# Leveraging Endogenous Research and Innovation for Sustainable Livestock Production, National Food Security and Poverty Alleviation In Nigeria

**Valentine A. Aletor**
**The Federal University of Technology, PMB 704, Akure,**
**Ondo State, Nigeria.**
**The *E-mail:* valet2002@hotmail.com**

**Abstract**

*In this treatise, a quick look is taken at the spectrum (range) of research from pure basic, strategic basic, applied, experimental development or research and development (R&D) to endogenous research and innovation (ER&I). It also defines development, innovation, food security, poverty; and discusses some contemporary theories of innovation within the context of organizational/national development. This was followed by an overview of global and Nigerian livestock, Food Security and Poverty situations; and the characterization of the Nigerian agriculture. It emphasizes the strong link between poverty and low agricultural productivity and chronicles the impact of some generated technologies by the National Agricultural Research Systems (NARS) on food production. The trends and patterns of Industry-Government-University research relationships in Nigeria are examined and some illustrations given to show in concrete terms, with examples of the "Asian Tigers" and the BRICS nations, how socio-economic development and human development indices (HDI) have become Research and Innovation-driven.Among the identified constraints to the attainment of food and nutrition security and the curtailment of deepening poverty despite Nigeria's huge agricultural resource endowments include: high cost of agricultural inputs; incessant power outages; chronic under-funding of agricultural research by government and the society, including industries; poor market outlets; huge post harvest losses due, largely, to the decay of research infrastructure needed for value-addition; low value accorded University-Industry R&I partnerships; lack of political will to make existing National Agricultural policies achieve set targets; information dearth and/or low diffusion of the available significant local agricultural R&I outcomes. Others were poor food distribution net works and very limited ACCESS to food and means of food production – land, water, animals, seeds, fertilizers, extension education, technology etcConsequent on the structural issues involved in food security: ie, the scientific challenge of **enhanced productivity**; the logistical and political questions of **distribution;** and socio-economic issues of **access,** robust mitigation paradigms are proposed. First, is to give full and true autonomy to Agricultural Research Council of Nigeria to effectively harness the synergies of the Universities, NARS, Research Institutes and Industries with regard to competencies, endowments (both material & intellectual) to pursue National Food Security programme without undue interference from a supervisory ministry. Also proposed, for poverty mitigation, is a **Value Chain model** which entails the active promotion of local content policy by government which strategically links ER& I with MSMEs for the manufacture of strategic basic agricultural equipment, foods, animal feeds, drugs/vaccines, goods and supplies with incentives such as tax holiday, low interest rates etc, provided such firms by government; substantial improvement in the power and transportation sectors, among others.*

## *1.0 INTRODUCTION*

***i). ``The glory of God is to conceal a thing: the glory of the king is to search it out''…(Falton Anderson)***

***ii) ``Those who create new knowledge are producing wealth, while those who consume it are producing poverty''… (Philip Emeagwali).***

***iii) ``A hungry world is dangerous world. When people do not have food, the have three options: they revolt, they migrate or they die. ….as future policy makers, you would agree that none of these are acceptable options''. (Josette Sheeran, World Food Programme).***

***iv) "In Southwest Nigeria, one in every two children (50%) under age five is stunted in growth that is, chronically undernourished. One in every three (33%) is also underweight; and one in every ten (10%) is wasted or acutely under-nourished".(- Voumard)***

***v) ``… lack of food and nutrition securities have their roots or origin in poverty. Food insecurity is, in my opinion, the "primus inter pares" in the hierarchy of the components of poverty. Even as we enter the new millennium, food insecurity especially in most of the developing countries (Nigeria inclusive) remains a humbler and a leveller, it continues to denigrate and demean, it wastes bodies and stunt minds. Food insecurity may not be the deadliest, but certainly, it is a most miserable form of affliction; and perhaps the greatest threat to the environment and sustainable agricultural development''. (Valentine Aletor, Aug 12, 1999).***

***vi) "Poverty has increased in Nigeria by close to 500% in three decades, 1980-2010. In statistical terms from NBS, 2010 Poverty Report, about 27% of Nigerians lived below poverty line in 1980, increasing to 42% in 1992 and now close to 115m out of 160m Nigerians (ie 71.8%) are poor. During the same period, the government official data indicated economic growth rate of 7.36-8.28%. …the paradox is the deepening poverty in the midst of 'remarkable growth'..."(Tribune, March 5, 2012).***

***vii) ``Eliminating hunger and malnutrition is technically feasible. The means are there. The challenge lies in … taking concerted actions nationally and internationally."(WHO)***

## *NOW THE BIG QUESTION ! WHY SHOULD NIGERIA - A RICH COUNTRY - BE POPULATED BY POOR & HUNGRY PEOPLE?*

The above quotations lend full credence to the fact that with globalization, nations are no longer rated developmentally based on their endowment with material and human resources but rather, on the available pool of KNOWLEDGE and its application for deliverables in terms of goods/packages, processes or services. Knowledge is now easily the fastest growing economy world-wide. It is also now widely acknowledged, that rapid advances in economic and overall Human Development Index (HDI) have become knowledge-based, private sector-led, science & technology-driven and mainly government-facilitated via appropriate policy instruments. The University and research institutes have been, and remain the apex of knowledge generation world-wide. With knowledge, jobs and wealth are created, poverty is mitigated and global competitiveness enhanced.

It is however a paradox that while the more enhanced countries of the West and South-East Asia have continually and aggressively engaged the synergies of their Universities, Research & Development (R&D) institutes and industries in knowledge generation,

skills acquisition and intellectual property pursuits (Isoun, 2004), most of the developing countries of Africa (including Nigeria) are yet to fully embrace these imperatives as the major driving force of global wealth creation. In the more advanced countries, industrial innovations at their institution of higher learning are accorded as much importance as teaching, research and community service. There is an acute awareness among higher education institutions in these countries of the need to be more responsive to the increasing pressures of economic globalization as well as the needs of industry and commerce. These responses according to Mangvwat (2005) include:

**i)** training more graduates to support the development of an increasingly knowledge based economy, both in organizations and as entrepreneurs;

**ii)** a higher and further education system that is fashioned towards life-long learning such that the workforce skills can meet the changing demands of globalization;

**iii)** the pursuit of cutting-edge or top-flight research & innovation which target commercial applications and;

**iv)** an expanding pool of educated people who can participate creatively in policy discourses and respond effectively to pressing socio-economic and political challenges such as prevalent in developing countries, including Nigeria.

Nigeria, as a country is endowed with a huge and wide array of natural resources from petroleum and natural gas to solid minerals, forests, arable lands, cash and food crops, and diverse livestock species: sheep, goats, cattle, poultry etc. Others are wild life species, extensive water bodies with different fish species etc. Over the years, several of Nigeria's R&D institutions and National Agricultural Research Systems (NARS) have made some modest strides in the development of a variety of potentially valuable science and technology products and processes that can contribute significantly to job creation, poverty alleviation and the attainment of food security. Unfortunately, most of these products are yet to find their way into meaningful commercial usage due to the very weak patronage of, or linkages of these institutions with industry and commerce. Although, Nigeria has long recognized the urgency to join the race in the new and emerging technologies including Information and Communication Technology (ICT), Biotechnology, Nuclear and new Energy Technology, Space Science etc, this need has made limited progress due to inadequate funding of the relevant institutions. The situation is exacerbated by the reluctance of the private industries and commerce to partner in the development of these technologies with result that Universities and R&D institutes have been denied the much needed human and financial resources which have facilitated the rapid rates of economic growth, the transformation as well as prosperity being experienced especially by the more developed countries of South-East Asia and the Pacific.

It is therefore the intent of this paper to re-direct attention on the compelling need for a much stronger partnership between the Universities, R& I institutes (including NARS), industries, commerce and governments (Local, State & Federal) in the management and utilization of Nigeria's vast agricultural resources (particularly, livestock) not only

for food security, but also for job creation and hence poverty alleviation. This need remains a critical success factor in meeting the key elements of the various development agenda of government including, but not limited to, CEEDS, LEEDS, SEEDS, NEEDS, vision 20:2020, NEPAD and the Millennium Development Goals (MDGs).

In addressing this subject, it is decided for convenience to:

- ***(i)*** take a cursory look at the spectrum of research & innovation to properly situate or underpin research partnership needs for enhanced human development indices,
- ***(ii)*** define and give an overview of global and Nigerian Livestock, Food Security and Poverty situations,
- ***(iii)*** characterize the Nigerian Agriculture and highlight the impact of some agricultural research initiatives/outcomes on food/ livestock production,
- ***(iv)*** examine the existing pattern of Industry-Government-R& I institutes partnerships in Nigeria ie, the Triple Helix Concept,
- ***(v)*** demonstrate the imperatives of leveraging R& I to harness Nigeria's vast agricultural resources for jobs creation, food security and poverty alleviation with the MSMEs as the main focus,
- ***(vi)*** highlight /identify some of the major draw-backs to industry-government-university research partnerships for development,
- ***(vii)*** suggest some ways forward to mitigate the constraints to the attainment of Nigeria's sustainable livestock production, food security and reduced poverty level and,
- ***(viii)*** make concluding remarks

## *2.0 RESEARCH, INNOVATION & DEVELOPMENT*

### *2.1 Spectrum (range) of research*

Although research does not have a unified definition in a classical sense, it can very simply, be regarded as ***a systematic investigation designed to develop or contribute to general or new knowledge.*** Whatever definition or activity that is regarded as research, it must be:

- **(a)** Systematic,
- **(b)** Designed to obtain knowledge and,
- **(c)** Such that the outcome/output is verifiable.

Within this broad definition is a clear delineation of the spectrum of Research (Fawole *et al.,* 2005) which include:

***(i) Pure Basic Research*** – an experimental or theoretical work primarily to acquire new knowledge without a specific application in view, i.e. no long-term economic or social benefit is envisaged.

***(ii) Strategic Basic Research*** – experimental or theoretical work undertaken to acquire new knowledge without a specific application in view, but is directed into specific broad areas in the expectation of useful discoveries. It provides broad base knowledge necessary for the solution of a recognized practical problem.

***(iii) Applied Research*** – original work to acquire new knowledge with specific

practical application in view i.e., it is to find possible uses for the findings of basic research or to determine new methods or ways of achieving some specific and pre-determined objectives.

***(iv) Experimental Development or Research and Development (R&D)*** - primarily undertaken for technological advancement to create new, or improve on existing materials, products or processes. This is mainly in the field of technology and it is typically carried out within commercial or business concepts.

***(v) Endogenous Research and Innovation (ER&I)*** – an emerging tendency since the mid 1990s which is defined as development from inside, or that which is based on local initiative, knowledge, institutions and resources (Gefu, 2004). ER&I therefore emphasizes or builds on target peoples' knowledge, local resources and innovativeness for value addition especially to items for which they have, or enjoy, comparative advantage. This is particularly relevant for the growth of the micro, small and medium scale enterprises (MSMEs) – the main engine of job creation and economic growth of the `Asian Tigers' and more recently the 'BRICS' nations.

**By the way, who are the `` ASIAN TIGERS '' & "BRICS" nations?**

The Asian Tigers originally, refers to the economies of Japan, S. Korea, Taiwan, Hong Kong, Singapore, Malaysia and lately, Indonesia. In the early 1960s to the early 1970s, most of these nations were at the same economic pedestal as Nigeria. But, between the early 1970s and 1980s, these countries and territories became noted for sustained high growth rates of GDP and rapid industrialization, with the manufacturing growth rate and exports at 15-25 and 30 % per annum, respectively (Kalu, 2008). These economies have or share development/policy instruments in common which include, but not limited to: disciplined and accountable governments; heavy investment in human capital, particularly in S, T & I capability for R&D to drive industrial development based on export promotion; high capital financing particularly for the SMEs; high savings rates ( about 25-30% GDP), double-digit growth rate; high agricultural growth rate; high level of foreign direct investment (FDI) up to 5-10% GDP etc. The BRICS nations: Brazil, Russia, India, China and South Africa – the global reigning Champions in terms of momentum in economic prosperity !

### *2.2 Innovation & theories of innovation*

***It is important to closely take a look at what innovation is, and what is NOT. According to Merriam-Webster Dictionary, innovation is:***

***1: the introduction of something new***
***2: a new idea, method or device.***

***For example, an invention which is typically, an idea made manifest, is useful only to the inventor unless it is offered to the public or for public good. If such an invention brings about an improvement in some product, process or service then that invention transforms into an innovation. Such an innovation may be big or small, it may be brand new or a bit different, it may be in terms of technical achievement or in the form of a design, it does not really matter. What matters the most is its impact !***

***From Wikipedia, the free encyclopedia, it states that: innovation comes from the Latin word, innovātus which means to renew. In other words, innovation can be seen as the process that renews something***

***that exists and not as is commonly assumed – the introduction of something new. At some other level, innovation can be seen as a change in thought process for doing something, or the useful application of new inventions or discoveries. It may refer to an incremental emergent or radical and revolutionary changes in thinking, products, processes or organizations. Since innovation typically changes values, its effects may be positive or negative since new developments clear away or change old organizational forms and practices. Consequently, organizations must prepare and compensate for the consequences of innovative forces. Since innovation is considered a major driver of the economy, all such factors leading to innovation are, or should be of interest to policy makers.***

***Within the above context however, there exist several theories of innovation particularly from organizational stand point. For example, Amabile et al (1996) propose: ``All innovations begin with creative ideas… We define innovation as the successful implementation of creative ideas within an organization. In this view, creativity by individuals and teams is a starting point for innovation; the first is necessary but not sufficient condition for the second.''. This implies that for innovation to take place, something more than the generation of creative ideas or insight is required ie, the insight must be translated into actions to bring about measurable differences in organizational products, packages and processes. A second theory is by Luecke and Katz (2003) who wrote: ``Innovation… is generally understood as the successful introduction of a new thing or method… Innovation is the embodiment, combination, or synthesis of knowledge in original, relevant, valued new products, processes or services''. The third by Baregheh et al.(2009) which states: ``Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes in order to advance, compete and differentiate themselves successfully in their marketplace''. The bottom line is that innovation typically involves creativity and not identical to it. It involves acting on, or deploying creative ideas to make some specific and measurable/tangible difference in a given domain..***

### *2.3 What is development ?*

***According to New Lexicon Webster and Collins English Dictionaries, Development is an act of evolution; and Evolution as the act of innovating or doing or introducing new things. Development is to grow; to become more advanced, and improve in value… The corollary in all of this, is that Research and Innovation are the building blocks and, or catalysts for Development. The truism of this assertion finds true and current expression in the examples of the "Asia Tigers" and/or the BRICS nations.***

## *3.0 FOOD SECURITY, POVERTY LEVELS, LIVESTOCK PRODUCTIVITY: THE GLOBAL AND NIGERIAN PERSPECTIVES*

### *3.1 Food Security & Poverty Level*

Food security is said to exist at national, regional, local or household level when all the inhabitants, regardless of age or sex are assured of continuous availability or ACCESS to adequate food supply. Nutrition Security on the other hand, is the continuous availability of sufficient food of adequate quality to meet nutritional

requirements of all members of a given household. Food and nutrition security is therefore not simply a question increased food production. Indeed, food can be abundant at national and regional levels and yet, there can be food and nutrition insecurity in households if ACCESS is limited or if there are poor distribution platforms. *Food security is therefore a structural issue best addressed via an integrated approach. There is the scientific challenge of* ***enhancing productivity****; the logistical and political questions of* ***food distribution;*** *and socio-economic issues of* ***access*** *to food & means of food production such land, water, fertilizers, improved seeds and animals, extension services, generated technologies and innovations etc.*

It was the Indian sage and a great statesman, Mahatma Gandhi who asserted that: "poverty is an insult, poverty stinks. It demeans, dehumanizes, destroys the body and the mind…if not the soul. It is the deadliest form of violence. Worst of all, poverty persists and outlives even the most imaginative strategies to alleviate it". Following from the above assertion, it is evident that lack of food and nutrition securities have their roots or origin in poverty. Food insecurity is, in my opinion, the "*primus inter pares*" in the heirachy of the components of poverty. Food insecurity especially in most of the developing countries (Nigeria inclusive) remains a humbler and a leveller, it continues to denigrate and demean, it wastes bodies and stunt minds. Food insecurity may not be the deadliest, but certainly, it is a most miserable form of affliction; and perhaps the greatest threat to the environment and sustainable agricultural development. For example, according to CTA (1998; 2000) more than 800 million people in developing countries were undernourished at the beginning of the 1990's, and several tens of millions of people are dependent on emergency food aids each year, whilst such aid is falling sharply. One in eight people cannot afford enough food to lead a productive working life while in the mid 1990's an estimated 1.1 billion people lived in absolute poverty, that is, on less than 1 US $ a day. The several million refuges and displaced persons especially in Africa and Asia are among those currently experiencing direct food insecurity. In overall terms, world's food production has risen faster than world's population growth since the 1960's according to FAO (1996). Available statistics indicate that the amount of food available per person per day is equivalent to 2,700 calories as compared with 2,300 calories in the mid- 1960's. In West Europe and North America, the average food availability is more than 3,500 calories/person/day while the corresponding value in Africa is 2,300 calories. Ironically, while the population of Africa has risen by 53% since 1980, the food production has risen by only 45%.

There are two main components to global food equation namely, food crop and animal protein components. Animal protein sources generally include meat from cattle, sheep and goat, poultry, eggs, milk and milk products, fish and wildlife. The pattern, performance and constraints in meeting per caput animal protein consumption by Nigerians has been adequately reviewed by Babatunde 1987; Tewe; 1997; Njoku, 2010. It is well documented by the various FAO reports that in spite of the efforts by international agencies, private relief organizations, scientists among others, protein-energy malnutrition (PEM) remains a major public health problem in several developing countries, including Nigeria. While proteins are of prime importance to health, they are usually deficient in the diets of people in these

regions, especially those in the vulnerable groups such as the weanlings, pre-school children, expectant and nursing mothers. The net-effect of this inadequate dietary protein is high mortality, morbidity and decreased disease resistance especially in children. The widening gap between the estimated protein requirement and actual protein consumption in many developing countries of Africa, including Nigeria, derives mainly from the phenomenal rise in the cost of animal protein sources such as eggs, meat, poultry, fish etc. Their prices are generally beyond the reach of the lower-paid or resource-poor citizenry that form more than 90% of the population in this region. If, and when available, these items, form only a minor and irregular part of normal diets. Other high protein sources such as beans have also become expensive, whereas cereals such as maize, guinea corn, millet and starchy roots such as cassava, yam, cocoyam or plantain although available, may meet dietary energy but, not protein needs especially among the vulnerable groups. The per caput protein intake as recommended by the food and Agricultural Organization (FAO) is 55g out which 10.6g should be of animal origin. The Nigerian food balance sheet indicate that only 4.82% of the required animal protein is consumed representing only about 10% of the recommended total protein intake.

Going by the FAO (1995) estimates, more than half of Nigerian children or 52.3% of the nation's population were stunted in growth arising mainly from declining intake of food nutrients. Again, the poor state of nutrition especially of the Nigerian child, was graphically painted in 1999 by a United Nations Children's Fund (UNICEF) representative in Nigeria – Dr. Voumard when he stated (The Punch of Wed. March 31, 1999 pg 10) and I quote: "In Southwest Nigeria, one in every two children (50%) under age five is stunted in growth that is, chronically undernourished. One in every three (33%) is also underweight; and one in every ten (10%) is wasted or acutely under-nourished". He further stressed that their saving grace was that nearly 97.7% of the people in this region consume iodized salt which reduces the threat to growth and mental retardation. Recent data from the National Bureau of Statistics (NBS, 2012) indicates that poverty has increased in Nigeria by close to 500% in three decades, 1980-2010. In statistical terms from NBS, 2010 poverty report, about 27% of Nigerians lived below poverty line in 1980, increasing to 42% in 1992 and now close to 115m out of 160m Nigerians (ie 71.8%) are poor. During the same period, the government official data indicated economic growth rate of 7.36-8.28%. What a paradox having deepening poverty and food insecurity in the midst of a 'remarkable growth economic'!

### *3.2 Comparative Analysis of Livestock Population*

As found in most countries of the world, the major livestock species found in Nigeria are cattle, sheep, goats, pigs and poultry. As at 2005, Nigeria had 15.2 million heads of cattle, 23.0 millions of sheep, 28.0 millions of goats, 6.6 millions of pigs and 140.0 millions of poultry (FAOSTAT, 2007). The livestock resources in Nigeria are fairly large compared with the total holding on the African continent but in some cases lower than those in selected countries in America and Asia. However, they are in some cases higher than those found in some countries in Europe. Nigeria holds about 12% of the continent of African goats, 9% of sheep, 31% of pig and 10% of poultry. These proportions gave Nigeria a pre-eminent

position in livestock industry in Africa (Alokan, 2008).

Larmode *(1998)* reported that Nigeria was the largest livestock producer in West Africa sub-region and third largest producer in the sub-Saharan Africa following Ethiopia and Sudan. Compared with countries like Italy, Spain and Germany, the livestock population of Nigeria is about 58%, 56% and 14% higher suggesting that Nigeria has more livestock potentials than even some well-known livestock producers of the world. However, the livestock population is managed by small holders and a considerable proportion is managed on free range traditional system. According to Rim (1992), 85% of all species found in Nigeria are been traditionally managed while commercially managed livestock was only significant for poultry *(13.8%)* and to a lesser extent or pigs (3.2%), cattle (0.5%), goats (0.03%) and sheep (0.2%). This is the trend contrary to what is obtainable in Europe and N America where over 97% of the livestock arc managed intensively.

### *3.3 Comparative Analysis of Livestock Products*

Table 1 shows that the livestock products (meat and milk) in Nigeria is consistently higher in most cases than those found in most African countries irrespective of the species of livestock concern. However, in comparison with other countries of the world, the livestock products from America (Mexico, Argentina, Brazil, Canada and *USA),* South and eastern Asia (China, Japan and India) and Europe (Italy, Spain, France and Germany) are much higher than found in Nigeria and Africa in general. With a population growth of about 3.0% per annum, Nigeria's present population of about 140 million will reach about 200 million by year 2020. This explains why large numbers of live cattle, sheep and goats were imported as well as various milk products (up to *US$275* M) in year 2004 (FAOSTAT, 2006; Alokan, 2008).

To be able to meet the protein needs of the populace and for export, there is a compelling need to leverage endogenous research & innovation in enhancing both crop and animal agriculture in Nigeria.

## *4.0 CHARACTERISTICS OF NIGERIAN AGRICULTURE & OVERVIEW OF IMPACT OF SOME RESEARCH OUTCOMES*

### *4.1 Characteristics of Nigerian Agriculture*

The characteristics of the Nigerian Agriculture was lucidly presented by Njoku (2010) to include, but certainly not limited to:

i). **Weaknesses** - Small scale farms and industries; Dependent on rain-fed agriculture; inadequate supply of and poor quality farm inputs; Inadequate mechanization; Inadequate finance; Inadequate infrastructure

ii). **Threats** - desertification; uncontrolled grazing/livestock migration; poaching; bushfires, increasing demand for fuel wood; increasing demand for timber, road expansion, oil extraction activities; urbanization; youth restiveness; HIV/AIDS, global warming.

iii). **Other constraints** - Socioeconomic environment (political economy issues); Policy environment (Agricultural extension; credit; subsidy; marketing)

iv). **Crops**

- Land - small units; no collateral value; prone to

degradation
- Seed - limited supply, low yield
- Soil- declining nutrient status; environmental denudation
- Agri-input - inadequate supply; questionable quality; late delivery; high cost
- Water supply - drought; flood, rain-fed agriculture, very low irrigation infrastructure
- Technology - traditional; few tractors; processing rudimentary/ inefficient; post harvest losses high
- Extension services - near total collapse
- Credit - inadequate; inaccessible; high interest rate
- Transportation - difficult (low rural roads density);
- Marketing- inefficient; unfavourable pricing

v). **Livestock**

(a) Brood stock - poor breed characteristics; low milk yield; artificial insemination limited; poor quality chicks;

(b) Management - mostly extensive; predation high; exposure to weather elements; Feed - expensive; poor quality; limited grazing facilities; underfed animals;

(c) Diseases and pests - varied and common; drugs expensive (quality uncertain); trans-boundary animal diseases; migratory pests.

(d) Processing technology - unsanitary processing habits; rudimentary technology; poor meat handling; few milk processing plants; dairy products largely imported;

(e) Credit - inadequate; inaccessible;

(f) Extension - generalized;

(g) Marketing - undeveloped; trucking of animals common; poor meat quality; open and unsatisfactory meat sales;

**vi). Fisheries**

a. Seed stock - scarce; expensive;

b. Management - low level of competence; high post-harvest spoilage

c. Feed - uncertain quality; primarily imported; expensive; inadequate supply

d. Diseases - varied; limited competence; drugs unavailable

e. Credit - inadequate; inaccessible

f. Marine fishing - few fishing trawlers and motorized boats; high cost of diesel; piracy; lack of dedicated fishery harbours/terminals

g. Marketing - poorly structured; unregulated.

The combined effects *of* these factors are poor crop and livestock productivity, low income for the livestock farmers, increased animal protein importation to ameliorate the deficit, high mortality and morbidity and *of* course, gross reduction in animal protein intake in Nigeria. Consequently, resource-poor families cannot afford sufficient animal protein such as egg, meat and milk in their diets. As a consequence, there is increased incidence *of* kwashiorkor, retarded growth, poor mental alertness, marasmus, mortality and morbidity among the protein vulnerable groups such as pre-school children, infants, nursing mothers and aged people.

**Table 1: Livestock products (x1000MT) of Nigeria and of some selected countries of the world**

| COUNTRIES | BEEF | MUTTON | GOAT | PIG | POULTRY |
|---|---|---|---|---|---|
| **Africa** | | | | | |
| Nigeria | 280F | 99F | 142F | 200F | 1042F |
| Ghana | 24F | 11F | 11F | 10F | 172F |
| Mali | 113F | 36F | 46F | 2F | 259F |
| Cameroon | 95F | 16F | 15F | 16F | 218F |
| S/Africa | 590F | 104F | 36F | 113F | 1686F |
| Zimbabwe | 102F | 1F | 13F | 27F | 206F |
| Egypt | 250F | 75F | 33F | 3F | 1445F |
| Malawi | 16F | - | 6F | 21F | 59F |
| **America** | | | | | |
| Mexico | 1496 | 40 | 42 | 1043 | 4908 |
| Costa Rica | 74 | 7 | - | 36 | 182 |
| Argentina | 2800* | 52F | 10F | 216F | 4163F |
| Brazil | 7526 | 68F | 40F | 3059 | 18684 |
| Colombia | 680F | 7F | 7F | 110F | 1442F |
| Canada | 1171 | - | - | 1952 | 4248 |
| U.S.A. | 11906 | 90 | - | 9064 | 38748 |
| **Asia** | | | | | |
| China | 6218* | 1991* | 1603* | 46048* | 71041 |
| Japan | 505* | - | - | 1259 | 2991 |
| Rep. Korea | 185* | - | 3F | 1153* | 1771 |
| India | 1490F | 234F | 473F | 630F | 6038F |
| Pakistan | 445* | 174* | 373* | - | 1892 |
| **Europe** | | | | | |
| Greece | 62F | 82F | 44F | 140F | 484F |
| Italy | 1125 | 58* | 4* | 1587* | 4224 |
| Spain | 700 | 237 | 14 | 3322 | 5442 |
| France | 1650F | 135F | 7F | 2340F | 6516 |
| Germany | 1220 | 44 | - | 4238 | 6597 |

F = FAO Estimate, * = Unofficial figure
Source: FAO (2003)

### *4.2 Impact of Research and Innovation from NARS on Crop & Livestock Productivity*

By definition, the National Agricultural Research Systems(NARS) of any country relate to entities or institutions in that country charged with the responsibility for organizing, coordinating and executing research that contributes explicitly to the development of agriculture and the maintenance of its natural resource base(ISNAR, 1991). Historically, agricultural research commenced in Nigeria in 1893 with the establishment of a botanical garden in Lagos Colony by the colonial masters(Adu, 2005). The crop research station at Moor Plantation, Ibadan followed in 1899 while the establishment of the Departments for Agricultural Research in Cash Crops were established in 1912 for the southern and northern protectorates of Nigeria which were later amalgamated in 1914. The West African Oil Palm Research Institute was established in Benin City in 1954 while research stations were established for cotton in Moor Plantation and Zaria under the coordination of the British Cotton Growers Association. An important point to note is that all these research efforts were designed by the British Colonial masters to promote export crops to feed their home industries to the neglect of food crops. At independence therefore, Nigeria inherited several Research Institutes including those for Cocoa, oil-palm, stored-products, trypanosomiasis, veterinary and the various Federal Departments of Agriculture at Samaru and Umudike. It is a well known fact, that the British colonial masters never established or put in place the concept of National Agricultural Systems (NARS). The non-adoption of this research strategy for Nigeria by the colonial masters was largely because it did immediately address their key industrial needs except in cocoa, oil-palm and cotton. Post-independence, Nigeria has however attempted to develop her NARS such that it now has three Universities of Agriculture, $\geq$32 Faculties of Agriculture, $\geq$ 18 Research Institutes, five International Agricultural Research Centres domiciled or with outposts in Nigeria such as: IITA, ICRISAT, ILRI, WARDA and IRRI, all of these belong to the Consultative Group on International Agricultural Research(CGIAR). Others are non-governmental Research Institutes such as the Justice and Peace Institute by the Catholic Church in Ijebu-Ode and certain private sector laboratories. Between 1975 and 1977, rather than have several of the agricultural research stations affiliated with universities, or remain Federal Departments, they were transformed into full-fledged Research Institutes such as NAPRI, NCRI, NIHORT, FRIN, NIOMR, RRIN, LCRI etc.

The *raison d'etre* for establishing these NARS is, and remains to serve as instruments for the strategic linkage of technology generation and technology transfer via training, research and extension services to user-communities. According to Adu (2005), Adeniyi and Aletor (2005), despite the extensive research network in Nigeria, the NARS has not sufficiently impacted on crop and livestock productivity due to a myriad of constraints including poor funding, unstable institutional structures and administration, overlapping research mandates, inconsistent policies or policy somersault, poor staff welfare and the attendant brain drain etc.

Despite the aforementioned draw-backs, the NARS have contributed modestly to Nigeria's GDP (Table 2) and generated substantial amounts of technologies, products and processes (Table 3)

particularly in the areas of crop production, animal production, fisheries, agro-processing etc.

Without doubt, most of these generated technologies (Table 3) via research & innovation have the potential to increase Nigeria's crop & livestock productivity and hence enhanced food and nutrition securities, employment generation, poverty reduction and overall human development index and enhanced GDP (Table 4). A major constraint to the effective utilization of these generated agricultural technologies for the enhancement of agricultural productivity and overall well- being of Nigerians, is the very poor or weak linkages of the Nigerian research community with commerce and industry.

## *5.0 STATUS OF INDUSTRY-GOVERNMENT-UNIVERSITY (R&I INSTITUTES) RESEARCH PARTNERSHIPS IN NIGERIA.*

The National Economic Empowerment and Development Strategy (NEEDS) programme as Nigeria's development plan in response to, or consistent with, the demands of the New Partnership for African Development (NEPAD), and by extension, the MDGs, is focused on four key strategies: employment generation, wealth creation, poverty reduction and value orientation. NEEDS envisages forging stronger links between educational institutions and Industry to stimulate rapid industrial growth and efficient exploitation of Nigerian's abundant resources (NPC, 2004). By inference therefore, it is evident that a synergetic partnership between the universities, R& D institutes and industries would be key to the realization of the core objectives of not only the NEEDS, but the MDGs. However, the state of R&D in the Nigerian private sector was graphically reported by Ndiokho (1999), then Chairman and Managing Director of UAC Nigeria Plc, when he stated, and remains so today, that contrary to the widely-held belief, a lot of R&D is taking place within the private sector in Nigeria. He posited that the operations of these firms were largely driven by their desire to commercialize R&D efforts on a continuous basis. He added that "unfortunately many firms in Nigeria today live on results of R&D work carried out in other countries of the world many of which bore little relevance to our natural resource endowment and environmental characteristics". This scenario which still persists, has accounted for the lack of significant absorption of local research results into their operations with negative effects on value addition to our vast natural endowments such as in agriculture, solid minerals, petroleum, human capacity etc. The history of the development of the Nigerian Private sector, particularly the multinationals, is such that most of the firms still remain, largely, as outposts and subsidiaries of parent multinationals (Ndiokho, 1997). The original intent of the parent multinationals had been, and still remains, largely that of producing in Nigeria, those goods and services that were previously imported into the country with the cardinal objectives of expanding the local market for the goods and services, and to avoid any anticipated import/export barriers.

Consequently, the products lines, and hence the R&D directions, are not only dictated, but conducted overseas. Most of the indigenous firms are not exempted from the practice of relying on R&D output from overseas. The common argument by the indigenous firms for their low patronage of local R&D include: the more ready availability of "imported" R&Ds than local

ones which are yet to be tested; higher cost of, and long gestation periods for R&D results and returns; absence of government support programmes for companies engaged in local R&D such as strong and enforceable intellectual property rights; tax holidays etc; absence of suitable research facilities in our Universities and other R&D institutions, fear of loosing to competitors should they depend on local R&D output; unstable socio-economic policies of government etc.

While many of the above concerns by the private sector in W. Africa remain well founded, the implications have been such that the Universities and research institutes are denied access to the enormous financial and other resources at the disposal of indigenous and multinational firms. It is paradoxical that universities and other R&D institutes which are at the apex for value addition to all facets of manufacturing from food & agriculture, pharmaceuticals, engineering, petrochemicals to solid minerals etc remain very poorly patronized while recent estimates indicate that in the manufacturing sector in Nigeria, about 30% of the industries have closed shop, 60% are ailing, while only about 10% are operating fully at the installed capacity. Most of these industries currently source no more than 50% of their manufacturing input locally and contribute less than 0.5% to local R&D efforts.

At the last count, Nigeria for example has 122 universities, more than 120 research institutes, 115 poly- and mono-technics and 34 Colleges of Agriculture. These universities are either Federal (36), State(36) or privately owned(50). Among the Federal Universities are four specialized Universities of Technology and three Universities of Agriculture located at different agro-ecological zones of the country. It is regrettable that in spite of these potentials for knowledge generation for value addition to the vast reservoir of material and human resources, some 70% of Nigerians are poor and food insecure, living on less than 1 USD/day.

Indeed, the economic scenarios presented by the **South Commission** in 1990 and the various publications by the World Bank, UN and UNDP since then paint a gloomy picture of the Economic and HDI in the third world countries, including Nigeria. A perusal of the recommendations of the South Commission or the Pakistani model (Naim, 2005) clearly indicate that the poor economic showing of most of Africa (Nigeria inclusive), can be reversed by a skilful and committed industry-led,

**Table 2: Sect oral Contributions to the GDP 1999 – 2003 (%)**

| | Years | | | | | Average |
|---|---|---|---|---|---|---|
| **Sector** | **1999** | **2000** | **2001** | **2002** | **2003** | **1999-2003** |
| Agriculture | 35.31 | 26.29 | 30.06 | 31.18 | 27.03 | 30.08 |
| Industry * | 36.93 | 51.99 | 46.95 | 43.00 | 47.50 | 45.27 |
| Building & Construction | 0.86 | 0.67 | 0.74 | 0.72 | 0.62 | 0.73 |
| Wholesale & Retail | 15.20 | 11.62 | 12.41 | 14.17 | 14.50 | 13.58 |
| Trade Services | 11.70 | 9.43 | 9.25 | 10.93 | 10.35 | 10.34 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

* Includes crude petroleum mining, and quarrying, manufacturing
Source(s): CBN (2003) Annual Report and Statement of Account; Adu(20005)

**Table 3: Impact of Generated Technologies by Nigerian NARS**

| S/N | Technology | Impact |
|---|---|---|
| 1. | Improved maize varieties (Downy Mildew Resistant) | Increased annual yield by 40-45% |
| 2. | Improved Rice varieties (Lowland and Upland) | Gave high yield of 5 to 6 tons/ha |
| 3. | Improved Soybean production package | Increased production from 50,000MT in 1991 to 300,000MT in 1997. Also provided nutritionally improved food. |
| 4. | Improved Sorghum varieties (Sk 5192, KSV8, KSVIII, ICSV 400) | Striga resistant, early, maturing, gave high yields of 3 to 5 tons/ha. |
| 5. | Improved Cassava varieties (NRS4(2)1425). | Low cyanide content.<br>Increased yield by 55% |
| 6. | Improved Cowpea varieties (Sampea 6,7; IT-90K, 277-2) | Reduced Insecticide requirement. Increased yield by 45% |
| 7. | Improved yam minisett | Increasing planting population. Reduced root-knot nematode by 75%. Increase yield by 45%. |
| 8. | Improved wheat varieties (Pavon 76, cite, ceros, seri) | Increase yield by 15% |
| 9. | Improved millet varieties | Short, early-maturing. Increased yield by 27% |
| 10. | Improved industrial sugarcane production package | Increase sugar production by 35% |
| 11. | Improved potato varieties (Nikola, Kondor, Diamant and RC 767-2) | Increased production by 20% |
| 12. | Use of chemicals to control pests and diseases of cocoa | Increased yield by 72% |
| 13. | Developed Shika Brown Layers | Increased fertility by 73%, 1st egg drop at 131 days, peak production of 85%. Average hen-day production of 80%. |
| 14. | Improved nutrition for broilers and layers | Broiler ready at 7 to 8 weeks. Reduced age at 1st egg, bigger eggs with better quality, increased egg production by 75% |
| 15. | Feedlot technology for cattle, sheep and goats | Increased meat yield by 55% and also improved meat quality |
| 16. | Peri-urban milk production | Increased cow yield from 0.7 litre to 1.5 litres/cow/day |
| 17. | Improved nutrition for pigs | Improved farrowing rate by 40%. Increased pork yield by 65% and improved leanness of meat |
| 18. | Artificial Insemination technology for cattle and sheep | Improved conception rate, reduced incidence of diseases and increased milk yield by 27% |
| 19. | Production of various vaccines for livestock diseases | Better stock health, reduced mortality and hence higher stock productivity |
| 20 | Recommended oil-palm agronomic and cultural husbandry practices | Increased oil yield by 60% |
| 21 | Improved grow-out period for hybrid *Heterobranchus bidorsalis* and *Clarias* | Fish attain 3 to 4 kg in 6 months. Increased fish farm-yield from 0.5 to 2 tons/ha/yr to 3 to 4 tons/ha/yr |
| 22. | Recommended agronomic practices for natural rubber (RRIN 900) | Increased yield from 2500 to 3500 kg/ha/yr rubber |
| 23. | Improved budded citrus varieties | Increased annual yield by 45% |
| 24. | Agro-forestry technologies for afforestation | Increased farm yield by 38.5% |
| 25. | Fabrication of simple farm implements | Reduced labour and enhanced soil quality |
| 26. | Alternative feed formulae for swine, poultry and fish | Substantial reduction in cost of finished feed for swine, poultry and fish |

**Sources: Balogun (1998); Aletor (1999); Adu (2005)**

**Table 4: Contribution of Agricultural Sub-sector to Agric. GDP (%)**

| | Years | | | | | Average |
|---|---|---|---|---|---|---|
| **Sub-sector** | **1999** | **2000** | **2001** | **2002** | **2003** | **1999-2003** |
| Crop production | 84.08 | 83.83 | 83.87 | 82.98 | 83.91 | 83.73 |
| Livestock | 9.85 | 9.76 | 9.69 | 10.34 | 9.75 | 9.88 |
| Forestry | 1.67 | 1.88 | 1.73 | 1.71 | 1.61 | 1.69 |
| Fishery | 4.50 | 4.53 | 4.71 | 4.97 | 4.73 | 4.70 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

**Source(s): Adu (2005)**

government facilitated, appropriate Science and Technology (S&T) programmes. What then are these prescriptions of the ***THE SOUTH COMMISSION?***

In 1987, some distinguished world statesmen and technocrats from China, India, Brazil and South Korea - the four nations that led the third world in S&T as well as those countries in dire need of tutelage on the effective application of S&T for growth and development was assembled. This initiative, taken on behalf of an Asian think-tank and nonaligned movement by the Prime Minister of Malaysia had Dr Julius Nyerere of Tanzania as the Commission's Chairman. The Commission met for three years (1987-1990) and produced a document which Nwokolo (1993) rightly described as third world's primer for economic development. The main thrusts of these prescriptions were, among others:

**i)** a strong educational infrastructure which emphasize science at all levels and vigorous pursuit of adult literary and universal primary education;

**ii)** a vigorous effort to develop domestic capability in technology through a network of training in modem manufacturing skills;

**iii)** the establishment of centres for technology information with access to scientific information;

**iv)** application of S&T efforts to agriculture to ensure food security or self sufficiency in food production as an essential first step in economic development;

**v)** a vigorous export drive for surplus food products;

**vi)** a well informed and science-boosted approach to new investments with rapid acquisition of manufacturing skills and industrialization for home consumption and export. It also emphasized strong domestic savings schemes to accumulate investment capital to reduce foreign borrowing. The imperatives of fiscal and monetary discipline were emphasized;

**vii)** a fight against three identified negative tendencies - corruption/lack of accountability, reckless/flamboyant consumption pattern and militarization;

**viii)** a caution that as development proceeds, the states must shift their pattern of production and export from raw materials to manufacturing of products with high and medium local R&D intensity. This, the Commission

noted, was necessary to avoid the adverse effects of the decline in the prices of raw materials in the commodity market and to encourage local industries to add value to their resource endowments via local R&D efforts;

**ix)** a warning that no nation can expect to develop S&T capability without adequate and priority resource allocation for the development of local infrastructural and human R&D capacities. It opined that technology transfer and absorption are only possible when the recipient country has developed its own capabilities in the basic and applied sciences and;

**x)** an urgent review of incentives and reward systems for S&T practitioners to ensure that at the secondary and tertiary levels, an increasing proportion of students will opt for science, technological and entrepreneurial courses.

## *6.0 OPTIMIZING NIGERIA'S AGRICULTURAL RESOURCES FOR FOOD SECURITY AND POVERTY ALLEVIATIONVIAR&I*

The above recipes for rapid economic development and wealth creation as prescribed by the South Commission have worked, and are still working for the faithful adherent to these tenets. For example, the "Asian tigers" have continued to enjoy economic prosperity by constructively engaging their Universities, R&D institutes and industries in symbiotic partnership to produce high-tech goods/foods and services for domestic and export purposes (See Tables 5 & 6).

The Asian-Pacific countries of Malaysia, Thailand and Indonesia who have adopted similar attitudes to the Asian tigers have frequently leveraged their annual economic growth rates to as much as 6-10% while those of Nigeria and most other Sub-Saharan Africa countries remain sluggish. In Punch of Tuesday October 30, 2006, the Director, National Agency for Poverty Eradication was quoted as saying that Nigeria's attainment of an annual economic growth target of 10% was predicated on the success of the SMEs as it is with the Asian Tigers. This position is correct, but with a caveat, which is: for that to happen, and for the SMEs and indeed, the entire Nigerian industrial sector to be globally competitive, they must partner more with the R& I sector. The lingering problems of capacity underutilization and the attendant acute unemployment being experienced nation wide, will be with us for a long time unless our MSMEs are linked with the R& I sector to fast-track the processes of management and value-addition to Nigeria's vast natural resources, particularly agriculture for food security and poverty alleviation. World wide, the MSMEs contributes about 65% of the GDP and provides employment for about 75-85% of the Americans, EU and South–East Asians. Statistics from the Ministry of Youth Development in 2008, indicate that of about 350,000 university graduates produced in Nigeria between 2007 and 2008, less than 10,000 ie 1 in 35 or 2.85% have been gainfully employed ! This is no surprise because, as government jobs are dwindling so are MSMEs who groan daily under unfavourable operational conditions of high energy costs, high costs of funds, unfavourable tax regimes, policy somersaults, amongst others.

## *7.0 MAJOR CONSTRAINTS TO UNIVERSITY /R&D-INDUSTRY*

***ENGAGEMENT IN NIGERIA***

The major factors responsible for the weak linkages between industries, commerce, universities and other R&D institutions in Nigeria include:

**i)** lack of well articulated, coordinated and, or effective National Integrated Policy on R&I, or the absence of political will to enforce existing ones;

**ii)** information dearth on the availability of local R&I capabilities, results and products which abound in our Universities and Research Institutes. For example, the following Agricultural R & D products have been developed in The Federal University of Technology, Akure and are awaiting commercialization**: Hand-fed Cassava Peeler; Automated Cassava Peeler; Water Hyacinth Harvester; Automatic Starch Extractor; Fruit Juice Processing Plant; Cassava Mash Roaster; Row Crop Weeder; Yam Peeling Machine; Honey Extracting Machine; Rice Polishing Machine; Plastic Extruder; Fish Smoking Machine; FUTA Bread; Palm**

**Table 5: Comparison of Key Economic Indicators**

| COUNTRIES | POPULATION (MILLION) | GDP (BILLION $) | PER CAPITA INCOME ($) |
|---|---|---|---|
| *SINGAPORE* | 4.3 | 90 | 21,230 |
| *MALASIA* | 24.8 | 94 | 3,780 |
| *KOREA* | 47.9 | 576 | 12,020 |
| *CHINA* | 1,288.4 | 1,417 | 1,100 |
| *NIGERIA* | 135.7 | 58.4 | 422 |

Source: World Development Report, 2005; Naim, 2005
*http://sesrtcic.org/statistics/byindicators.php*

**Table 6: High Technology Exports: 2003**

| COUNTRIES | EXPORT (BILLIONS) | MANUFACTURED EXPORTS (% OF TOTAL EXPORTS) | HIGH TECHNOLOGY EXPORTS (% OF MANUFACTURING) |
|---|---|---|---|
| *NIGERIA* | 2.4 | 58.1 | 0.2 |
| *INDIA* | 54.7 | 75 | 5.0 |
| *CHINA* | 438.4 | 90 | 23.0 |
| *MALAYSIA* | 100.7 | 79 | 58.0 |
| *KOREA* | 194.3 | 92 | 32.0 |
| *SINGAPORE* | 144.1 | 85 | 60.0 |

Source: World Development Report, 2005; Naim, 2005
*http://www.unido.org/doc/5156*

**kernel cracker; Biological Insecticide/Pesticide; Mango Ogi; Leaf protein concentrate-based infant weaning foods; various alternative animal/fish protein feed resources etc.**

**iii)** lip-service on the part of successive governments about the importance of S&T as the foundation of R&D and engine of modern economic growth;

**iv)** chronic under-funding of universities, NARS, R& I institutions by government and the society (including the industries) leading to decay of teaching and local R&I capacity building infrastructure;

**v)** absence of strict laws on patents and intellectual property rights which discourages firms from committing their huge resources which R&D often requires;

**vi)** inadequate recognition of local researchers by industry and government which lead to under-utilization of available human capacity, poor reward and value systems, all of which encourage "brain-drain" with crippling effects on the nation's R&I capabilities.

## *8.0 SOME SUGGESTED WAYS FORWARD.*

To optimize the productivity, management and utilization of Nigeria's huge agricultural resources endowment (livestock inclusive) for economic prosperity, wealth creation and food security would require a paradigm shift, not only in the existing pattern of R& I-industry sector relationships, but also in our overall perception and appreciation of S&T and local R& I as the basis of sustainable growth and development. Consequently, what is urgently needed is a careful integration of the following:

**i)** a re-visit and a faithful adoption by African nations, particularly Nigeria, of the key elements of the prescriptions of South Commission earlier highlighted;

**ii)** the establishment of **autonomous, active** National Research Foundation or a National Autonomous R&D Council which will, among other functions, harness the university-industry synergies with regard to competencies, endowments (both material and intellectual) and experiences to produce high intensity local R&I products such as agricultural machinery, foods/feeds, services etc. This body should be empowered to fund competitive, market-oriented research in which the industries, universities and research institutes collaborate. The on going STEP-B programme must be taken beyond its current life span while the ongoing research funding initiative of TET Fund must be sustained.

**iii)** **the Agricultural Research Council of Nigeria (ARCN), although well conceived with clear programmes for attaining food and nutrition security, must be made active and autonomous in pursuit of its mandate.**

**iv)** the active promotion of local content policy for the manufacture of strategic basic equipment, drugs, foods, livestock/fish feed, goods and supplies with incentives such as subsidies, grants, tax holidays etc provided such firms by government;

**v)** a strict enforcement of patent laws and stiff penalties for intellectual property breaches;

**vi)** the re-evaluation of our value and reward systems to retain our best brains to champion development as is done in the more advance countries. For example, by 2005, more than 15m Nigerians are in diaspora including Dr. Phillip Emeagwali; Prof. Gabriel Oyibo - the 3-time Nobel Price nominee for Mathematical Physics and Prof. Esogbue a member of Board of NASA in the USA etc and ;

***vii)*** ***it was about time that the Nigerian scientific or R & I community came up with a credible, formidable Lobby or Advocacy Group to forcefully make a case for better*** funding of S***,T and Innovation as a Critical Success factor for Development in which food security and reduced poverty are a major components.***

## *9.0 CONCLUSIONS*

**i).** As rapid economic advances, wealth creation and overall human development indices have become knowledge-based, private sector-led, S&T-driven, and government-facilitated, R& I community-industry-government symbiotic engagements remain a critical success factor, or determinant of the extent to which Nigeria, and indeed, the developing countries of Africa will meet the key elements of the MDGs particularly Goal 1 which relates to stemming poverty and hunger.

**ii).** This is because the "Asian Tigers", some of whom were at the same level of technological and economic development with Nigeria about 1970s to early 1980s, owe their current technological advancement and relative economic prosperity to the productive and synergistic partnerships between their universities, research institutes and the private sector with government providing the enabling environment.

**iii).** The desire of African Nations(Nigeria inclusive) to attain food and nutrition security and ward off the crushing poverty level, will remain illusory if our universities, NARS (including S&T outfits) fail to follow global trends, or if they are denied the means to do so by governments and the society, including the private sector.

***Endogenous R& I must be at the driver's seat in the journey to frontally confront the embarrassing Nigerian paradox of being a rich nation populated by poor and hungry people !***