

# **THE ROLE OF RESEARCH IN AGRICULTURAL DEVELOPMENT**

**BY**

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## **Introduction**

Agriculture is one of the pillars and most vital production sectors of any Nation's economy. The roles of the Nigerian agricultural sector include provision of food for the population. The sector has been the largest employer of labour with more than 75% of the nation's population involved in one form of agriculture-related activities or another. The sector provides income for the farming households as well as being a major source of foreign exchange earnings for the nation.

Against this backdrop of the agricultural sector's contribution to employment creation, poverty and hunger reduction, reduction in rural-urban migration, the present administration has not only focused on the MDG's but has also commenced the nation's agricultural transformation in all its ramifications.

Agricultural research in Nigeria started more than 100 years ago with the establishment of a botanical garden in Lagos during the late 19<sup>th</sup> century. By 1903, the Forestry and Botanical Department (renamed Agricultural Department) for Southern Nigeria was created. By 1912, the latter was divided into Northern and Southern regions. By 1914, the Forestry and Veterinary Departments were created. The Fishery Department evolved in 1951. In a nutshell, by the 70's and 80's, different research institutes and departments of agriculture had emerged. Presently, Nigeria has the largest and most elaborate National Agricultural research systems in Sub-Saharan Africa. By 2006, the government set up an umbrella body known as the Agricultural Research Council of Nigeria (ARCN) which was established to address the challenges faced by the agricultural research system. ARCN's mission is to achieve significant improvements in agricultural productivity, marketing and competitiveness through generation of appropriate technologies, policy options and knowledge management of the

agricultural research system. ARCN is able to achieve their mission through the adopted village studies and the Agricultural Research Outreach Centres (AROC).

### **Functions of Research**

Agricultural research provides information for policy makers and funding agencies.

It provides transfer of research-induced technology to farmers which is the only way to measure research benefits to society. Agricultural research impact study also provides feedback to scientists on which technologies or technology components are successful at farm levels.

**Table 1: List of the NARIs under the Aegis of ARCN**

<b>Name of NARI</b>	<b>Location</b>
1. National Root Crops Research Institute (NRCRI)	Umudike
2. National Horticultural Research Institute (NIHORT)	Ibadan
3. Cocoa Research Institute of Nigeria (CRIN)	Ibadan
4. Nigerian Institute for Oil-Palm Research (NIFOR)	Benin City
5. Rubber Research Institute of Nigeria (RRIN) Iyanomo,	Benin City
6. Nigerian Institute for Oceanography & Marine Research (NIOMR)	Lagos
7. Lake Chad Research Institute (LCRI)	Maiduguri
8. National Veterinary Research Institute (NVRI)	Vom
9. National Institute for Fresh-Water Fisheries Research (NIFFR)	New Bussa
10. Nigerian Stored Products Research Institute (NSPRI)	Ilorin
11. National Cereal Research Institute (NCRI)	Badegi
12. Institute for Agricultural Research & Training (IAR&T)	Ibadan
13. National Animal Production Research Institute (NAPRI)	Shika Zaria
14. National Agricultural Extension & Research Liaison Services (NAERLS)	Zaria
15. Institute for Agricultural Research (IAR)	Samaru, Zaria

### **Changing Expectations of Research, Technology and Innovation**

Over the years, there has been a significant change in the expectations of science and technology and innovations, from increasing **crop** and **livestock** productivity to creating competitive, responsive and dynamic agriculture, that directly contribute to the Millennium

Developmental Goals. A competitive agriculture which will result in market-driven exchange of both knowledge and products; viable in domestic, regional and global markets.

A responsive agriculture that is addressing multiple sources of small farmers, agribusiness, food insecure customers, wealthy consumers etc. A dynamic agriculture that is able to adapt to long-term agro ecological changes, medium term structural changes and short term shocks (Spielman, 2008)

### **Investment in Agriculture and Agricultural Research**

Public spending on agricultural research as a proportion of agricultural GDP in Africa declined over the years. (ECA-OECD Review, 2005). The current average level of public expenditure to support agriculture is around 4 percent. Comprehensive African Agricultural Development Programme (CAADP) reports estimate that if the MDGs are to be met, 10 percent of the national budget should go to the agricultural sector and at least 2 percent of the GDP should go to national agricultural research and development by 2010. Unfortunately, Nigeria invests 2% of her national budget into agriculture annually while Burkina Faso invests 10% and most Asian nations invest 16% of their national budget into the agricultural sector. Those countries in Asia which have successfully managed to transform their agrarian economies have consistently spent a much higher percentage of public expenditure to support agriculture. Publicly funded research will continue to play a key role since agricultural research needed to address poverty involves a long term investment.

### **Recent Technological Advances in Bio-Technology and ICT**

Biotechnology has provided unparalleled prospects for improving the quality and productivity of crops, livestock, fisheries and forestry. Conventional biotechnologies have been around for a very long time, while genetic modification (GM) technologies have emerged more recently. GM technologies are making rapid progress worldwide. Africa lacks capacity and resources to move biotechnology research forward. Countries have not yet developed proper legislation frameworks on bio-safety of GM organisms.

Bio safety is a highly technical field, which typically requires high initial investments for building the necessary human resource capacity and institutional infrastructure (including laboratories and green houses for risk assessment or testing and identification of genetically modified organisms). Bio safety issues transcend national boundaries. Transboundary movement of GMOs across porous borders is going to be a formidable challenge which may require policy interventions and coordination (PAPA, 2008).

There is general consensus that both transgenic and conventional breeding will be needed to boost crop and livestock productivity during the next 50 years (Science, March 2008). However the low public investment in biotechnology and slow progress in regulating possible environmental and food safety risks is restraining the development of GMOs that could help the poor. Improving the capacity of the public sector R & D organizations to assess the risks and benefits to harness and deploy new agricultural technologies is very important.

The revolution in ICT technologies and increased access to them in developing countries is enabling a variety of new approaches to capacity building and knowledge sharing exploitation of these opportunities require additional investments.

### **Meeting commitments and Targets**

Under the United Nations Millennium Development Goals targets are set for: reducing hunger and poverty, achieving universal primary education, promoting gender equality, improving maternal health and nutrition, combating HIV/AIDS, malaria and other diseases and ensuring conservation and the enhancement of basic life-support systems including land, water, forests, biodiversity and the atmosphere. There is increasing evidence to show that we will not meet any of the targets set for 2015. It has been observed that if the prevailing trends persist SSA is expected to miss every single of the 18 targets of the MDGs (Rippin & Bruntrup, 2006). In 2001, 46 percent of SSAs population lived in extreme poverty. Though this proportion is expected to decline in the coming years the decline can only be described as marginal.

Thus, in 2001, African heads of state adopted the strategic framework to develop integrated socio-economic development framework for Africa – the New Partnership for Africa's Development (NEPAD) under the auspicious of the African Union (AU). The agricultural agenda of NEPAD is driven by the comprehensive African Agricultural Development Programme (CAADP). This strategy calls for an annual growth rate of 6.5 percent. At least 10 percent of the national budget as defined in the Maputo Declaration (February, 2003) should be allocated to agriculture.

To sum up, there is a need for agriculturalists to grow intellectually and operationally from a narrow focus on agriculture and technological research and dissemination to a better understanding of rural societies and their needs. There is a need to seek greater understanding of alternative pathways for rural economic development, placing the role of agriculture in perspective, and redefining the role, mission, and strategy of the agricultural institutes and agents as facilitators of rural economic growth. This calls for the change in the mind sets of

the change agents and greater flexibility and creativity in defining the agenda as well as in defining new public-private-civil society partnerships on the basis of whatever is necessary to improve opportunities, productivity and income generation capacity of poor rural households. The Nigerian agricultural sector has traditionally been expected to provide food for the growing population, generate foreign exchange earnings, employ part of the labour force, and provides income for the farming households.

### **Integrated Agricultural Research for Development (IAR 4 D)**

In the contemporary context research is not merely intended to develop and promote technologies to farmers but also empower farmers to better understand and respond to changing circumstances as they emerge. Farm enterprises and commodity production are no longer viewed in isolation of one another rather they are seen as interacting with natural resources management, markets and policies. Collaboration is no longer approached in a top-down manner through assigned tasks instead partnerships are forged and have recognized the importance of participation and interaction balanced with individual needs and goals.

The agricultural research for development takes a systems approach that goes beyond integrated natural resources management to encompass the domains of policies and markets and the effects that these have on the productivity, profitability, and sustainability of agriculture. The agricultural research for development and their important interactions recognizes that the general approach to rural transformation involves intensification of subsistence oriented small holder farming systems, better management of natural resources while intensifying their use, developing more efficient markets and enabling policies.

Agricultural research for development requires additional mechanisms to foster integration of these four dimensions and a new way of doing research and development. Therefore the support pillars of agricultural research for development include:

- Promotion of organizational and institutional change to enable cross-disciplinary research and development and multi-institutional collaboration.
- Capacity building of the various stakeholders (farmers, scientists, and other relevant stakeholders)
- Information and knowledge management and
- Continuous monitoring and evaluation and systematic approach to impact assessment.

The National Agricultural Institutes (NARIS).

The 15 agricultural research institutes are commodity based. For example, NRCRI is given a mandate for research into yam, cassava, etc., while CRIN is saddled with research into export crops such as cocoa, kola, cashew and coffee. Lake Chad Research Institute sees to the improvement of millet and sorghum production. Nigerian Institute for Oceanography and Marine Research (NIOMR) has mandate for research into fish and fishery produce. The National Veterinary Research Institute (NVRI) has mandate for large animals – cow, cattle and other small ruminants. While NCRI is into rice and other cereals improvement programme, NIHORT has the mandate to conduct research into the genetic improvement, production, processing, storage and marketing of Tropical fruits, vegetables, spices and ornamental plants. A list of some of the Nihort’s mandate crops/plants are shown in Table 2.

**Table 2: Targeted Horticultural Crops for Nationwide Production**

<b>Vegetables</b>	<b>Fruits</b>	<b>Ornamentals (Flowers)</b>	<b>Spices</b>
<b>Okra</b>	<b>Pineapple</b>	<b>Cut Flowers</b>	Onion
<b>Egg plant</b>	<b>Banana</b>	Rosa spp	Ginger
<b>Green peas</b>	Citrus, e.g.	Ixora	Garlic
Tomato	Sweet orange	Borganville globe	Nutmeg
Pepper	Grape fruits	Cactus	Curry leaf
Ugu / Leafy greens	Tangerine	Marigold	Parsley
Water melon	Lemon and	Eucalyptus	Scent leaf
Cucumber	Lime	Jonie Walker	Peppermint leaf
Carrot	Mango	Carpet grass	Celery
Cabbage	Plantain	Port-Harcourt grass	
	Pawpaw	Purple heart	
	Avocado peas	Chrysentemum	
	Ogbonno		

- **Emboldened = Crops earmarked for Export to EU by the 26th November, 2011 Brussels Summit**

Part of the tasks of research is to acquire information on agricultural activities of other developed and developing economies of the world. Thus, table 3 shows a comparative status of world yield figures of some horticultural crops while table 4 is the production in metric tonnes of selected horticultural crops in Nigeria.

**Table 3: Comparative Status of World Yield Figures of some Horticultural Crops (2006 cropping season) (Kg/ha)**

<b>Crops</b>	<b>USA</b>	<b>Nigeria</b>	<b>S/Africa</b>	<b>Ghana</b>	<b>Cot/d'l</b>	<b>Brazil</b>	<b>Malaysia</b>
Citrus	24,191	4,514	18,344	-	12,243	-	5,512
Guava/Mangoes	4,384	5,805	1,916	11,000	4,996	15,959	4,337
Plantain	-	6,094	-	9,699	3,846	-	-
Pawpaw	21,736	8,250	10,212	4,470	23,915	48,337	10,011
Other fruits	18,000	6,406	10,434	3,461	7,166	13,157	7,319
Pepper	24,617	7,842	-	3,597	5,859	-	-
Okra	7,589	2,638	-	3,597	5,859	-	-
Onion (dry)	51,186	14,843	25,061	7,727	-	20,534	-
Vegetables	77,877	7,534	15,500	8,000	7,857	11,750	13,157

**Source:** FAO production statistics division 2008 <http://daosta.FAO>

**Table 4: Production (“000MT) of Selected Horticultural Crops in Nigeria (1999-2009)**

Year	Crop						
	Onion	Okra	Pepper	Tomato	Ginger	Egg plant	Garlic
1999	436.3	625.8	812.5	1,078.8	196.3	430.4	79.709
2000	593.0	685.2	864.8	1,260.8	196.2	455.7	79.709
2001	617.2	696.2	861.6	1,251.0	200.3	430.5	80.145
2002	632.7	706.3	901.1	1,284.1	221.2	468.5	79.929
2003	658.7	736.4	945.8	1,324.4	221.5	492.0	80.18
2004	1,147.1	962.8	1,009.9	1,805.1	245.6	509.2	79.43
2005	1,182.5	1,233.3	1,406.2	2,042.9	249.8	519.1	89.25
2006	1,175.0	1,280.2	1,430.1	2,079.0	272.1	546.3	89.46
2007	1,238.2	1,038.7	1,310.2	1,701.4	261.0	462.1	91.27
2008	1,365.7	1,060.5	1,626.2	1,823.8	372.5	453.7	108.59
2009	1,695.22	1,178.2	1,793.3	1,823.102	425.11	629.9	114.44

**Source:** FAO production statistics division 2008 <http://daosta.FAO>

## Constraints

Tropical fruits and vegetables are faced with numerous challenges along the value chain and these pose major threats to the attainment of the full potentials of the commodities in Nigeria, either for local consumption or foreign market. The challenges in the sector include:

- Post-harvest handling (sorting, grading and cold storage, etc)
- Poor road network.
- Low utilization of improved seeds and seedlings (Nigeria uses 5%; East Africa 25% and Asia uses 60% improved seed/seedlings).
- Low rate of fertilizer usage: Nigeria uses an average of 13kg/hectare; Western World uses 100kg/hectare and Asia uses 150kg/hectare.
- Low yield: Crop yield in Nigeria is only 20-50% of that obtained in other developed countries of the World.
- Lack of Credit facilities to horticultural growers. No bank or finance house is ready to give loan to agricultural/horticultural entrepreneurs.

Despite these challenges, when the export market is stimulated, viable businesses that focuses on fresh produce production, processing, grading, packaging, transportation, marketing and short-term cold storage will be developed.

## PROGRAM STRUCTURE OF NIHORT’S R&D

The outcome of the Brussels' conference on **Nigeria Fresh Produce Export** potentials to the EU revealed that there is a huge market for Nigeria in the production of six horticultural crops which includes Green peas, Okra, Pineapple, Banana, Eggplant and Ornamentals.

The following are the major steps in achieving the structure:

### ***Farmer clusters***

The Program shall entail the establishment of horticultural commodity farms based on specific crop of ecological advantage, in the different local government areas of the different geopolitical zones. Farmers in each zone shall be formed into clusters of twenty or more farmers, whose total land area shall be forty or fifty hectares. Farmer clusters shall be encouraged to employ young adult school leavers that are over 18 years of age to do farm operations. They shall be encouraged to continue to purchase improved seeds annually to ensure good plant vigour and higher yield of farm produce for export by the Association.

### ***Fresh Produce Growers and Exporters Association***

The Fresh Produce Growers and Exporters Association (FPGEAN) shall buy fresh produce from farmer clusters. The FPGEAN shall sort, grade, packaged and convey produce in refrigerated trucks to cold-rooms in the Airport or close to the Airports for onward export out of Nigeria.

### ***Input Supply***

Farmers who have registered to be part of those exporting their produce shall not only be supplied with improved seeds seedlings pesticides fertilizers, etc. and tractor hiring but shall also be trained on appropriate agrochemicals/bio pesticides and fertilizer, type, time and method of application. Presently many companies are springing up producing organic fertilizer since the whole universe is going organic. Many more shall be encouraged to set up organic fertilizer production plants in the country.

The use of **Bio-pesticides** is also being encouraged to go along with the use of organic fertilizers. This is in a bid to avoid detrimental residual effect when synthetic chemicals are used. Research has shown that the use of crop bio-pesticides in crop production have no residual or detrimental effect on both man and animals.

*Fertilizer Strategy* is such that the government shall stimulate a thriving private sector fertilizer industry. The government shall no longer get involved in fertilizer procurement and distribution, supporting farmers through subsidies, using the success story of Taraba State.

### ***Transportation***

Nigerian government shall provide packing houses, for sorting, cleaning, grading, Cooling Vans/Vehicles for transporting fresh produce from farms to the cities and Cold-rooms near or at the Airports. The FPGEAN shall hire these vehicles to transport fresh produce to the Airports.

### ***Storage***



Fresh produce shall first be stored in Cold-rooms which shall be provided at subsidized rates by the government. Entrepreneurs shall also be encouraged to own Cooling Vehicles, Cold-rooms and packaging houses.

### **GOVERNMENT POLICIES**

- The present administration has decided to fix fertilizer. This will be done by privatizing fertilizer sales and distribution.
- Government shall ensure that fake and expired agro-chemicals and bio-pesticides do not enter into Nigerian market, through adequate policy being put in place. In addition, the government has decided to fix:
  - (a) Marketing Institutions
  - (b) Financial value chains
  - (c) Agriculture investment frame-work

### **Synergy/Collaboration**

The project shall collaborate with other stakeholders in the country as well as

Association of Local Government Organization of Nigeria (ALGON) to ensure the participation of all concerned, especially at the grassroots. The State Governments shall be key in the execution of the project.

### **Expected impact (Socio-economic Target)**

The establishment of the horticultural farms and the subsequent production of horticultural crops shall trigger off series of economic activities and operations along every commodity value-chains.

- Export will result in the provision of infrastructures e.g. cold rooms, cooling vans, especially at (Lagos, Abuja, Port- Harcourt)Airports.
- Presence of Agro-chemical industries
- Packaging and handling shall be enhanced
- Increase in production of raw materials
- Capacity building and technical training of manpower

### **Growth Enhancement Support (GES)**

Government shall enhance income of farmers through fiscal savings.

The surplus crops produced shall be marketed through (NIRSAL) Nigerian Incentive based Risk Sharing for Agricultural Lending.

The GES shall target 5.4 million horticultural farmers by the next 9 years

- The GES shall make use of mobile phones to communicate vital information to every farmer.

### **Development of Crop Processing Zones**

- **FPGEAN** shall establish and manage a functional multi-stakeholder platform for fresh produce export.
- **ARC/NIHORT** Value Chain **capacity building** for input dealers, producers, transporters and exporters through training and workshops.
- Farmer clusters/groups shall be linked up with processing plants.
- Government shall put in place Cold-rooms at major Airports.
- There shall be supportive infrastructures for the processors.
- There shall be tax breaks for the processors.

#### HORTICULTURAL TRANSFORMATION PLAN (VALUE CHAINS)

- **PINEAPPLE VALUE CHAINS**
  - Pine apple juice
  - Pine apple Squashes and cordials
  - Pine apple fruit wine
  - Canned pineapple slices/Pineapple rings in syrup
  - Dry pine apples
  - Pineapple Juice Concentrate
  - Pine apple Jams and jellies
- **CITRUS (ORANGE) VALUE CHAINS**
  - Frozen concentrated orange Juice(FCOJ)
  - Orange Jams, Jellies and Marmalades
  - Citrus essential oils
  - Citrus pectin
  - Citrus ethanol
  - Citrus pulp pellets
- **MANGO VALUE CHAINS**
  - Mango juice
  - Canned Mango Products
  - Mango Kernel flour
  - Mango jam
  - Mango wine
  - Dried mango slices
  - Mango chips
  - Mango bar
- **TOMATO VALUE CHAINS**
  - Tomato ketchup or Sauce
  - Tomato pulp
  - Tomato puree
  - Tomato paste
  - Tomato powder
- **GINGER VALUE CHAINS**
  - Dried ginger powder
  - Ginger juice extract
  - Ginger flakes

- Ginger essential oil
- **ROSELLE VALUE CHAIN**
  - Roselle juice
  - Roselle concentrates
  - Roselle jam
  - Roselle fried snacks
  - Roselle fruit Leathers
  - Roselle soup
- **PEPPER VALUE CHAINS**
  - Dried pepper powder
  - Milled pasteurized pepper mix
- **ONION VALUE CHAINS**
  - Dried onion rings
  - Onion flakes
  - Onion powder
  - Irradiated whole onion
- **EGUSI- MELON VALUE CHAINS**
  - Egusi- melon soup
  - Egusi-melon oil
  - Egusi-melon candy (Robo)
- **PLANTAIN VALUE CHAIN**
  - Plantain Sticks
  - Plantain Flour
  - Plantain Chips
  - Peeled plantain

## CONCLUSION

Agriculture is a major sector in any nation's economy. Nigeria, being an agrarian country, employs majority of her populace and provides their livelihoods. It contributes to employment creation, poverty and hunger reduction and reduction in rural- urban migration.

And so, in the new transformation policy through research, Nigeria will:

- No more embark upon isolated projects without a strategic focus to drive agricultural growth and food security in a clear and measurable way.
- Focus on agriculture as a business
- Focus on value chains where Nigeria has comparative advantage
- Develop strategic partnerships to stimulate investments to drive a market-led agricultural transformation at :
  1. State and local governments
  2. Inter-ministerial collaboration
  3. Private sector
  4. Farmer groups and civil society
- Sharp focus on youth and women

- Pineapple Juice



**Pineapple fruit wine**





*CITRUS VALUE CHAINS*



Orange juice



# MANGO VALUE CHAINS

## Mango Juice



## Mango jam



## Mango Wine



## Dried mango slices



Mango chips



Mango bar



**Canned mango pulp**



**Canned fresh mango slices**

• **TOMATO VALUE CHAINS**

**Tomato juice**



**Peeled Tomatoes**



**Tomato pulp**



**Tomato paste, puree**





pawpaw



red

roselle calyces



pawpaw fruit cuts

### FRUIT CANS PACKAGING



Can (Tinned)



## PLANTAIN VALUE CHAINS



Chips  
**Plantain Sticks**



**Plantain Flour**



**Plantain**



**Peeled plantain**



Aseptic **Tetra Pak** Filling



The juices can be in bottles/tetrapaks but the latter is the most current technology.

