This consist of ways to improve access to machinery, equipments and replacement parts, seedlings use, access to fertilizer, regulated pesticides, herbicides and fungicides usage.
- ✓ Post-Harvest Technology Development and Utilization: - **Quality** cannot be improved after harvest, it can only be maintained. Appropriate utilization of technology like cold storage, quick harvester, sizer separator, and debris separator e.t.c either on the farms or congregating area like depots will help reduce incidence of post-harvest food losses and wastages, preserve the food product before its use as direct consumable or intermediate production utilization.
- ✓ Strengthening Food Laws and Standards to improve Food Safety: - In reality, we need to re-align our food laws and standards to reflect new trends in food processing, preservation, storage and production. Some of our laws are peculiar to us while many need to meet international norms.
- ✓ Improved Performance of Food Safety Regulators: - Exposure to adequate training and recruitment of new/fresh brains to re-organize, re-orientate and re-energize them to meet up in their regulatory duties. Effort should also be geared towards making them self-funding. Also, private analysts, developmental

laboratories to be monitored and regulated by the regulatory bodies should be licensed to help expand their scope of work.

- ✓ Regulating and facilitating products Exports: - When our food products are properly cultivated/ reared, processed/value added, properly labeled while all these processes are monitored and an assessment profile of the products can be provided on request, our exports will greatly improve and this will boost our economy.
- ✓ Expanded and Improved Animal Health and Veterinary services: - This sector calls for greater attention than it presently enjoys. Workers in this sector should be motivated to carry out more research and more regulatory activities on animals' health that is fit and proper for consumption. More new faces should be encouraged to come into this very important anchor sector of the integrated food chain.
- ✓ Integrated Feedstock Production:- Except in fish and poultry section, no other animal production section enjoys leverage on feedstock production in Nigeria whereas we have large quantity and quality of feedstock left to waste on farms after harvesting most of our food raw materials. This should be harnessed to provide raw materials for factories, integrated feed mills that are interested in catering to the feeding needs of cattle, horses, goats and other livestock. This will also provide rural employment and income for youths that are willing and curb rural –urban migration.
- ✓ Land Use Reforms: - Earnest reforms in the land use act must be made to provide land availability for agricultural purposes. A lot of individuals, groups and organizations' who are interested in agricultural cultivation still find it difficult to access land for use and this needs to be addressed adequately to promote agricultural development.
- ✓ Agricultural Cooperatives: - Even with a lot of reforms in the banking sector of Nigeria, the agricultural sector still finds it difficult to access loans/ finance from the banks. This needs to be rectified with more agric cooperatives encouraged to be formed so that various farmer groups can aggregate and have access to supplies, equipments, seedlings and other inputs needed in agriculture as is been done presently in fertilizer distribution. Even though such is not foolproof from corrupt tendencies but will reduce it greatly and make access more open and direct with proper monitoring and deployment of appropriate technology.
- ✓ Biotechnology Development, Deployment and Utilization: - As a matter of urgency, The President, Muhammadu Buhari should adequately go through the Biotechnology act as passed by the National Assembly, scrutinize it and note the areas needed to tweak so that accent can be granted the bill if it needs to be re-presented to the new assembly so that Nigeria can benefit from the advantages contained therein and join the league of Biotechnology developing nations. This will also prevent proliferation and usage of unlicensed and negative biotechnological practices.
- ✓ Bio resource utilization (Agricultural waste):- This involves utilization of all waste from Agricultural activities including food processing /meals waste, agric crop residues and forestry residues. Biomass from these sources can be used to produce bioenergy and other biomaterials. A biorefinery production unit utilizes these materials which we have in abundance and we generate more daily to stimulate our bio economy.

- ❖ Capacity building for small and medium enterprises (SMEs) to meet the ever increasing demand by trading partners for quality and safe food. As epitomized by Nestle and IITA in encouraging personnel of their trading partners to produce intermediate industrial food raw materials in a safe and wholesome manner through training.
- ❖ Population growth control, hybridization, genetic engineering and prevention of genetic erosion in agricultural and livestock biodiversity.
- ❖ There is no doubt that all the available resources for agriculture production have not been adequately harnessed. The large hectares of irrigable land are there calling for tilling, most especially during this period of climate change and threat by the vagaries of weather
- ❖ Treating food the same as any other internationally traded commodities has the tendency of jeopardizing the safety of food.
- ❖ The West Africa Quality Program (WAQP) is assisting National standard bodies SON to provide the necessary information about technical regulations, standards or conformity assessment procedures adopted or proposed within its territory by central or local government bodies; and act as a store house for information on WTO/TBT agreements and notifications from other WTO member countries.
- ❖ Boosting agricultural science and technology, enhancing human capital through education and improved health are some of the indispensable tools to ensure food safety and food security in Nigeria.

It has been documented since the 1980s, that the achievement of food security requires paying attention to supply-side, which can be secured through agricultural production, commercial imports or food aid and on the demand-side food has to be safe, nutritious, and appropriate to meet food preferences [6]. Modern advances in biotechnology hold great promise for addressing key challenges in agriculture, human health and the environment. Biotechnology as with any new technology has its advantages and limitations; the application of modern biotechnology has highlighted its positive impact on agriculture, human health and the environment through increased crop yields, the reduced use of pesticides and herbicides, production of nutritionally enhanced foods and affordable vaccines. The debate about biotechnology continues because of political, trade and ethical issues that have been raised in the public domain. Little distinction been made between biotechnology as a tool; genetically modified (GM) crops and foods as products, leading to the intense controversy about the perceived risks to human health and environment, which underscores the need to have biosafety regulations [58]. Taking cognizance of the different applications of Biotechnology in the environment, food and agriculture, healthcare and the industrial sectors, it is indeed an essential panacea to the pervasive poverty and food security problem in Nigeria.

Additionally, if there is to be improvement in food and nutrition security situation of Nigeria, national governments must address a number of issues including the following:

- Provision of access to sufficient quantities of food items. This may require formulation of policy for sustained, broad-based, economic growth. It is estimated that, to end hunger in Sub-Saharan Africa by 2050, a 3.5 percent annual average growth rate in per capita Gross Domestic Product (GDP) is necessary in the region.
- Direct nutrition interventions to provide food to those suffering from acute hunger and malnutrition and nutrition information and supplements to women of childbearing age and young children are necessary. Such interventions are a vital component of any effort to build the quality of human capital, encourage economic growth, and improve standards of living.
- Enhancing the means to acquire food, whether through cash incomes or access to productive resources.
- Considering the importance of agriculture as a source of income to rural households, there is a need for improvement in their agricultural production. The effectiveness of on-farm production determines the level of access to food enjoyed by both farmers and the broader population to whom they are linked through the market. Increased food supplies simultaneously increase the income of farming households and reduce the prices people pay for food in the marketplace, both of which enhance nutrition security. Moreover, increases in the production of both food and non – food crops contribute to the broader economy, both in rural areas and in urban manufacturing centers.
- Levels of education should be improved, particularly for girls, because the knowledge imparted is critical both to achieve nutritional security and to enhance productivity for economic growth. This is also to ensure that people can provide themselves and their dependants with nutritionally balanced, hygienically prepared food.
- Provision of clean water, adequate sanitation and effective health services.

  This is very important for the individuals to benefit from the food consumed. Poor health situation of the individuals may prevent them from having nutrition security.
- Efforts must be made to open national markets to international trade, both within Africa and globally, as national food availability should not depend upon national food production alone. The nutritional security of the population of a country is enhanced by the degree to which it invests in building the institutional and legal frameworks and physical infrastructure needed to facilitate open, reciprocal and free trade.
- The issue of gender equity must be addressed, as a close link exists between improved child nutrition and the extent to which women participate in making economic decisions within their households. Greater social equity enhances women's access to resources thereby increasing the diversity and quantity of food they can provide and improving the level and quality of the care they can give to their dependents.
- Siting and creation of strategic food reserves e.g. grain silos across the country to mop up excess production during harvest periods and release them during scarcity.
- Locally conceived and implemented action has been shown to be the most effective way to improve food and nutrition security. Federal government should give broad direction to local efforts and facilitate the success of such efforts through resource allocation, institutional support, and the provision of necessary expertise.
- Federal government should ensure that budgetary allocations reflect the central importance that food and nutrition security have for the welfare of all people, as well as the immense economic benefits they provide

for relatively little cost. In this regard, donor funding should be viewed as a secondary resource, and used to complement the resources allocated by governments.

- Dedicated advocacy should be used to inform policymakers at all levels of the critical role that improved nutrition plays in development and poverty alleviation.

Without this, it is unlikely the malnourished will receive any attention in any planning and resource allocation decisions made in the democratic, centralized, bottom-up political systems emerging across Nigeria.

4.3. Areas of Remaining Debate and Disagreement

Hunger and food insecurity remain seemingly intractable problems. In looking to the future and the contribution of agriculture to their resolution, two broad areas remain the subject of considerable debate:

1. Can Nigeria meet an increasing demand for food? Specifically, how will changes in global and regional food supply impact upon prices and how will levels of hunger and food insecurity be affected?
2. Can agriculture make a significant contribution to tackling poverty, which remains the principal cause of hunger and food insecurity?

Interwoven through both these questions is an additional issue: the growing impact of HIV/AIDS and its implications for agriculture and food security.

4.4. Meeting the Increased Demand for Affordable Food: – Can it be Achieved?

Trends in world food production and supply are summarized by Yusuf, *et al.* [58]. Globally, population growth will slow down, incomes will grow and the incidence of poverty will be reduced. However, in developing countries, while levels of hunger will remain high and the demand for cereals will increase, there will be a slower rate of agricultural production growth with wheat and rice production increasing only modestly.

However, three factors are likely to have a major influence on the availability and price of global food, particularly basic grains:

1. The extent to which the world can physically continue to increase production levels and, more importantly, yields.
2. The impact of changes in the pattern of food consumption, particularly the increasing consumption of livestock products in large parts of the developing world.
3. The impact of possible policy reforms in the developed world, particularly the implications of reduced support to farmers.

4.5. Can Agriculture Make Significant Contribution to Tackling Food Insecurity?

Agriculture must figure prominently in poverty alleviation strategies of developing countries. Accelerated public investments are needed to facilitate food security through:

- Yield-increasing crop varieties, including those that are drought and salt tolerant and pest resistant, and producing improved livestock.
- Yield-increasing and environmentally friendly production technology.
- Reliable, timely, and reasonably priced access to appropriate inputs such as tools, fertilizer, and, when needed, pesticides, as well as the credit often needed to purchase them.
- Strong extension services and technical assistance to communicate timely information and developments in technology and sustainable resource management to farmers and to relay farmer concerns to researchers.
- Improved rural infrastructure and effective markets.
- Particular attention to the needs of women farmers, who grow much of the locally produced food in many developing countries.
- Primary education and health care, clean water, sanitation and good nutrition for all.

4.6. Is Domestic Food Self-Sufficiency A Sensible National Policy Objective?

The extent to which countries should invest in domestic self-sufficiency, or use their agricultural resources to produce higher value crops and import food for basic needs remains a niggling question. Aiming for domestic self-sufficiency can result in inefficiencies and high costs especially, as history shows, when this is attempted through the use of state agencies to supply inputs and credit and then purchase, transport and store produce. Input provision and credit tend to be subsidized, initially to promote adoption, but once subsidies are in place, they can be difficult to remove. Produce may be bought at 'floor prices' that sometimes exceed a comparable economic value, such as an import parity price. Transport of both inputs and produce may be heavily subsidized, particularly when uniform 'pan-territorial' prices are set across the country. Storage and spoilage while in store have direct costs. Such costs are

likely to exist even when public agencies operate well, but when they lack performance incentives, they are likely to remain inefficient, thus raising costs still further.

What of the inevitable years of harvest failure that occur once or twice a decade? In the absence of domestic reserves, the aftermath of a bad harvest may see delays in obtaining commercial imports, and possible speculation by both farmers and traders holding stocks off the market in the hope of rapidly escalating prices. Add to these scenario unpredictable actions by governments in various attempts at price control and the ingredients exist for extremely large increases in the prices of staples over a few months.

The general question is this: can staple food availability be entrusted to market forces when critical conditions for market efficiency (adequate information, many buyers and sellers, predictable and stable public policy) are lacking.

Conclusion: The need to improve food and nutrition security must be communicated effectively and understood widely; its significance for the welfare of all members of society must be recognized. Ultimately, advocacy must build the political will needed to ensure that resources are provided to help individuals and households attain food safety, food and nutrition security.

Lastly, Food security is a complex topic, standing at the intersection of many disciplines. As food scientist and technologist, we are challenged to lead the way and manage this transformation.

References

[1] FAO, 2010. "Global Forest Resources Assessment." Available: https://www.google.com.pk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=8&ved=0ahUKEwj-9aGMlv_OAhUIAxoKHRk-AZAQFggqMAI&url=http%3A%2F%2Fwww.fao.org%2Fdocrep%2F013%2Fi1757e%2Fi1757e.pdf&usg=AFQjCNHU_SjAdFYs-JJ_r6VRHCbfYkT2oA&sig2=lBVeflGbEXBRYDF_xz5Kpw&bvm=bv.131783435,d.d2s

[2] FAO, 2012. "The State of Food Insecurity in the World." Available: https://www.google.com.pk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjW7sW3mP_OAhXDbRQKHSuZC0IQFggZMAA&url=http%3A%2F%2Fwww.fao.org%2Fdocrep%2F016%2Fi3027e%2Fi3027e.pdf&usg=AFQjCNGQGn3gBskKgWP71Dk2iH5M_TAYlA&sig2=jBz-HwEdlSdxpd0LW_0q9Q&bvm=bv.131783435,d.d2s

[3] FAO, 2008. *The state of food insecurity in the world*. Rome: Food and Agriculture Organization.

[4] World Bank, 1986. *Poverty and hunger: Issues and options for food security in developing countries*. Washington DC: World Bank.

[5] IFSS, 2002. "The Integrated Food Security Strategy for South Africa. Pretoria, Department of Agriculture."

[6] Devereux, S., Vaitla, B., and Haunstein, S. S., 2008. *Seasons of hunger: Fighting cycles of quiet starvation among the world's rural poor*. London: PlutoPress.

[7] Smith, L. C. and Subandoro, A., 2007. *Measuring food security using household expenditure surveys.Food security in practice technical guide series*. Washington, D.C: International Food Policy Research Institute.

[8] Abu, O., 2012. "Food security in Nigeria and South Africa: Policies and CHallenges." *J. Hum. Ecol.*, vol. 38, pp. 31-35.

[9] Idachaba, F., 2004. "Food security in Nigeria: Challenges under democratic dispensation." *Paper presentedat Agricultural and Rural Management Training,*

[10] NAFDAC, 2004. "Position paper on use of Food Additives."

[11] FAO, 2006. "The State of Food Insecurity in the World." Available: http://www.fao.org/docrep/009/a0750e/a0750e00.htm

[12] FAO, 1996. *World food summit, Corporate document repository*. Rome: FAO.

[13] Allen, L. H., 2002. *Ending hidden hunger: the history of micronutrient deficiency control*. Washington, DC: The World Bank (Background Paper for the World Bank/UNICEF Nutrition Assessment).

[14] Demment, M. W. and Allen, L. H., 2003. "Animal Source Foods to Improve Micronutrient Nutrition and Human Function in Developing Countries. Proceedings of the conference held in Washington, DC, 2002 June 24–26." *Journal of Nutrition*, vol. 133, pp. 3875S–4061S.

[15] Allen, L. H., 2006. *Eds Guidelines on food fortification with micronutrients*. WHO Library catalogue-in-publication Data: WHO/FAO (UN).

[16] Honfoga, B. G. and Van den Boom , G. J. M., 2003. "Food-consumption patterns in central west africa, 1961 to 2000, and challenges to combating malnutrition." *Food and Nutrition Bulletin*, vol. 24, pp. 167-182.

[17] World Health Organization, 1990. "Resolution WHA 43.2.Prevention and control of iodine deficiency disorders. In: Forty-third World Health Assembly, Geneva 14 May 1990. Geneva."

[18] Wiebe, K., 2003. "Land Quality, Agricultural Productivity, and Food Security at Local, Regional, and Global Scales Paper prepared for presentation at theAmerican Agricultural Economics Association Annual Meeting, Montreal,Canada, July 27–30, 2003 Economic Research Service, USDA."

[19] FAO, 2005a. *FAO warns world cannot afford hunger*. Newsroom: FAO.

[20] Stamoulis, K. G., Pingali, P., and Shetty, P., 2004. "Emerging challenges for food and nutrition policy in developing countries special issues on globalization of food systems: Impact on food security and nutrition." *Electronic Journalof Agricultural and Development Economics,* vol. 1, pp. 154-167.

[21] FAO, 1998. "Urgent Action Needed to Combat Hunger as Number of Undernourished in the World Increases." Available: @ www.fao.org

[22] Gebremedhin, T. G., 2000. "Problems and Prospects of the World Food Situation." *Journal of Agribusiness 18, 2 (Spring 2000): 221- 236 Agricultural Economics Association of Georgia,*

[23] Smith, L. C., Ramakrishnan, U., Ndiaye, A., Haddad, L., and Martorell, R., 2003. "The Importance of Women's Status for Child Nutrition in Developing Countries,Research Report Abstract 131, IFPRI."

[24] United Nations, 2005. "Millennium development goals, united nations department of public information."

[25] Diouf, J., 2005. *Towards the world food summit and millennium development goal targets: Food comes first" foreword the state of food insecurity in the world*: FAO. pp. 4-5.

[26] IFPRI, 2002. *Cutting hunger in Africa through smallholder-led agricultural growth: a technical paper in support of USAID's agricultural initiative to cut hunger in Africa (AICHA)*. Washington DC, USA: International Food Policy Research Institute.

[27] Lele, U. and Agarwal, M., 1989. *Smallholder and large-scale agriculture in africa: Are there tradeoffs between growth and equity? Madia discussion paper no 6.* . Washington DC, USA: World Bank.

[28] Hossain, M., Lewis, D., Bose, M., and Chowdhury, A., 2003. *Rice research, technological progress, and impacts on the poor: the Bangladesh case (summary report). Discussion Paper No 110. Environment and production technology division*. Washington DC, USA: International Food Policy Research Institute.

[29] Saxena, N. and Farrington, J., 2003. *Trends and prospects for poverty reduction in rural India: context and options. Working Paper 198*. London, UK: Overseas Development Institute.

[30] Leavy, J. and White, H., 2000. *Rural labour markets and poverty in sub-saharan africa. Mimeo paper*. Brighton, UK: Institute of Development Studies.

[31] Ashley, C. and Maxwell, S., 2001. "Rethinking rural development." *Development Policy Review,* vol. 19, pp. 395–425.

[32] Von Braun, J., 1995. "Agricultural commercialization: impacts on income and nutrition and implications for policy." *Food Policy,* vol. 20, pp. 197–202.

[33] Poulton, C., Al-Hassan, R., Cadisch, G., Reddy, C., and Smith, L., 2001. *The cash crop versus food crop debate. Crop Post-Harvest Programme Issues Paper Number 3*. Chatham, U. K.: National Resources International.

[34] DFID, 2003a. *Eliminating Hunger: Strategy for Achieving the Millennium Development Goal on Hunger*. London, UK: Department for International Development.

[35] Harper, C., Marcus, R., and Moore, K., 2003. "Enduring poverty and the conditions of childhood: lifecourse and intergenerational poverty transmissions." *World Development,* vol. 31, pp. 535–554.

[36] Alderman, A., Hoddinott, H. J., and Kinsey, B., 2003. "Long-term consequences of early childhood malnutrition " *IFPRI Discussion Paper 168. International Food Policy Research Institute Washington DC, USA,*

[37] Devereux, S., 2000. *Famine in the twentieth century. IDS Working Paper 105 Institute for Development Studies*. UK: Brighton.

[38] Behrman, J. R., Alderman, H., and Hoddinott, J., 2004. "Hunger and malnutrition." *Paper for the Copenhagen Consensus – Challenges & Opportunities,*

[39] Gillespie, S. and Haddad, L., 2003. *The relationship between nutrition and the Millennium Development Goals: a strategic review of the scope for DFID's influencing role*. London UK: Paper for the Department for International Development.

[40] World Bank, 2006. "The world bank annual report 2006." Available: https://www.google.com.pk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwiq1v7Cm__OAhUCkRQKHYg1BbwQFggbMAE&url=http%3A%2F%2Fsiteresources.worldbank.org%2FINTANNREP2K6%2FResources%2F2838485-1158333614345%2FAR06_final_LO_RES.pdf&usg=AFQjCNHX3eQsVr5eHq5GqkMtSdJlDVZb1w&sig2=XRFTXBQEGCM76jBqQyCtsw&bvm=bv.131783435,d.d2s

[41] Oguntola, S., 2008. "Food insecurity More Evident and Nigeria is no Exception Nigerian Tribune."

[42] Ijaiya, G., 2008. "Estimating the Rate of Absolute Poverty for National Development" in Nigeria: Environmental and Economic Issues. Concept Publications Ltd Lagos Nigeria." pp. 164–175.

[43] Smith, L. and Haddad, L., 2002. "How potent is economic growth in reducing undernutrition? What are the pathways of impact? New cross-country evidence." *Economic Development & Cultural Change,* vol. 51, pp. 55–76.

[44] Ifesan, 2012. "MTECH lecture note: Intrinsic and extrinsic parameters of foods that affect microbial growth." pp. 5-7.

[45] Pinstrup-Andersen, P. and Cohen, M. J., 2000. "Modern biotechnology for food and agriculture: Risks and opportunities for the poor. In: Agricultural biotechnology and the poor."

[46] Niba, L. L., 2003. "The relevance of biotechnology in the development of functional foods for improved nutritional and health quality in developing countries." *Afr. J. Biotechnol,* vol. 2, pp. 631-635.

[47] Mazur, B. J., 2001. "Developing transgenic grains with improved oils, proteins and carbohydrates." *Novartis Found. Symp,* vol. 236, pp. 233-239.
[48] James, C., 2003. "Global review of commercialized transgenic crops." *Curr. Sci.*, vol. 84, pp. 303-309.
[49] Wiggins, S., Anderson, E., Chaplin, H., Cromwell, E., Clay, E., Farrington, J., Harvey, P., and Tripp, R., 2004. *Can Africa feed itself in 2025 under the impact of HIV/AIDS? A report to the United Nations AIDS Programme (UNAIDS),*. London, UK: Overseas Development Institute.
[50] De Waal, A. and Whiteside, A., 2003. "New variant famine: AIDS and food crises in southern Africa." *The Lancet,* vol. 362, pp. 1234–1237.
[51] Mohammed, I., 2008. "Road map to attaining food security in Nigeria. Nigerian Tribune Monday."
[52] Nigerian Punch Newspaper, 2008.
[53] Maxwell, S., 2004. "Launching the dfid consultation new directions for agriculture in reducing poverty. Paper prepared for the department for international development." Available: http://dfid-agricultureconsultation.nri.org/launchpapers/simonmaxwell.html
[54] David, M., De Beatriz, A., Dirven, M., and Vogelgesang, F., 2000. "The impact of the new economic model on latin America's agriculture." *World Development,* vol. 28, pp. 1673–1688.
[55] Hite, J., 1997. "The von Thunen model and the new economic geography as a paradigm for rural development policy." *Review of Agricultural Economics,* vol. 19, pp. 230–240.
[56] Ojo, M. O., 1991. "Food policy and economic development in nigeria central bank of nigeria."
[57] Jayne, T. S., Tschirley, D. L., Staatz, J. M., Scaffer, J. D., Weber, M. T., Chisvo, M., and Mukumbu, M., 1994. "Market Oriented Strategies to Improve HouseholdAccess to Food –Experience from Sub-Saharan Africa, MSU InternationalDevelopment Paper No. 15, Michigan State University."
[58] Yusuf, K. M., Amasiora, V., and Ashanu, E., 2012. "Biotechnology as a Tool for Sustainable Human Nutrition: Educated Nigerian Women and Household Food Security."
[59] Yahaya, O. Y., 2008. "A Geographical Analysis of Women Participation in Agriculture in Asa Local Government Area of Kwara State. A research Proposal presented at the Staff / Postgraduate Student Seminar Series, Department of Geography, University of Ilorin."
[60] Central Bank of Nigeria, 2005. "Central Bank of Nigeria Annual Report and Statement of Accounts for the Year ended 31st December."
[61] Central Bank of Nigeria, 2007. "Annual Report and Statement of Accounts for the Year ended 31st December."
[62] Nigerian Compass, 2008. "Government Plans to Re-organize Freight Forwarding Sector. Nigerian Compass Maritime."

Table-1. Contribution of Agriculture to the Total Gross Domestic Product (1965 – 2000)

Period at 5yrs Interval	Total GDP ($ Million)	Agric share of GDP	% Share of Agric in total GDP
1965-1970	21.08	11.55	54.8
1971-1975	31.19	12.05	38.6
1976-1980	114.07	24.09	21.1
1981-1985	376.43	133.23	35.4
1986-1990	413.60	165.14	39.9
1991-1995	496.40	159.54	32.1
1996-2000	626.93	154.24	24.6

Source: Yahaya [59]

Table-2. Contribution of Agriculture to the Total Gross Domestic Product (2000 – 2007)

Period	Total GDP(# Billion)	Agric share of GDP	% Share of Agric in Total GDP
2001	431.78	182.66	42.30
2002	451.71	190.37	42.14
2003	495.01	203.01	41.01
2004	527.58	216.21	40.98
2005	561.8	231.46	41.19
2006	595.82	248.60	41.72
2007*	632.86	267.06	42.20

Source: - CBN [60, 61] Note GDP at 1990 Constant Basic Prices. *Provisional figures.

Table-3. U.S. Exports to Nigeria from 2003 to 2007 by 5-digit End-Use-Code

END-USE	2003 VALUE	2004 VALUE	2005 VALUE	2006 VALUE	2007 VALUE
Wheat	269.066	388.027	517.050	460.624	657.098
Rice	81	2.015	2.323	92	153
Soybean	1.792	1.244	2.554	15	0
Oilseeds	263	90	0	8	8
Corn	95	0	8	1.45	46

Source: - Nigerian Compass [62]