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**Inaugural Lecture series 249.**

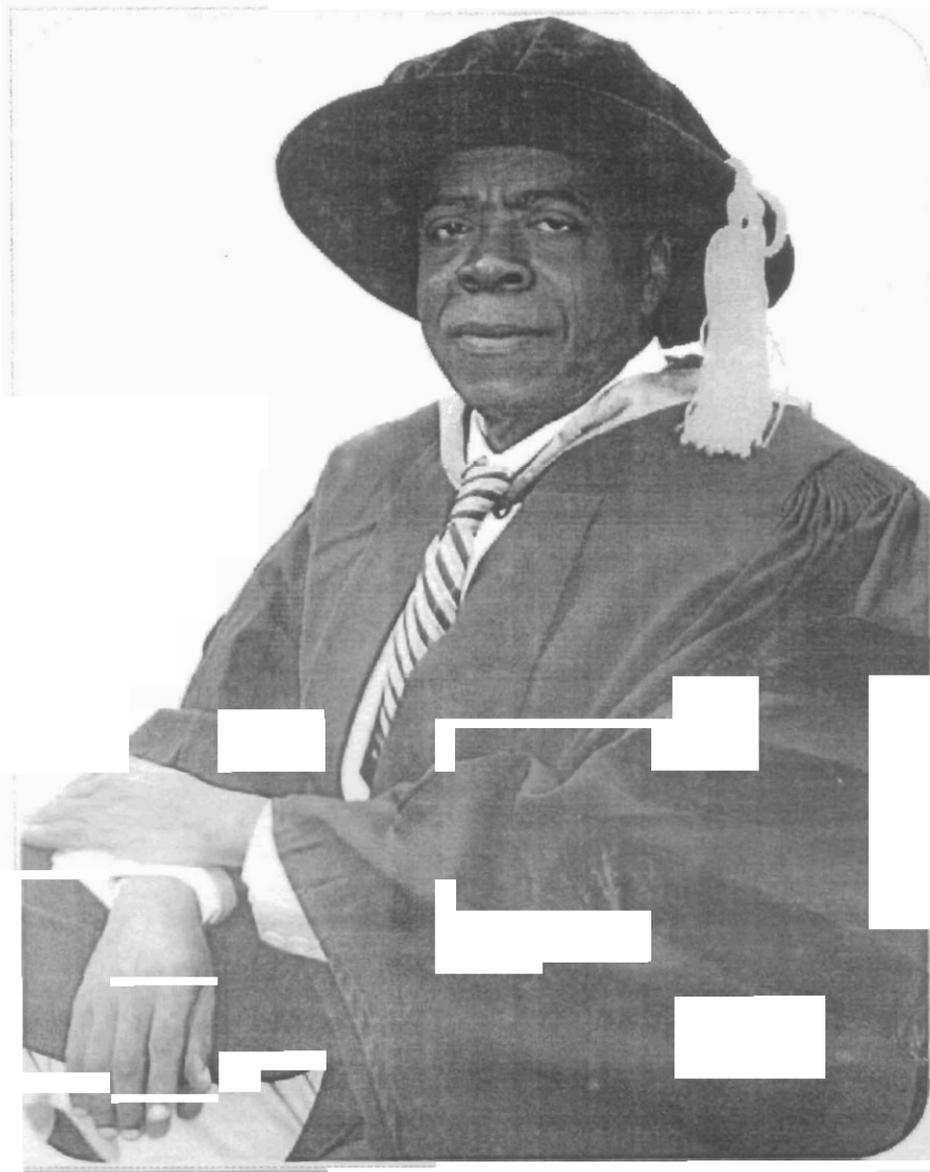
**SMALL OR LARGE SCALE  
AGRICULTURE FOR NIGERIA:  
Issues, Challenges and Prospects**

**By**

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*Professor of Agricultural Economics*



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**SMALL OR LARGE SCALE AGRICULTURE FOR NIGERIA:  
Issues, Challenges and Prospects**

**An Inaugural Lecture Delivered at Oduduwa Hall,  
Obafemi Awolowo University, Ile-Ife, Nigeria  
on Tuesday 11th September, 2012**

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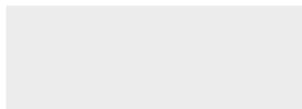
Obafemi Awolowo University Press Limited  
Ile-Ife, Nigeria.

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ISSN 0189-7848



*Printed by*  
Obafemi Awolowo University Press  
Ile-Ife, Nigeria.



# INTRODUCTION

**Agriculture** has been the only source of **food** and the most reliable source of **fibre** both of which are needed for basic human survival. In addition, for an agrarian economy like Nigeria, a long lasting **economic development** should have **agricultural development** as its bedrock. There is no consensus on the best system to organise agriculture to achieve agricultural progress. No two nations may use the same method to achieve positive results because of possible differences in climatic conditions, cultural, technological and institutional settings.

The Vice Chancellor, Sir, colleagues, students, distinguished guests, I thank Almighty Allah for giving me the privilege and opportunity to deliver the 249th Inaugural Lecture of the Obafemi Awolowo University, Ile-Ife, Nigeria.

My interest in academics was aroused and nurtured by my mentor, Prof O. O. Ladipo (a retired Professor in the same Department). He identified me from my undergraduate days as a young person to encourage into the academic profession. I wish to say that I have no regrets at all and am very grateful for the successful mentoring. Part of the success is my standing here before this audience to deliver an inaugural lecture.

The title of this lecture is “Small or Large Scale Agriculture for Nigeria: Issues, Challenges and Prospects”.

The Vice Chancellor, Sir, I wish to start by explaining the terms and concepts that will facilitate effective communication with my audience. Other sections of the lecture are roles and requirements of agriculture in economic growth and development; agricultural development efforts and challenges; requirements for research in agricultural economics; my contributions to knowledge singly and jointly with other researchers and; decision on choice of farm type for Nigeria.

## Concepts and Terms

### ***Agriculture***

Agriculture (also called farming) is the cultivation of plants, animals and fungi, and other life forms for food and fibre used to sustain life. By this definition, agriculture encompasses the production of crops, livestock, fishery and forestry.

### ***Production***

This is the conversion of inputs to outputs. The final stage of production process is reached when the commodity is available for final consumption. Thus, the concept of production as used here involves the stages of conversion of physical inputs/services to physical outputs/services, harvesting, storage, processing and marketing to get the physical outputs/services for final consumption. Agricultural production could be carried out at subsistence or commercial level. *What is subsistence farming? How is it different from commercial farming?*

### ***Pure Subsistence and Commercial Farming***

**Pure subsistence farming** literally is a type of farming that feeds farmer's family only. It is an agricultural system in which a farm family or community uses what it produces and produces what it uses. The subsistence farmer does not keep markets in mind when planning production. Individual farmer is an island in the inputs and outputs markets. *Does pure subsistence farming exist?* The answer is No. This is because no individual farmer is an island in the agricultural inputs and outputs markets or exchange system. The opposite of subsistence farming is commercial farming.

**Commercial farm** is a farm firm. A **firm** is a unit of production with the objective of making **profits**. A commercial farm produces agricultural commodities by obtaining production resources from the input markets and selling its agricultural outputs in the output markets with the objective of making profits. There is a continuum between pure subsistence and pure

commercial farming with individual farmer or group of farmers lying in between the two extremes of pure subsistence and pure commercial farming. A significant difference between subsistence and commercial farming in a capitalist/mixed economy like Nigeria is the emphasis in the objective of profit making by commercial farmers. *What is profit and how is it measured?*

### ***Profits and Profitability Measurement.***

Profit is the difference between Revenue (Income) and Cost. **Revenue** is the value of output expressed in monetary term. **Cost** is the monetary value of inputs used to produce output. There are two types of profit depending on how cost is defined. These are accounting profit and economic profit (Leftwich, 1979). Cost could be defined as implicit or explicit cost. **Explicit cost** is the payment for resources bought or hired. **Implicit cost** of production is the cost of self owned, self employed resources. **Accounting profit** is the difference between revenue and explicit cost. **Economic profit** is the excess of revenue over the sum of implicit and explicit costs. The distinction between the two costs in determining the level of profit and for decision making becomes necessary in an economic system where implicit cost is significant but disregarded in determining profits- a situation that occurs in traditional smallholder farming (Alimi, 1991). Most agricultural enterprises in Nigeria are becoming increasingly commercial. *What are the methods of organising commercial agriculture?*

### ***Smallholder and Large Scale Farming and Characteristics***

Commercial agriculture could be organised as small or large scale farming. Classification of farms into small or large scale is a function of farm size. *How is farm size measured?* Farm size for both livestock and crop enterprises could be measured in terms of physical, financial, and labour factors (Harsh *et al.*, 1981). The physical factors for crop farms indicate both the amount of resource input (number of total and tillable hectares) and production output (quantity of crops produced). The same pattern

is followed for the financial size factors but the units of measurement are in monetary terms. In addition, farm size could be measured by the amount of labour employed in the farm. This factor reflects the amount of labour resource used in the business. There is no agreement on the cut off point between small and large scale farms. In addition, some farm sizes considered to be large in developing agriculture may be small scale in developed agriculture. Alimi (2000) noted that the mean crop farm size in Oyo State of Nigeria was one hectare. Olayide and Heady (1982) indicated cultivated crop farm size less than 10 hectares as small scale. Going by this standard, nearly all the crop farm enterprises in Nigeria would be small scale.

Whether subsistence, commercial, small or large scale, resources are needed for production. *What are the production resources in agriculture and their characteristics?*

### ***Factors of Production in Agriculture***

Factors of production are the resources combined together to produce output(s). These are grouped into four major classes of land, labour, capital and management.

Land is the single most important factor used in farming. Land in this context refers to agricultural land and nothing in terms of agricultural production could take place without it. Land economists regard land as the sum total of natural and man-made resources over which the possession of earth surface gives control (Fabiya, 1979). Nigeria is very rich in natural resources (Table 1). It has a land mass that spans over 91.08 million hectares out of which 36.50 million are for arable, 3.00 million for permanent crops and 39.00 million for pasture (FAOSTAT, 2010). Nigeria is endowed with significant water resources. Apart from numerous north-south flowing rivers, there are two big drainage systems. These are Niger-Benue Rivers together with their many tributaries draining into the Atlantic Ocean; and Komandugu-Yobe Rivers with their tributaries flowing into Lake Chad. Nigeria is rich in marine and inland water resources containing large numbers of

aquatic animals and plants. The country has a tropical climate characterised by high temperatures and high humidity favouring the cultivation of tropical crops of wide diversity. The country has two distinct climatic seasons, the wet and dry seasons. Since agriculture in Nigeria is largely rain fed, the length of the cropping season is determined significantly by the duration of the wet season. The land accommodates big population of domesticated animals and wildlife. With the foregoing, the country has enough land resources to be self-sufficient in agricultural production.

Farm labour is the quality and quantity of human efforts available for farm work. Farm labour could be divided into family labour and hired labour. Family labour is the labour supplied by the farming family, which consists of the man hours made available by the farmer, his wife(s), children and relations. The exchange of family labour does not pass through the labour market. No payment is involved as such it is an implicit cost. Changes (decrease) in family size, rising trend of putting children in schools and migration of youths from rural to urban areas are likely to affect (decrease) the labour supply from family labour source. Hired labour is that which the farmer paid for to work on his farm. The exchange of hired labour for wages passes through the labour market and the wage is determined by the forces of demand and supply for labour. A country's population is the main source of its labour. Nigeria is blessed with high human population that is rising but a relatively declining rural population (Table 1). The importance to agriculture of each labour source relative to the past is declining thus causing shortage of farm labour.

Capital has been simply defined as goods, which have been produced to be used in further production as distinguished from goods produced for consumption. In agriculture, capital includes such items as simple tools, machinery, seeds, fertilizers, chemical, livestock and valuable improvements on land. The use of relevant capital increases productivity. The major difference between traditional and developed agriculture is in the kind and amount of

capital used in farming, which is relatively higher in modern agriculture.

Management refers to the ability to organise/control the other three factors of production and to take risk. Management is concerned with the efficient allocation of the limited resources to achieve the producer(s)' objectives. Socio-economic characteristics of the entrepreneurs such as ability to take risk and literacy level have been found to influence management. The ability to take risk is a function of the resource base of the entrepreneur.

Examination of Table 1 indicates poor socioeconomic characteristic conditions of the nation despite abundant natural resources.

**Table 1. Geo-Socioeconomic Characteristics of Nigeria**

| Year  | 2005    | 2006    | 2007    | 2008    | 2009    | 2010    |
|---|---------|---------|---------|---------|---------|---------|
| Total Area ('000 ha)                            | 91,077  | 91,077  | 91,077  | 91,077  | 91,077  | 91,077  |
| Area for Arable ('000 ha)                       | 35,000  | 36,000  | 36,500  | NA      | NA      | NA      |
| Area for Permanent crops ('000 ha)              | 3,000   | 3,000   | 3,000   | NA      | NA      | NA      |
| Area of land for Pastures ('000 ha)             | 38,500  | 38,750  | 39,000  | NA      | NA      | NA      |
| Irrigated Land ('000 ha)                        | 293     | 293     | 293     | 293     | NA      | NA      |
| Area per Capita (ha per person)                 | 0.65    | 0.63    | 0.62    | NA      | NA      | NA      |
| Rural Population ('000)                         | 75,829  | 76,603  | 67,515  | 39,972  | 39,692  | 39,385  |
| Total Population ('000)                         | 140,879 | 144,273 | 147,722 | 151,212 | 154,729 | 158,259 |
| Fertilizer Production (tonnes)                  | 10,713  | 47,675  | 25,861  | 25,800  | NA      | NA      |
| Fertilizer Consumption (tonnes)                 | 242,560 | 227,619 | 88,334  | 497,697 | NA      | NA      |
| Share of Food Import in Agricultural Import (%) | 92.6    | 91.1    | 87.9    | NA      | NA      | NA      |
| Share of Food Export in Agricultural Export (%) | 86.5    | 78.4    | 74.4    | NA      | NA      | NA      |
| Agricultural Import (US\$million)               | 2,514   | 2,702   | 6,072   | 3,400   | NA      | NA      |
| Agricultural Export (US\$million)               | 655     | 597     | 591     | 856     | NA      | NA      |
| GDP per Capita (\$ per person)                  | 439     | 456     | 474     | NA      | NA      | NA      |
| Life Expectancy (year)                          | 47      | 47      | 48      | NA      | NA      | NA      |
| Child Mortality Rate (per '000 births)          | 159     | 169     | 189     | NA      | NA      | NA      |
| Tractor Use (Number per 1000 ha)                | 0.9     | 0.8     | 0.7     | NA      | NA      | NA      |
| Human Development Index                         | 49      | 50      | 41      | 42      | 42      | NA      |
| Net Trade Total (US\$million)                   | 27,736  | 23,307  | 36,550  | NA      | NA      | NA      |
| Net Agric Trade (US\$million)                   | -1,855  | -2,093  | -2,148  | NA      | NA      | NA      |

NA means Not Available

**Source:** Faostat Statistics Division, FAO Statistical Year Book, 2010

The basic objective of engaging in any commercial activity at the individual firm level is profit making. *What is the basic objective of economic activities at the national level?* The basic objective of all economic activities in a nation is to have economic growth and economic development. *What is economic growth and how is it different from economic development?*

### ***Economic growth and Economic Development***

Economic growth is an increase in the value of overall economic activities of a community (nation). The overall economic activities are measured by Gross National Product (GNP). Economic growth occurs in a nation if its per capita real income rises. Economic growth gives little or no consideration to human welfare. There can be economic growth with no improvement in human welfare- a situation of growth without development. This is exemplified by countries with high per capita real incomes but poor standard of living. Economic development is economic growth plus positive change in socio-economic characteristics of health, education, living conditions, security and expanded range of opportunities for the citizenry. The prerequisite for economic development is economic growth to generate the purchasing power for economic development. It implies, therefore, for economic growth and development to occur among the farmers, there must be improvement in their main income source (agriculture), that is, there must be agricultural development. *Why is the need for agricultural development?*

### **Roles and Requirements of Agriculture in Economic Growth and Development**

#### **Roles of Agriculture in Economic Development**

Agricultural development is important because of the roles expected of agriculture. Agricultural development is necessary to increase the per capita income and **improve the standard of living of the farming population** and the rural areas. Farmers constitute

a significant proportion of Nigeria's population most especially in the rural areas. In order not to neglect a considerable proportion of the population, their source of income and livelihood must be improved.

Agriculture is the **only source of food** for human and animal consumption. Nigeria like any other developing country has her population increasing at a faster rate than the rate of food production. The gap created by food shortage as a result of the difference between demand and production of food in Nigeria was filled with food importation which drained the country's hard earned foreign exchange reserves. A nation that is dependent on other nations for food supply to feed its citizens is definitely at the mercy of the food exporting nations and this could be used as an effective weapon to bring such a dependent country down.

Apart from being the source of food, agriculture must **provide raw materials** for the manufacturing industries. The alternative to production of raw materials internally is their importation, which like food importation drains the country's foreign earnings and ties the success of the secondary (processing) industries to the raw material producing countries' policy and to the ability of the country to generate enough foreign earnings or borrow to pay for the imports.

Nigeria, being an agrarian country, agriculture should be a significant **source of foreign exchange earnings**. The funds generated by the earnings could be used to purchase equipment (machines) for agricultural and industrial development. *Has agriculture developed in Nigeria or has agriculture performed its roles?*

The reality of the situation on ground is that agriculture has failed to perform its roles in Nigeria. This is because Nigeria's agriculture cannot produce enough food to feed its teeming population, no adequate agricultural outputs to serve as raw materials for agro-allied industries, farmers belong to the poorest group of people; there is declining contribution of agriculture to Gross National Product and to foreign exchange earnings. *What*

*are needed for agricultural development and their present conditions?*

## **Requirements for agricultural development and their current conditions**

One of the tools of agricultural development is technological development. Technology is a system which is dependent on or which consists of mechanical processes, management techniques and infrastructure services or simply as a series of biological and mechanical techniques (Ladipo, 1986).

There are six distinct farm production technologies in Nigeria that depend on agro-ecological zones and the extent of the use of different categories of farm resources (Akinyosoye, 2005). These six categories of production technology are:

**Traditional Manual Technology (TMT).** In this technology level, the two most important production resources are land and labour. Land is obtained through inheritance, borrowing and pledging. Family labour is the main source of farm labour. Capital inputs are rudimentary consisting of locally made hoes and cutlasses. Improved seeds/seedlings and fertilizers are not used.

**Improved Manual Technology (IMT).** IMT is similar to TMT most especially in farm operations except that improved inputs such as fertilizers and high yielding planting materials are used in IMT.

**Improved Semi-Mechanised Technology (ISMT).** This is an improvement over IMT because farm operations such as land clearing and cultivation are carried out with the use of mechanical tools rather than manual.

**Improved Animal Traction Technology (IATT).** This is similar to ISMT except that animal driven tools replace mechanical farm tools and is feasible only where draught animals exist.

**Improved Fully Mechanised Technology (IFMT).** In this technology, in addition to the use of improved inputs, nearly all the farm operations are mechanised replacing physical human energy.

**Improved Irrigation Technology (IIRT).** This level of technology arises when each other technology level is complemented with irrigation water.

A significant characteristic in the hierarchy is decline in labour-capital ratio as production technology advances.

Assessing the present state of Nigeria's agricultural technology along these parameters, it could be correctly concluded that the technology is not developed. Most of the farms are at inadequate level of mechanisation resulting in low yields. In a situation where higher technology is used, there is the basic problem of **inappropriate technology through technology transfer**. An appropriate technology is that designed for a particular country, which could acquire and operate it. At this stage of Nigeria's development, an appropriate technology should be small scale considering the small resource base of the users (farmers). It should use local materials to conserve the hard-earned foreign reserves. In addition, it should be less skill intensive to be within the technical knowledge of the users, be produced cheaply for it to be within the purchasing power of the potential buyers and lastly be labour intensive to solve the problem of unemployment in the country.

Another important tool of agricultural development is finance. Modern system of agriculture requires more resources beyond what the individual farmer can raise from his personal savings, thereby requiring outside sources of financing. A major outside source of financing is loans. The perceived credit worthiness of the farmers is very low affecting the amount of loans they could obtain. This is caused by the farmers' low level of assets to use as collateral security for loans.

Markets for farm products are very important in agricultural development because the ultimate goal of production is consumption. There must be markets for farmers' surplus production and products sold at remunerative prices. Agricultural marketing is the performance of agricultural business activities involved in the flow of goods and services from the primary

agricultural producers to the ultimate consumers. A way of determining the performance of a marketing system is to consider the relationship between farm gate product price and the consumer price. This measures the proportion of consumer prices received by the farmers. This proportion is usually low for farm products indicating inefficient marketing system that will lead to inefficient allocation of farm resources. Some of the causes of poor performance of the marketing system are unfavourable spatial price behaviour, inter-seasonal variation in prices, poor standard of grades and measures, and unreliable foreign markets.

Of tremendous importance to agricultural development is the availability of infrastructural facilities. Transportation costs accounted for a significant proportion of marketing costs. Transportation problems emanated from either non-availability or poor conditions of both main and feeder roads and vehicles, leading to wastage of agricultural products on the farms, high costs and hence high prices of the relatively smaller quantities that manage to get to the consumption centres.

Provision of processing facilities is very necessary because processing performs both time and form functions of marketing. Processing of farm products stimulates demand for agricultural products because they can appear in different forms. It also improves storability of the products thereby reducing price fluctuations.

Another item of great importance in agricultural development is extension services. The basic role of an agricultural extension worker is to take proven agricultural practices to farmers, sort out farmers' problems and bring them to research workers for solutions. The extension service serves as a link between research stations and the farmers without which research results could not get to the ultimate users (farmers) most of which are illiterate.

Of significant importance to agricultural development are biological factors. Farmers should use improved seeds and seedlings, make use of chemical if economical and safe (Alimi,

2004), apply organic and inorganic fertilizers to restore deficient nutrients (Alimi *et al.*, 2006; 2007(a); 2007(b); 2009) to the soil after conducting soil test, carry out land irrigation and land improvement activities.

Another factor for agricultural development is the conduct of relevant research for improvement in agricultural inputs and products. Research in Nigeria is confronted among other things with the problems of inadequate funding and scarcity of research facilities.

Last but not the least for agricultural development is the presence of competent agricultural planners and committed national leaders. There should be effective policies backed by necessary actions for achievement.

The reality is that Nigerian agriculture experiences sub-optimal conditions for agricultural development.

*Are Nigeria's agricultural policy makers aware of these? If yes, what are the previous agricultural development efforts and the challenges against significant success?*

### **Agricultural development efforts and challenges in Nigeria**

Any meaningful effort at agricultural development should also address the issue of rural development. This is because farming is largely carried out in the rural areas and most farmers live in the rural areas. Rural areas must be made attractive to farmers to live most especially the youths to prevent or reduce rural-urban migration. Adegbola and Akinbode (1986) and Akinyosoye (2005) discussed various agricultural and rural development schemes embarked upon in Nigeria dating back to the colonial era and the constraints to meaningful success. Each of the development programmes addressed one or more objectives of enhanced farm production; empowerment of rural households; development of rural infrastructure; improved marketing, farm financing, research and economic management. Some of the government initiated programmes addressing enhanced farm

production are Farm Settlement and Farm Institute programmes; Improved Planting Materials Supply Scheme; Fertilizer Supply Scheme; Crop Protection Chemical Supply Programme; National Accelerated Food Production Programme (NAFPP); Operation Feed the Nation (OFN); Green Revolution Programme (GRP); River Basin Development Authority (RBDA); Agricultural Development Programme (ADP); Forestry Development Programme (FDP); National Fishery Development Programme (NFDP); National Agricultural Land Development Authority (NALDA); and Farm Mechanisation Support Programme.

A number of programmes introduced by governments and non-governmental organisations to ease financing of agricultural and rural enterprises starting from pre-colonial era are National Loan Development Board (NLDP); Western Nigeria Agricultural Credit Corporation (WNACC); Nigeria Agricultural and Cooperative Bank (NACB) which operates Smallholder Loan Scheme, Large Scale Investment Loan Scheme and On-Lending Scheme; Livestock Lending Scheme; Self-Help Group Linkage Programme; National Agricultural Insurance Scheme; Peoples Bank of Nigeria (PBN); Community Banks (CBs); Agricultural Credit Guarantee Scheme Fund (ACGSF); National Livestock Development Programme (NLDP); National Directorate of Employment (NDE) Loan Scheme; and Non-Governmental Microfinance Agricultural Loan Schemes such as Farmers Development Union (FADU), Lift Above Poverty Organisation (LAPO), Nalt United Self-Help Organisation (NUSHO) and Community Women and Development(COWAD).

Some of the programmes implemented by governments to improve infrastructural facilities in the rural areas are Directorate of Food, Roads and Rural Infrastructure (DFRRI); Agricultural Extension System (AES); Agricultural Land Resource Management Programme; Rural Water Supply and Sanitation (RUWASSAN) Programme; Rural Electrification Projects (REPs), Rural Communication Management Programmes.

Programmes designed for improvement in rural life and poverty alleviation are Better Life Programme (BLP)/Better Life for Rural Women Programme (BLRWP); Family Support Programme (FSP); Family Economic Advancement Programme (FEAP); Poverty Alleviation Programme (PAP); and National Accelerated Poverty Eradication Programme (NAPEP).

Each of these programmes has its own limitations most especially at the execution stages. The success of Farm Settlement and Farm Institutes programmes was affected by the recruitment of wrong participants that deserted at the slightest obstacle. Some of the challenges confronting Improved Planting Materials Supply Scheme are poor and delayed funding of research activities and National Seed Service (NSS); inadequate funding of out-growers; conflict in the roles of NSS and private organisation in seed production process; absence of clarity on intellectual property rights for breeder seeds thereby reducing the involvement of private sector; and lack of clear seed pricing policy.

Fertilizer Supply Programme was affected by little involvement of the private sector in production, procurement and distribution of fertilizers. There were cases of leakages, transit losses, lateness or non-deliveries of the fertilizers to designated depots and smuggling across the border to the neighbouring countries, artificial scarcity and an unsustainable fertilizer subsidy burden. Idachaba (1994) reported terrible cases of corruption, embezzlement and diversion of fertilizers. The benefit of the subsidy on fertilizer rather than reaching the farmers went to the urban elite fertilizer agents or middlemen. The importance of fertilizer became so high that it graduated to the level of a political commodity to be used to gain favour from farmers and canvas for votes. DFRRI was alleged for committing a lot of atrocities such as poor road construction that hardly lasted a rainy season, claiming to construct roads made by some other organisations, water projects that supplied water only during commissioning.

Tractor Hiring Service Centre programmes were confronted with the challenges of demand for tractor services being higher

than supply leading to fraudulent rationing methods, inaccessibility of farms resulting from poor roads, inability of some farmers to pay even at the subsidized rate and poor maintenance of the tractors leading to closure of most if not all the centres. Efforts at manufacturing tractors through Steyr Nigeria Limited had the problem of inability to increase the local content of its products and the poor Naira currency exchange rates making the price of tractors to skyrocket and beyond the reach of the farmers causing low demand and the closure of the company.

There is lack of policy coordination on agriculture among Federal, State and Local governments and between the private and public sectors. The policy makers at the Federal level are not in tune with the happenings at the grass root leading to faulty policies and failure of programmes. The various programmes were either not well planned or poorly executed. They were more on noise-making than substance and lacked sustainability content. The managers of the programmes are usually the beneficiary instead of the intended targets. The intended beneficiaries were not usually involved in the policy making process. Incompetent individuals based on political factors were selected to manage projects.

Public credit institutions were poorly organised with low coverage and low repayment rates. Loan approval and disbursement were usually politically motivated thereby not encouraging repayments as such loans are assumed to be the beneficiary's share of the national cake.

*One of the ways of addressing problems of agriculture is through research to produce solutions for improved farm practices. One of the major disciplines in agriculture is agricultural economics. What does research in agricultural economics entail?*

### **Nature of Research in Agricultural Economics Discipline**

**Agricultural Economics is the application of economics and management theories and principles in addressing the**

prospects and challenges in agriculture. It covers the fields of agricultural sciences, economics and management. It is a hybrid of agricultural science, economics and management sciences. A student of Agricultural Economics at the undergraduate level, in addition to taking courses in economics and management sciences requires basic knowledge of physical and biological agricultural sciences. At the postgraduate levels, there is no significant difference in the disciplines of Agricultural Economics, Economics and Management Sciences.

A successful research requires the selection of appropriate **research design**.

### **Research Designs in Agricultural Economics**

A **research design** is the procedure for carrying out any given investigation. It is an outline that specifies data collection and analyses methods for solving a given problem. The different research designs according to Nworgu (2006) are Historical Research Design or Historiography, Case Study Research Design, Causal-Comparative or Ex-post Facto Research Design, Experimental Research Design and Survey Research Design.

**Historical Research Method** is essentially about past events and is mostly applied in the discipline of History. Historical research enables searching into the past and relevance of this in solving present and future problems.

**Case Study Research Design** is an extensive study of a social unit. A social unit may be an individual, a group of individuals, a community or an institution. Its weakness is in low or lack of generalizability. The results obtained from a case study cannot be said to apply to all cases or all social units because of small sample size and possible non-representativeness of the chosen case.

**Experimental Research Design** is the collection of data on respondents in a relatively highly controlled environment. There are basically two types of experimentation. These are laboratory and field experiments and the difference between the two is in the

setting. The physical and biological scientists make use of laboratory experiment in which variables not studied are put under perfect control in the laboratory. For field experiment, the research is conducted in a natural setting and only very small number of variables can be manipulated or controlled.

**Causal-comparative or ex-post-facto research design** is similar to experimental design because both try to establish cause-effect relationships but it is different from the experimental study because researcher has no control over the variables of interest.

**Survey Research Design** is the study of a group of persons or items or characteristics by collecting and analysing data from a few or a part considered being representative of the entire group.

The most **popular research design methods** (on data collection) used in Agricultural Economics discipline are **Field Experimentation and Survey Research Designs with the latter being more popular**. In addition, both primary and secondary data could be collected for analysis. Research Design procedure in Agricultural Economics discipline is indicated in Fig 1. It is relevant to all disciplines (social sciences, medicine, management sciences etc) using survey research design.

In the use of survey research design, adequate attention should be given to the use of appropriate **sample size** and correct **sampling method** for the sample to be representative of the population to ensure generalizability. **Sampling method** describes the process of taking a sample from the population. A sampling method is considered appropriate if the sample represents the population very well such that the characteristics in the sample are the same as the population. The various sampling methods are divided into two. These are probability and non-probability techniques.

**Probability Sampling Technique** is a method that ensures each element in the population has some specified independent opportunity of being included in the sample drawn. The methods under this technique are considered to be objective and not biased. Types of Sampling Methods under Probability Sampling

Technique are Simple Random Sampling, Stratified Sampling, Cluster Sampling, Systematic Sampling and Multistage Sampling.

**Simple Random Sampling Method-** Its basic characteristic is that each element in the population has equal opportunity of being included in the sample.

**Stratified Sampling Method-** This method uses the characteristic of interest (e.g. gender, association, union) to divide members of the population into groups called strata. The requirements for the use of stratified sampling method are that the population should be heterogeneous with respect to the variable of interest, capable of being divided into subsets and the elements within the stratum must be homogeneous.

**Cluster Sampling Method-** The population like the stratified sampling method is divided into groups or sections but unlike stratified sampling, members of each group are heterogeneous and groups are homogeneous. It is used when the population of interest covers a large geographical area.

**Systematic Sampling Method-** This is the selection of members of the population to be included in the sample at a regular and consistent interval.

**Multistage Sampling-** It involves the use of more than one stage in the selection of a sample and probabilistic sampling technique used in each stage.

**Non-probability Sampling Technique** is any other sampling method that does not conform with the rules of probability sampling technique. It is based on the subjectivity of the researcher, which is on criteria unilaterally set by the researcher. It may be difficult to make inference about the population from the results of the sample. Some of these methods are Purposive/Judgemental, Quota, Accidental/Convenience, Key informant, Sequential, Representation, Double and Snowball Samplings.

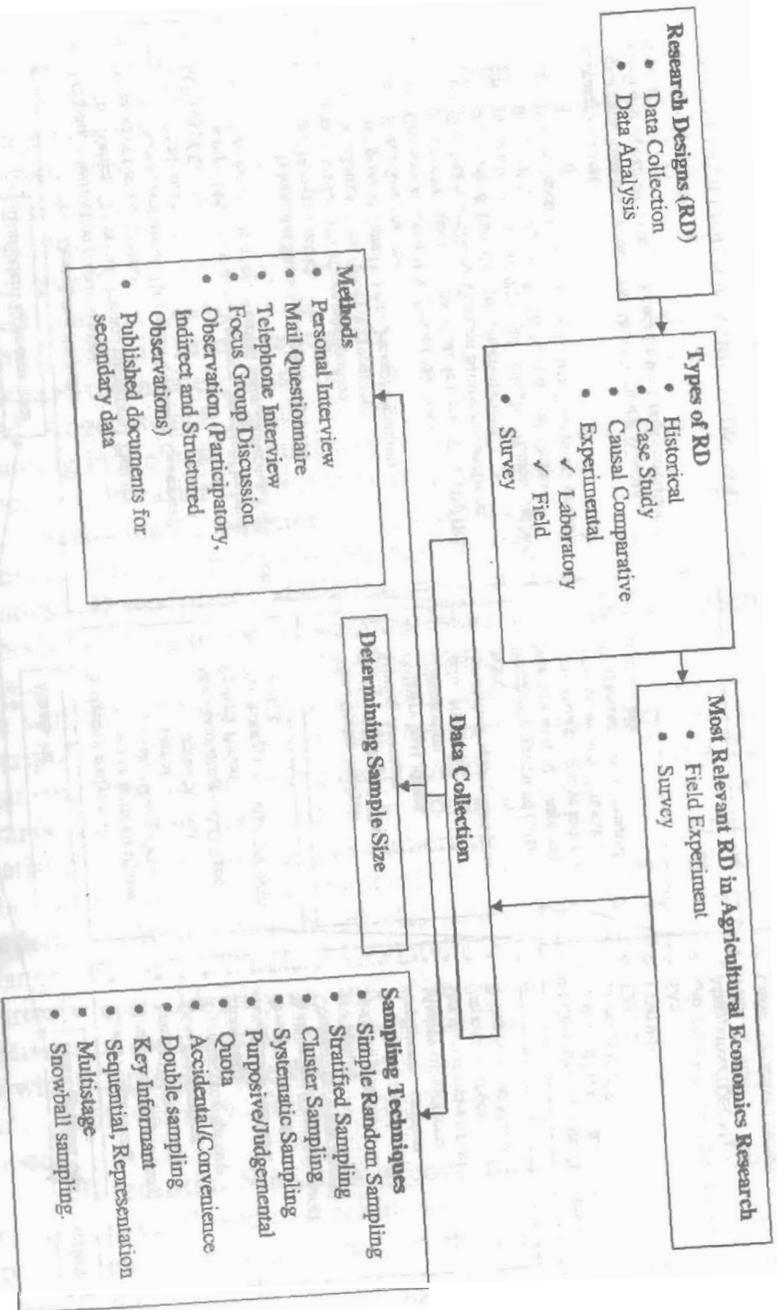
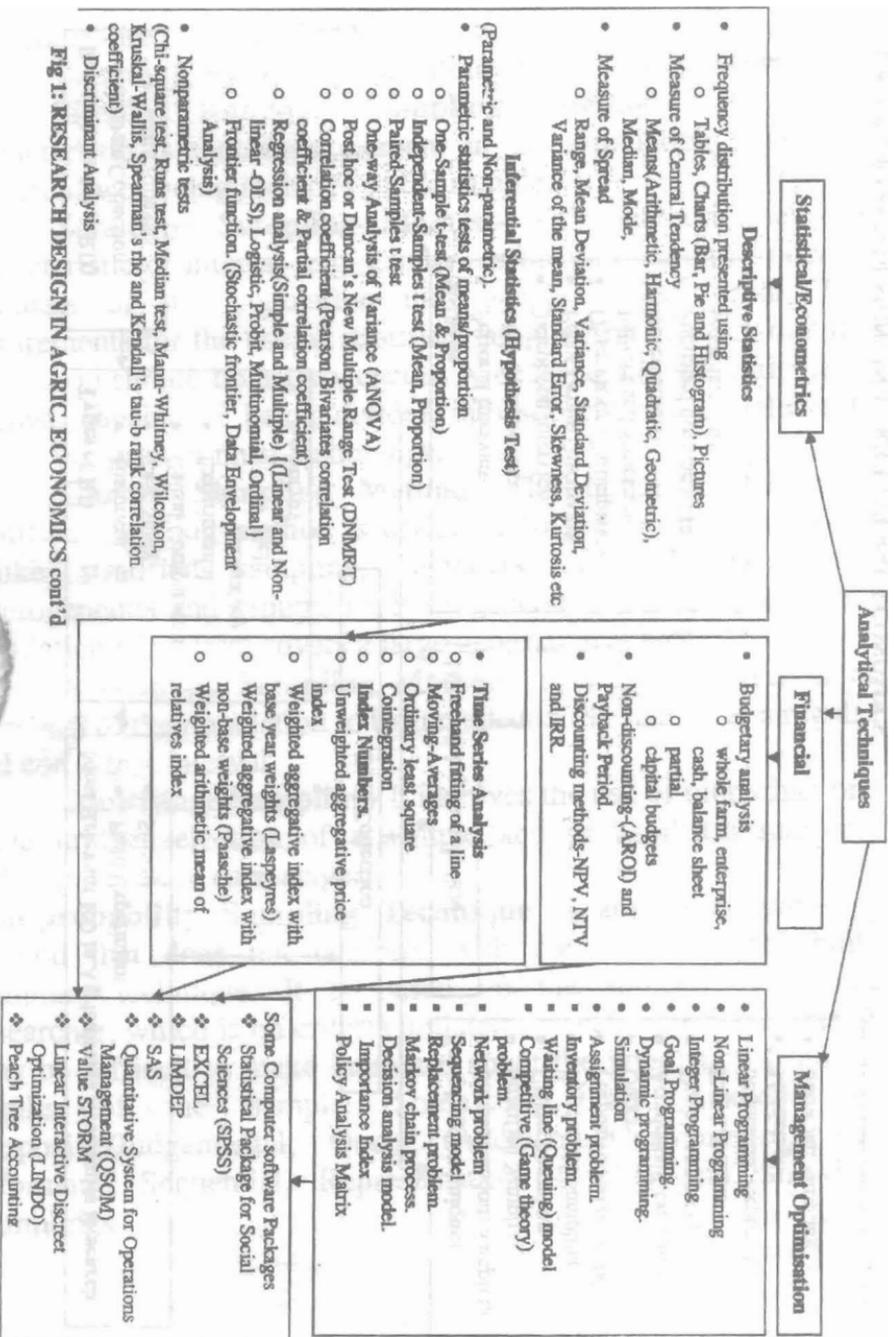


Fig 1: RESEARCH DESIGNS IN AGRICULTURAL ECONOMICS



**Fig 1: RESEARCH DESIGN IN AGRIC. ECONOMICS cont'd**

## **Analytical Techniques**

After ensuring the collection of representative data, the next stage is analytical techniques. The relevant analytical methods in agricultural economics discipline are divided into Statistical/Econometrics; Financial and Management techniques. Analytical techniques have essentially three basic parts. These are i) the **selection** of appropriate analytical method and its assumptions, ii) **performing the calculation** on the raw data collected and iii) **interpreting** the results. A sound agricultural economics researcher must be versed in the three stages. The second stage, which used to be very cumbersome and time consuming in the past when it was manually or mechanically done, has been made easier by electronic data processing.

**Statistical/Econometric techniques.** The statistical techniques are grouped into descriptive statistics and inferential statistics. **Descriptive statistics** is concerned with efficient methods of **organising, summarising** and **presentation** of statistical data (Francis, 2004). This part of statistics describes data only without making any deductions from the data. One form of descriptive statistics makes use of **frequency distributions** in organising and summarising data, and presents data using **Tables, Charts and Pictures**. Another form of descriptive statistics (Statistical Measures) engages numerical techniques to summarize data. This involves the computation of **measure of central tendency** (Mean, Median, Mode) and **measure of dispersion** (Range, Variance, Standard Deviation, Standard Error, Skewness, Kurtosis etc). Identifying the efficient methods of descriptive statistics to use depends largely on the characteristics of the data as to whether the data are numeric or non-numeric. For non-numeric data, analysis may not get beyond frequency distribution and mode.

**Inferential Statistics** is concerned with the concepts and procedures employed in reaching conclusions about a body of data (population) when only a part of the data (Sample) is examined (Daniel and Terrell, 1979). It involves hypothesis testing.

Inferential statistics are either **parametric or nonparametric** statistics depending on the nature of the data. Some parametric statistics tests are One-Sample t-test, Independent-Samples t-test, Paired-Samples t-test, One-way Analysis of Variance (ANOVA), Post hoc or Duncan's New Multiple Range Test (DNMRT), Pearson Bivariates correlation coefficient, Partial correlation coefficient, Regression analysis (Linear and Non-linear).

**One-Sample t-test.** It shows if the mean value of a single variable differs from a specified constant (value). *Does the mean income of dry season rain forest maize farmers differ from N20,000?*

**Independent-Samples t-test.** It tests the significance of the difference between two population means. *Is there any significant difference in the mean income of dry season rain forest maize farmers and the mean income of dry season derived savannah maize farmers?*

**Paired-Samples t-test.** The Paired-Samples t-test procedure compares the means of two variables for a single group. The data may consist of two measurements taken on the same subject (pre-post design) or one measurement taken on a matched pair of subjects (case-control study).

**Analysis of Variance (ANOVA).** Analysis of variance is used to test the hypothesis that several (more than two) means are equal.

**Post hoc test or Duncan's New Multiple Range Test (DNMRT).** After ANOVA has indicated that difference in means exists, DNMRT or Post hoc test is used to identify which means are different.

**Correlation Analysis.** It measures the strength and direction of the association between variables. The **Bivariate** (Pearson correlation coefficient) measures the linear association between only two scale variables. *Is there any association between farm size and net income per hectare?* The **Partial Correlations** procedure computes partial correlation coefficients that describe the linear relationship between two variables while controlling for

the effects of one or more additional variables. *Is there any association between farm size and net income per hectare while holding other farmers' socioeconomic characteristics constant?*

**Regression analysis.** This is used to determine the form of the relationship between variables. The primary objective of this analytical method is to predict or estimate the value of one variable corresponding to a given value(s) of another variable(s). *Determine the form of the relationship between net farm income and farm size.* It becomes a multiple linear regression when there is more than one independent variable. *What is the relationship between net farm income and farm size, quantity of fertilizers, amount of labour and farmers' literacy level?* **Logistic regression** technique applies when the dependent variable is dichotomous and the independent variable(s) is numeric or non-numeric. **Multinomial Logistic Regression** is useful for situations in which dependent variable is not restricted to two categories only. The **Ordinal Regression** procedure allows building of models, generation of predictions, and evaluation of the importance of various predictor variables in cases where the dependent (target) variable is ordinal in nature.

**Probit analysis** is most appropriate when the interest is on estimating the effects of one or more independent variables on a binomial dependent variable.

**Frontier functions.** Frontier methods estimate the optimal functions rather than the average functions achieved by the estimation of OLS. While OLS and its variants fit a line of best fit through the data thereby giving the average function, frontier fits the line over the data for a production function and under the data for a cost function. Frontiers could be estimated using Data Envelopment Analysis (DEA) and Stochastic.

**Nonparametric statistics tests** are relevant rather than parametric when data to be analysed do not meet certain parametric assumptions (sample is drawn from non-normally distributed population), data consist merely of ranks, parameters are not involved and when quick result is needed. Some

nonparametric tests are Chi-square test, One-Sample Runs test, Two-independent samples (Median) test, Sign test, Kruskal Wallis, Spearman's rho and Kendall's tau-b rank correlation coefficient.

**Discriminant Analysis-** It is to correctly classify observations or people into homogeneous groups. The independent variables must be numeric and be normally distributed.

**Factor Analysis-**It is a way of reducing large number of variables in a research design to a manageable smaller set.

## **Analysis of Time series data**

**Time Series Analysis** – When time series data are collected, analysis is concerned with determining Secular Trend, Seasonal Variation, Cyclical Variation and Erratic Variation. Analysis could be by Freehand fitting of a line, Moving-Averages, Ordinary Least Square and Cointegration.

## **Index Numbers.**

These are relative numbers that express changes in economic variables over time. Some of the methods of index numbers are Unweighted aggregative price index; Weighted aggregative index with base year weights (Laspeyres index), Weighted aggregative index with non-base period weights (Paasche index) and Weighted arithmetic mean of relatives index.

## **Financial Analysis**

**Financial Analysis.** The financial analysis used in agricultural economics discipline is essentially budgetary analysis. Budgetary analysis leads to the preparation of whole farm, enterprise, cash, balance sheet, partial and capital budgets for determining financial performance (Alimi and Manyong, 2000).

**Whole-farm budget.** It is a quantitative expression of the total farm plan summarising income and costs to determine the entire farm profit level.

**Enterprise budget.** An enterprise budget is a single crop or livestock or an activity in a farm or organisation listing all income and costs of a specified enterprise to provide an estimate of its profit. Both whole-farm and enterprise budgets are otherwise called income statement because they lead to establishment of the level of profit/loss.

**Partial budget.** It indicates the financial effects of change in enterprise, change in the levels of a single technology and change to different technology(ies).

**Cash Flow Statement.** The cash flow statement summarizes the cash inflows and outflows over a given period of time.

**Balance sheet statement.** It is the financial position statement of the farm firm. It indicates the assets, capital and liabilities of the farm firm.

**Capital Budgeting.** The terms capital budgeting, investment appraisal and project appraisal are used to refer to the concept of analysing the net cash revenue flows generated by investment in assets over their economic useful life. The capital budgeting methods are divided into discounting and non-discounting techniques. The non-discounting methods are Average Return on Investment (AROI) and Payback Period. Some of the discounting methods are Net Present Value (NPV), Net Terminal Value (NTV) and Internal Rate of Return (IRR).

**Average Return on Investment.** This project evaluation method expresses average profit after tax as a proportion of investment cost of the project.

**Payback Period.** This is concerned with the length of time (duration) that the investment project takes to recover its initial investment cost.

**Net Present Value.** Net Present Value (NPV) uses the concept of discounting to determine the present value of future net cash flows.

**Net Terminal Value.** Net Terminal Value otherwise called Net Future Value considers the worth of the project at the end of its useful life. It assumes a reinvestment of the cash inflow.

**Internal Rate of Return Method.** The Internal Rate of Return is the rate of return at which discounted future net cashflow of a project is equal to the investment (project) cost.

### **Management Optimisation Analyses.**

These are the techniques used to improve management activities for increased performance (Sharma, 2007). It is for the determination of optimal inputs combination or products combination or levels of input or output to obtain minimum cost, maximum output or profits in production, finance, marketing and personnel functions. Some of these techniques are Linear Programming, Non-Linear Programming, Integer Programming, Goal Programming, Dynamic programming, Simulation, Assignment problem, Inventory problem, Waiting line (Queuing) model, Competitive (Game theory) problem, Network problem, Sequencing model, Replacement problem, Markov chain process, Decision analysis model, Importance Index and Policy Analysis Matrix.

Some Computer software Packages used in Agricultural Economics for data processing are Statistical Package for Social Sciences (SPSS), EXCEL, LIMDEP, SAS, Quantitative System for Operations Management (QSOM), Value STORM, Linear Interactive Discreet Optimization (LINDO) and Peach Tree Accounting.

### **My Contributions to Knowledge Singly and Jointly with other Researchers**

The Vice Chancellor, Sir, I hereby present the highlights of my humble contributions to knowledge (research efforts) individually and jointly with other co-researchers in the areas of academic research.

I have focused my research effort on the economics of agricultural enterprises most especially at the small scale level (determining profitability, resource availability and resource use efficiency), agricultural technologies, gender issues, poverty, evaluation of macroeconomic policies and agricultural development programmes using field **experimental and survey research designs** (collecting field experimental and survey data and analysing using relevant Statistical/Econometrics; Financial and Management techniques).

My initial research focus was on determining the most economically appropriate varieties of crops, breeds of livestock and agricultural activities for recommendation to farmers based on experimental and empirical research results. This involved my interacting with scientists in biological agricultural sciences in conducting field experimental research and complementing by supplying relevant economics information and carrying out economic analysis.

In a situation where farmers have access to two or more crop varieties, crop cultivars, or technologies, the interest will be on choosing the one that will give the highest economic returns.

Alimi and Akinyemiju (1987) conducted a field experimental research on three common varieties of cassava *Manihot esculenta* Cranz (IITA, IAR&T and Local Odongbo) to determine if differences exist in varietal yield and the mean weight of cassava components, the economic rationale of producing cassava and the traditional method of processing cassava to gari. The yields from the three varieties were subjected to Analysis of Variance to know if there are differences in the mean yields and Duncan's New Multiple Range Test for mean separation. Budgetary analysis was used to determine the profitability of cassava production and processing enterprises. Analyses indicated that there were no significant differences in the yield parameters among the three varieties. Cassava production was profitable but not the processing of cassava to gari necessitating the need for a technically more efficient gari processing method.

There are many cultivars of soybean from which farmers are to select for cultivation. Economic rational farmers would want to choose the most profitable to produce. Alimi *et al.* (1990) conducted field experiment on twelve cultivars of soybeans to determine the most profitable. Duncan multiple range test indicated TG<sub>m</sub>7 and IITA varieties had the highest significant grain yields. Economic and Budgetary analyses showed that TG<sub>m</sub>7 was the best for having highest physical and economic efficiencies.

One of the constraints to crop yield is pest infestation, which is combated by the use of pesticides. Olaifa and Alimi (1988) determined through a field experiment the most economic number of spraying and rate of application of carbaryl on okra yield in the early and late seasons. Four carbaryl concentration levels and five different numbers of sprayings were applied to early and late seasons' okra crop. Okra yields were subjected to independent-samples t- test to indicate the better season and Duncan's new multiple range test for the best number of spraying and concentration level. Income statement was prepared to determine the most profitable level and better season. Results indicated carbaryl concentration of 0.17 and 0.35% with 3 sprayings as best for effective insect pest control in the early and late seasons. Okra yield was higher in early than late season. However, okra enterprise was more profitable in the late season than early because of relatively higher product prices.

Weeding is an important activity in crop production that accounts for significant proportion of production cost and affects crop yield. Akinyemiju and Alimi (1989) examined three different weed control methods of hand-weeding, boom-spraying and knapsack-spraying, and no-weeding to determine the most economical method for maize production using budgetary technique. No-weeding resulted in a loss. Boom-spraying was the most profitable method followed by hand-weeding and knapsack spraying in that order. Boom-spraying was recommended for large scale farms, hand-weeding for small scale farms if labour is cheap but knapsack in a high labour wage situation.

The presence of water hyacinth on Nigeria's waters is assuming a dangerous dimension affecting negatively socioeconomic activities. It becomes necessary to control it within a manageable proportion. Alimi and Akinyemiju (1990) using field experiment and survey research design examined mechanical, manual and chemical water hyacinth control methods to determine the most cost efficient. Mechanical control was more economically efficient than manual but not as efficient as chemical control. However, it must be ascertained that the chemical is not in any form dangerous.

One of the socioeconomic activities that could be affected by water hyacinth infestation is water borne transportation. Alimi and Akinyemiju (1991) analysed the impact of water hyacinth infestation on the water transport enterprises and commuters using survey research design. Water hyacinth resulted in increased boat transport fare borne by the commuters and drastic reduction in profitability of boat transport enterprises in the short run and losses in the long run. Water hyacinth must be controlled since neither the commuters nor the boat enterprises benefit from its infestation.

Poor soil fertility and low-yielding varieties have been identified as some of the factors responsible for low maize yields. A field experiment was conducted by Alimi and Alofe (1992) to determine the profitability response of improved open-pollinated maize varieties to Nitrogen fertilizers. Enterprise and partial budgeting showed that varieties had no significant effects on yield and profitability, use of N fertilizer was better than non-use, early season yields and profitability were better than late season and  $100\text{KgNha}^{-1}$  was the most economic level.

A combination of measures designed to increase available farm resources and efficient use of the existing ones is highly necessary. Alimi (1991) determined the influence of farmers' socioeconomic characteristics on resource availability. Primary (survey) data collected on farmers' socioeconomic characteristics and resource availability were analysed using descriptive statistics and correlation analysis. Farmers were the only reliable source of

family labour. Farmers had very limited access to hired labour, labour savings and consumable inputs because of low financing and were low in management. For production and productivity to improve, farmers' socioeconomic characteristics have to be strengthened.

Bamire *et al.* (2004) employed both descriptive statistics and stochastic frontier production function to determine the economic efficiency of farm resources under different land improvement techniques. Results showed that prevalent land improvement techniques are crop rotation, organic and inorganic fertilizers, bush fallow and alley cropping. While socioeconomic characteristics influenced farmers' decisions on the choice of appropriate land improvement techniques, extension programmes targeted on adequate and efficient use of ecologically sound on-farm techniques is required for increased farm productivity and income levels, and to conserve limited farm resources.

My research activities were also into evaluation of macro-economic policies and agricultural development programmes.

One of the macro-economic policies formulated and implemented in Nigeria was Structural Adjustment Programme (SAP). This policy was expected to have some effects on the sectors of the economy most especially agricultural export crops. Alimi and Awoyomi (1995) studied the impact of structural adjustment programme on cocoa farming. Analysis indicated high devaluation of Naira currency, increase in Naira value of exported cocoa beans despite decline in real prices, rise in input costs and projected inter-temporal downward trend in the performance of cocoa production enterprise. The study suggested value addition through local processing of raw cocoa beans to finished or semi-processed commodities (cocoa powder) of high standard to attract remunerative and stable prices.

Both male and female are actively involved in agricultural production. Women's contribution to labour supply in food production and processing is significant. Alimi and Ayanwale (1998) studied the relative contributions and remuneration to women in

small scale commercial traditional palm oil processing. Primary data were collected on the socioeconomic characteristics of palm oil production process. Results indicated that more than 70% of the production stages were exclusively handled by women most especially processing. Despite the higher involvement of women in palm oil production, the return on their investment was lower than that of men caused mainly by inheritance system that is male dominance. It was suggested that women should be financially empowered to own oil palm trees.

One of the government's efforts at using agriculture to conquer the twin problems of unemployment and food insufficiency was the establishment of National Directorate of Employment (NDE). Alimi (2000) evaluated the trend in the crop farm size of NDE participants using Markov chain analysis. Results indicated a declining inter-temporal mean and median farm size caused by inadequate financing, farm land tenure problems and poor infrastructural facilities which have to be attended to urgently to save the programme. One of the objectives of NDE scheme is to produce a crop of self employed tertiary institution graduates and employer of labour in agricultural sector. Alimi and Odogun (2001) evaluated the income and employment generation ability of NDE poultry farm enterprises. Primary data collected were analysed using budgetary technique and Markov chain process. Results indicated that poultry farming was profitable, participants earned higher income than the income earned by peers in civil service, generated employment for two other persons and had rising poultry farm size overtime. Some of the challenges confronting the participants, that must be addressed, are difficulty in getting products to the market, lack of access to reliable water sources and poor and late delivery of inputs by NDE officials.

Alimi (2000) determined the resource use efficiency of food crop production of Oyo State farmers collecting primary data from smallholder farmers which were analysed using descriptive statistics and regression technique. Results of the analyses indicated the mean farm size of one hectare and that the production resources except

hired labour were not optimally utilized. Increasing the levels of farm size, capital and technology would increase production and profits to farmers. Agricultural policy efforts should be directed at making capital and compatible technology available to farmers to increase farm size and productivity. In the same vein, resource productivity of women farms was determined (Alimi, 2001). It was revealed that women were smallholder farmers cultivating mainly food crops for household consumption. There was underutilization of farm land, technology and fixed capital which if increased would lead to economic improvement.

Modern cultural methods in agriculture emphasise chemical (pesticide) control. It is worth investigating if chemical control as practised by the farmers on their farms is of economic benefit (profitable) and safe. If safe to use because a number of pesticides are hazardous to human beings, crops and the environment. Alimi (2004) conducted a study on the economic impact of insecticide use, and awareness and practice of insecticide safety precaution on okra production. Primary data collected on cultural practices and socioeconomic characteristics of okra production enterprise were analysed using descriptive and inferential statistics, partial budgetary, and regression, residual and sensitivity techniques. Analyses showed that insecticides use on okra farms was economically superior to non-use. Most of the insecticides used by okra farmers were hazardous, and high proportions of the farmers were not aware of, and did not practice safety precautions. In order to realize the full economic benefit of insecticide use without its adverse effects, efforts should be directed at creating awareness and encouraging the use of insecticide handling and application safety precautions.

Enterprises in agricultural and non-agricultural sectors usually have more than one mode of obtaining a product. Poultry products could be produced through integration of feed mill with poultry unit or non-integration specializing in poultry production only. Alimi (2002) designed a study to identify the economically better between integrated and non-integrated poultry management systems. Primary data were collected from poultry farmers on

farmer and farm characteristics, types of integration and reasons for poultry farm integration and non-integration; and were analysed using descriptive and inferential statistics, importance indices, budgetary and regression techniques. Analyses indicated that integrated poultry farmers practiced backward integration to include feedmill in order to have control over quality, supply and prices of feeds for increased profits. Integrated poultry farm enterprise was significantly higher in capital investment, capital use efficiency, return on capital invested, and net income making it economically superior to non-integration. Non-integration was as a result of lack of capital for investment in feed mill. In order to improve poultry production, integration should be encouraged by making funds available for investment in feed mill.

Production processes are constantly undergoing changes for modernity to generate new and better production method. Beekeeping enterprise has evolved from the traditional method to a modern method of production. Alimi (2002) used empirically based study to examine the economics of modern beekeeping enterprise. Primary data collected were analysed using descriptive and inferential statistics, enterprise budgeting, sensitivity technique, business risk measurement method and Markov chain process. Results indicated that honey was the only economic output of beekeeping enterprise. The enterprise is profitable, yield or price of honey will decrease by more than 50% to incur losses, the enterprise would experience growth in size but declining physical efficiency over time, beekeepers should specialize rather than practice diversification. In order for the beekeepers to continue to enjoy high level of profits in future in the presence of projected high output (supply), demand base should be widened both in the local and foreign markets. Alimi *et al.* (2008) identified enterprise size, literacy level, experience and extension agents' contacts as determinants of bee honey production.

Identifying the key objective of a business enterprise, as well as the means and constraints to its achievement will ensure the enterprise's success and sustainability. Alimi *et al.* (2004)

identified the key objective(s) of certified maize seed enterprises, their level of achievement and production constraints affecting their sustainability. Primary data collected on production characteristics were analyzed using descriptive, regression technique and importance indices. Results indicated profit maximization as the most important business enterprise objective; farmers operated mean output level less than the profit maximizing level although at a profit. Constraints to production in descending order of importance were uncertain output market, expensive complementary inputs, high labour wage rate and insecurity of farm land which when addressed would ensure sustainability and increased profitability of certified maize seed enterprise.

Similarly, Alimi *et al.* (2006) identified the poultry meat farmers' objectives of production, determine the optimal farm size and prioritize the constraints to achieving the enterprise objectives. Findings showed that the most important objective of production was profit maximization. From the profit function analysis, the profit maximizing output level was higher and more profitable than the mean output level that farmers operated which was higher than the average profit maximizing level of output. The constraints that limit farm size and which could affect sustainability of the enterprise were irregular demand of poultry meat, poor feed quality, high mortality rate and feed price instability in that order. These constraints, if addressed, would lead to increase in poultry meat supply to meet local demand and export.

There are two cropping seasons for some crops in the Southwestern Nigeria. These are rainy and dry seasons. Economic evaluation and comparison of production in the two seasons are necessary to determine if production has to be in both seasons. Alimi (2005) conducted a study on the economics of monocropping okra under tropical conditions during the rainy and dry seasons. Primary data were collected from monocropping okra farmers and analysed using descriptive and inferential statistics, budgetary and regression techniques and importance indices. Results of the analyses indicated that monocropping okra

enterprise had higher yield and farm size but lower prices in the rainy season relative to dry season. Production was profitable in both seasons, but profits were higher in the dry season. The highest ranked constraints to okra production enterprise were low output prices and high perishability in the rainy season; and moisture stress and scarcity of cultivable land in the dry season. For improved enterprise performance, okra farmers should have access to effective storage/preservation facilities to balance low prices in the rainy season; and cheap and effective irrigation technologies for dry season okra cropping.

Increased knowledge in science and technology is bringing about technical change in all aspects of agricultural production with its attending consequences. Alimi *et al.* (2005) conducted an empirically based study on the consequences of technical change in palm fruits processing. Results indicated that only pounding of boiled palm fruits and cracking of nuts stages of the traditional method have been significantly mechanized resulting in greater efficiency in palm oil extraction, higher labour productivity, more income to stakeholders, less drudgery and health hazards, and lower processing time, thereby making modern method better than traditional.

Agricultural growth is necessary for agriculture to perform its roles. Increase in agricultural production could be achieved by increasing either the cropped area or productivity or both. Knowledge of mode of growth is necessary for relevant agricultural policy decision. This is because policies to influence each mode are not the same.

Tijani and Alimi (2009) identified the sources of agricultural growth in Nigeria whether it is vertical (increase in productivity) or horizontal (increase in cultivated land area) or both using time series data and cointegration analysis. Findings indicated that horizontal expansion accounted for most variation in the production of rice, melon, maize and cassava. In order to have increase in agricultural production in Nigeria, efforts should be focused at policies that will ensure easy availability of cropped land while not neglecting

research for improved productivity. Alimi *et al.* (2006) conducted a study on maize grain to determine the intertemporal trends in maize grain output and factors influencing production. The time series data on maize grain output, yield and area harvested with maize grain and survey data on maize grain production enterprise were analysed using descriptive statistics, correlation and regression techniques and importance indices. Results indicated annual increase in maize grain output, a positive and significant relationship between maize output and area of land cropped but no association with yield. Thus, the area cultivated instead of yield currently determines the level of maize output. Although availability of farm land was not a constraint but lack of cash capital, expensive land preparation equipment and fertilizers limit production.

Alimi *et al.* (2007) carried out a study on the trend in production and market potential of certified maize seed. The study made use of both primary data collected from certified maize seed farmers and secondary data obtained from Statistical Bulletins of Central Bank of Nigeria. The primary data collected were analysed using descriptive and inferential statistics, budgetary technique and Markov chain process while time series analysis was used for the secondary data. Certified maize seed production was profitable and farmers preferred selling through guaranteed markets. Both the production and market potential of certified maize seed grow overtime. High proportion of maize grain farmers did not use certified maize seed largely because of ignorance and lack of complementary inputs. These obstacles must be removed to improve both maize seed and maize grain production.

Alimi *et al.* (2008) forecast inter-temporal farm size and factors militating against large farm size for increased plantain production. The primary data collected were analysed using descriptive statistics and Markov chain process. The results of Markov chain analysis showed that plantain farmers will have an upward trend in plantain farm sizes, and farm sizes would increase if the problems of poor infrastructure, inadequate finance, social risk(theft) are solved.

The fragility and high susceptibility of the soils in Nigeria to degradation and loss of nutrients make augmentation through the use of fertilizers necessary to obtain reasonable crop yield. There are organic and inorganic fertilizers available to improve crop yields. The use of market oriented organic fertilizer is being encouraged to improve soil fertility and there is the need to determine the economic rationale of this technology. Alimi *et al.* (2006) determined the change in net income of users of commercial organic fertilizer relative to non-users of fertilizers in vegetable crop production to find out based on economic reason only, if its use should be encouraged. Analyses indicated that use of commercial organic fertilizer resulted in additional yield and rate of returns over and above non-use making the use of organic fertilizer technology economically superior to non-use of fertilizers. Alimi *et al.* (2007a) determined the more profitable technology between commercial organic and inorganic fertilizers in vegetable production. Results indicated both the users of organic and inorganic fertilizers applied less than the recommended quantities of fertilizer and obtained less than the optimal yield. However, the commercial organic fertilizer technology resulted in higher yield and marginal rate of return than the inorganic fertilizer technology at the present farmers' fertilizer application rates thereby making commercial organic fertilizer technology superior to inorganic fertilizer.

Modern Fadama irrigation facility was introduced to the farmers to raise farmers' income and reduce the poverty level. Ayanwale and Alimi (2006) determined the impact of Fadama irrigation facility on smallholder vegetable farmers' production and income using the stochastic frontier production function to estimate the technical efficiency level of the participants. The findings showed that the programme increased the income of the participants by about two times, enhanced access to farm inputs and the training and knowledge base, thereby alleviating rural poverty.

Credit (loan) is an important factor that facilitates agricultural production. Identifying the determinants of credit

supply and demand will facilitate credit transactions. Oluwasola and Alimi (2008) identified factors influencing loan supply as interest rates charged, the level of savings of borrower, the amount of loan demanded and the proportion of previous loans repaid; while interest rates, farm expenditure, the amount borrowed from alternative sources, farm size and savings were the determinants of credit demand.

Every member of the household (children inclusive) participates in activities for household poverty alleviation. Alimi *et al.* (2006) evaluated and compared the contributions of male and female children towards household poverty alleviation. Findings indicated that children contributed to household poverty alleviation with their labour and more by girls than boys. High proportion of children had unfavourable attitudes towards their involvement in household poverty alleviation, which is significantly higher for boys than girls. This is because participation affects their leisure and time for study. Since children's negative attitudes and HPRAs differ between boys and girls, gender-specific policies are needed to free children for their future capacity building. Child labour is a social malaise and has become an area of interest to academics, policy makers and the media in Nigeria. Alimi and Masuku (2010) analysed survey data on child labour using a logit regression model noted that determinants of child labour participation were household income per capita, children's levels of education, household head's perception of child labour and usefulness of children's education; as well as, literacy level and sex of household head which must be influenced to reduce or eliminate child labour.

### **Decision on Choice of Farm Type (Small or Large) for Nigeria**

In deciding between large and small scale farms, a number of issues have to be put into consideration. The key issues are farm production and productivity, resource availability and control, and social implications.

## **Production and Productivity**

Production (quantity of output) could be increased by increasing productivity (yield-quantity of output per unit of input) or by increasing quantity of input (increasing farm size) or both. Large scale farm has large farm size under a single management unit, while small scale farm has a small farm size. The level of production obtained by small number of large scale farms could be achieved by large number of small farms. One farm type will be better than the other if it exhibits higher productivity. No study on farm size has indicated large scale farms to be significantly more efficient (productive) than small scale farms in Nigeria. Studies on small scale farms (both farm types) indicated improvement in production and productivity would be achieved with easy access and efficient use of production resources. For any farm type, effort should be directed at the availability and efficient use of resources.

## **Resource Availability and Control in Farm Type and Social Implications**

The basic resources for agricultural production are grouped into land, labour, capital and management. As indicated earlier, the country is blessed with natural resources indicating high prospect for agricultural development. Land availability is affected by the land tenure system operating in some parts of the country which does not favour easy acquisition of large area of land. In some situations, the small scattered pieces of land possessed by a large number of smallholder farmers is the only reliable physical asset they own and may not be ready to lose its ownership for large scale farming without social upheaval-the large scale farming that will throw them into unemployment market or at best make them labour on their farmland. Labour supply for farming is affected by rural urban migration of able-bodied persons (youth) because of worse social amenities in the rural areas and perceived misconceptions of available better opportunity in the cities.

Capital in terms of man-made aids for further production and availability of funds for capital acquisition is very low in

smallholder farming. The large scale farms that have access to funds and advanced technology have little or no control over the technology. Most facilities for large scale farming are imported with little or no indigenous content or knowledge leading to reliance on foreign experts usually not fully under the control of large scale farmers. The imported technology is usually not adaptable to the local environment causing technology failure and poor performance of the agricultural enterprises and sector.

The reality is that the man made environment for small and large scale agricultural production in Nigeria is poor. The fact is that the country is at a cross road concerning the choice between large scale and small scale farming options. **My submission is that smallholder farmers should not be sacrificed for large scale farmers to prevent avoidable suffering and upheavals.** Efforts should be directed at providing relevant enabling environment to both large scale and small scale farming for sustainable increased production and productivity- an enabling environment that will not trample on the rights of each group. With development in all the sectors of the economy and availability of better remunerative use of resources in non-agricultural sector, resources (land and labour) will voluntarily move out of agriculture without hidden or open suffering and social disruption.

### **Summary and Conclusion**

Both large and small scale farms exist in Nigeria with small scale farms in a very high proportion providing food, income and employment for the small farmers. The existing farm types are unable to meet the food and fibre requirements of the nation despite her rich endowment of natural and human resources.

The nation has initiated and implemented a number of laudable agricultural and rural development programmes with little or no success recorded. Factors responsible for failure are largely at the implementation stage caused by corruption at all levels, most especially at the very high levels (the managers of programmes); and recently the escalating national insecurity condition.

Sacrificing the interest of the small farmers for the large scale farmers may not be a sustainable option.

The major problem confronting agriculture in Nigeria is not strictly its farm size but inability to provide enabling environment (that will affect both farm types) for success. Enabling environment in terms of **infrastructure** and **incentives** to farmers; infrastructure covering the provision of facilities for effective and efficient adaptive production technology, empowerment, irrigation, power (electricity), transportation, communication, storage, processing, marketing, banking, finance, education, research, extension services, capacity building, administrative machinery, State Security, Judicial system, political and good governance. The agricultural sector should be provided incentives to perform its roles. There is no country in the world having thriving agricultural sector without the sector being subsidised. However, successful countries ensure the **subsidy gets to the real farmers**, not politicians and influential non-farmers.

The country should embark on moral persuasions to curb corruption; however, adequate punishment should be given with dispatch to offenders to serve as deterrent to others. Since it is easier and less disruptive for a head to successfully control other parts of the body, the **governments** must provide the lead and encourage individuals and non-governmental organisations, local and foreign, to complement their efforts in genuine agricultural development.

## **Acknowledgements**

I started my Ife work life as an accountant in the Business and Investment Unit of the Bursary section of University of Ife (now Obafemi Awolowo University) in 1982. The experience garnered there is highly memorable. The pull factor drove me back to Agricultural Economics Department for which I have no regrets.

I appreciate the immense contributions of my colleagues (academic and non-academic), students (undergraduate and postgraduate both past and present) in the Department of

Agricultural Economics, Faculty of Agriculture (Obafemi Awolowo University, Nigeria and University of Swaziland, Swaziland).

I recognise the moral, mental and psychological supports derived from my numerous caring and faithful friends, extended family members, mentors and informal associations within and outside the University system.

My appreciations go to my wife (Dr (Mrs) K. M. Alimi) and children (Biodun, Wumi, Niyi and Tayo) who jointly carried the cross of my academic pursuits most especially when conditions necessitated less focus on them for demands of academics.

Lastly, I appreciate this audience for creating time to come and patiently listen to this lecture. May Almighty Allah reward you abundantly.



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