AN ECONOMIC EVALUATION OF GOVERNMENT SERVICES FOR AGRICULTURAL DEVELOPMENT IN THE NORTHERN STATES OF NIGERIA: THE CASE OF GROUNDNUT FARMERS IN KANO STATE

By

PETER EBILAYI OCHALA

Bachelor of Science
University of Wisconsin
Madison, Wisconsin
1968

Master of Arts
American University of Beirut
Beirut, Lebanon
1971

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
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Thesis Approved:

Dean F. Schreiner
Thesis Adviser

Luther G. Tweeten

Gerald A. Doeksen

Lionel M. Shaw

Daniel D. Badger

N N Durham
Dean of the Graduate College

PREFACE

The importance of agriculture in Nigeria cannot be overemphasized since it contributes over 50 percent of the country's GNP, as well as providing employment for more than 70 percent of the population. Nigeria's agriculture is primarily subsistence and as such cultivation is mainly by traditional methods. Prior to the recent discovery of oil in commercial quantities in the country, agricultural exports were the main source of foreign exchange earnings. For these reasons, the development of agriculture is a major aspect of the country's economic growth.

Peasant farmers cannot raise their productivity substantially through their own efforts. They need improved technology and capital, which only the government and other public agencies can adequately provide. This is necessary to ensure adequate food supply for the ever-growing population, and to increase the income and general welfare of the people.

Shortage of funds calls for the use of some investment criteria in allocating funds to agriculture as well as other sectors of the economy. Though efficiency is the most often used measure of these agricultural investments, equity considerations are equally important, particularly in a country where poverty is prevalent, and its alleviation a major task.

The study on which this thesis is based involves (1) the determination of costs and returns of providing various agricultural

services for groundnut production and (2) identifying the significant factors which influence farmers' adoption of recommended farming practices.

The format of this presentation includes an introduction to the problems investigated and statement of objectives of the study in Chapter I, and a review of economic theory in determining private and social profitability of government services in Chapter II. Current results in the evaluation of government services are presented in Chapter III, while a brief description of agriculture and government development programs in Nigeria is given in Chapter IV. Empirical results in determining the private rate of return to "government services" and the empirical results in determining the social rate of return to "government services" are discussed in Chapters V and VI, respectively. The results in the "adoption of technology" model is presented in Chapter VII, while policy implications for the use of government services in groundnut production in Northern Nigeria are discussed in Chapter VIII. Finally, summary and conclusions are presented in Chapter IX.

The author wises to express his appreciation to his major adviser, Dr. Dean F. Schreiner, for his guidance throughout the entire study. Appreciation is also expressed to other committee members, Dr. Luther G. Tweeten, Dr. Daniel Badger, Dr. Gerald Doeksen, and Dr. Ansel Sharp, for their invaluable assistance in the preparation of the final manuscript.

A note of thanks is given to the Ford Foundation who provided financial support for the entire study, and the staff of the Kano State Ministry of Natural Resources, who provided great assistance

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CHAPTER I

INTRODUCTION

Since World War II, great emphasis has been placed on the process of economic growth and development. This is particularly true of the less developed countries where the need for increasing agricultural production, and improvement of general economic welfare, has been very pressing. There is no doubt that most economists today would recommend the expansion of the agricultural sector of a developing economy as a prerequisite for industrialization.

It is often argued that modernization of agriculture and also its mechanization are necessary to free labor for industrial development. Similarly, the advocates of agricultural development priorities argue that very little capital is required to expand agricultural production.[1]

Modernizing agriculture, be it for domestic food consumption only, or as a basis for general economic growth, requires massive infrastructures, which must be provided by the government or some other public agencies. The components of such agricultural infrastructures would naturally vary from one economy to another. In addition, there must exist efficient institutions for the provision and maintenance of these infrastructures.

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[1] Gerald Meier, Leading Issues in Economic Development (Oxford, 1970), pp. 410-418.

The major focus of this thesis is an economic evaluation of the "basic" agricultural development services in Northern Nigeria (now referred to as the Six Northern States). It has been demonstrated very often that crop yields can be increased quite considerably, in fact doubled in some cases, through the use only of improved agricultural inputs. The application of fertilizers and the use of improved seed varieties and seed dressing has been found to increase crop yields on many experimental farms in Nigeria. This can be seen from the results of the crop demonstration programs in the Six Northern States.[2] Through agricultural extension services, efforts have been made to encourage farmers to adopt this simple "packaged" technology at a relatively high cost to the various ministries of agriculture. It is necessary, therefore, to determine the economic pay-off from the provision of this packaged technology.

Also of importance is the factors which influence the adoption of these services. Great emphasis has been placed in the past on the effect of socio-cultural factors on the adoption of improved agricultural practices. Failure to adopt these practices has been frequently blamed on the role of customs and tradition. The writer, however, believes that economic factors also play important roles in the farmer's decision to adopt or not to adopt a recommended practice. The recommended inputs may require credit that is not available, have a high risk, or have returns that are not convincing enough to the farm family to warrant adoption of the practices.

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[2]See tabulated summaries in Chapter V.

How much government investment should go into providing these essential services also depends on the social benefits to be derived. Because of the difficulty of identification and measuring of these benefits, the question of how much public resources should be allocated to agricultural development programs has been prone to considerable debate.

A frequent accusation, particularly among the critics of the government in Nigeria, is that public expenditures on agricultural programs are becoming exceedingly high while the results of the services and/or programs are not noticeable. Some contend that these expenditures on the agricultural services or programs are a complete waste of scarce resources and should be reduced to the very minimum.

Others feel that the government is not spending enough on agricultural development programs, and that since agriculture is an important source of Nigeria's GNP, its share of the National Development Budget should be higher.

Another aspect of the same problem is the observation sometimes made that agricultural policy in the Northern States of Nigeria is "to use the limited financial resources to bring about small changes over large areas rather than large changes over small areas." These statements all point to the question of government agricultural development programs.

To enable subsistence farmers to increase their farm productivity, the government and other private agencies must provide them with facilities and services which otherwise may not be available. These services, within the present framework may be grouped into two "packages":

(1) A "Package" of Technical Inputs

(a) Improved seed variety (or livestock breed)

(b) Seed dressings

(c) Fertilizers and other agricultural chemicals

(2) A "Package" of Supporting Services

(a) Agricultural Extension (demonstration plots and workers)

(b) Farm Credit and Marketing Services

(c) Agricultural Information (newsletters, posters, etc.)

This classification is very arbitrary. The important thing to note, however, is that while the experimental farms have convincingly demonstrated the results of the adoption of the technical inputs in group 1, we are still to determine what combination of the supporting services (group 2) must be available for farmers to give higher adoption of the recommended practices.

Another aspect of the problem is the time-space dimension. In studying the differences between the responses from village to village, for example, one should be able to ask the question: Are these inputs available in the form and in the places needed at the right time? If this question cannot be answered, then the true effect of these inputs cannot be determined.

In addition to the services mentioned above, the Extension Demonstration Program is one of the major programs to increase agricultural productivity. This program involves an effort to encourage farmers to adopt recommended practices for the production of major crops in Nigeria through the use of a "packaged" technology (improved seed, seed dressing and fertilizers) without any major changes in the farming system and tenure arrangements. The adoption of these recommended

practices coupled with the use of other agricultural services (e.g., credit, mechanization, irrigation, etc.) is believed to bring about substantial increases in agricultural production.

This study is specifically designed to investigate the effects of these services on groundnut (peanut) production in Kano State of Northern Nigeria. The analysis is basically to measure (1) the private and social returns to the adoption of the recommended practices and (2) the importance of various economic factors which influence the adoption of the "packaged" technology for groundnut production in Kano.

Objectives of Study

The primary objectives of this study are as follows:

1. Determine the cost of providing the services of the packaged technology for groundnut production.
2. Determine the private returns to the farmer for adopting the "packaged" technology for groundnut production.
3. Determine the private and public returns to government investments in providing these services.
4. Identify the significant economic factors which influence the adoption of the "packaged" technology for groundnut production.
5. Make suggestions for further use of government services in Agricultural Development in Northern Nigeria.

Hypotheses to be Tested

The following hypotheses will be verified from existing research results or tested in this study:

1. That crop yields can be significantly increased by using only the basic technical inputs (fertilizer, improved seed, and seed dressing) without major changes in farm organization.
2. That the adoption of this "packaged" technology is profitable to the individual farmer.

3. That marginal social benefits from providing these agricultural services are greater than the marginal social costs.

4. That the additional private cost of adopting the recommended practice significantly affects their adoption.

5. That the adoption of the recommended practice is higher in the areas where more supporting services are available.

Methodological Procedure

Selection of Villages and Sample Farmers

The survey villages are selected from three of the eight administrative divisions in Kano State. This is due to the shortage of resources and time to enable surveys to be conducted throughout the State. Moreover, because of the similarity among many of the divisions, one does not lose much additional useful information by doing the survey in a fewer number of divisions.

Table I shows the ranking of the eight administrative divisions based on the distribution of crop demonstration using the "packaged" technology (fertilizers, improved groundnut seed variety, and seed dressing), and the supporting services discussed in the previous section. The total points indicate the order of ranking with the divisions having the least points signifying highest availability of services. A score of 1 means that the division has the highest amount of the particular group of agricultural services in the state, while the score of 8 indicates the least amount of these services available.

From this ranking, the following three divisions were selected for the study:

(1) Danbatta

(2) Gumel

(3) Hadejia

TABLE I

CROP DEMONSTRATION DISTRIBUTION IN KANO STATE
(RANKING OF THE DIVISIONS)*

Rank	Division
1	Birimin Kudu
2	Danbatta
3	Rano
4	Gwarzo
5	Gumel
6	Hadejia
7	Kazaure
8	Kano Metropolitan Area

*The rankings for Gumel and Hadejia could be regarded as equal, based on the 1972/1973 and 1973/1974 demonstration distributions. (See details in Chapter IV.)

Ignoring the highest and lowest ranked (Birmin Kudu and Kano Metropolitan Area, respectively), these three divisions were randomly selected.

Two villages were selected from each district in the three administrative divisions. The choice of the two villages in each district was based mainly on:

(a) Proximity to the State and Divisional Agricultural offices;

(b) The number of agricultural services available;

(c) The number and frequency of visits by agricultural extension workers.

One of the two villages represents those closest to the agricultural offices and with the highest amount of agricultural extension services, while the other village is the most remote and has least contact with extension agents.

The Farmer Samples

The sample of farmers interviewed composed of ten farmers carefully selected in each survey village. Emphasis was on stratification rather than representativeness of the sample.

The farmers were selected on the basis of:

(a) Income (2 farmers)

(b) Farm size (groundnuts only) (2 farmers)

(c) Proximity to the village crop demonstration plot (2 farmers)

(d) Leadership (2 farmers)

The two farmers were selected based on each of the above categories. For example, one farmer had the highest farm income while the other had the least in the village. In cases where one farmer fell into more

than one category (e.g., largest income and nearest to the demonstration plot), he is selected for one, and another farmer is selected for the other category. It should be noted, however, that the highest income farmer in the village is not necessarily one with the largest groundnut farm since groundnut production is only one of many sources of family income.

To insure cooperation among the villagers, the village head and his deputy or assistant are included in each sample. This has proved very useful in previous village surveys in the area. These two farmers represent category (d) above.

Finally, two other farmers were selected at random on the basis of availability for interview.

Questionnaires

The questionnaires used in the village survey were designed to provide data on the following:

1. General Information
2. Demonstration Plots
3. Extension Agents' Activities
4. Farmer Cooperatives
5. Farm Mechanization
6. Irrigation Usage
7. Farm Input Data
8. Groundnut Yields and Marketing
9. Farm Credit

Several short questionnaires were used at different intervals during the study, but the most important one is the Farmer Interview Form F (Appendix J).

The questionnaires provided information on the above services. More specifically, the data collected were necessary in determining:

(1) The availability of "new" inputs, extension agents, credit, etc.

(2) The incremental cost of "new" inputs.

(3) Market value of groundnuts at village and the nearest market.

(4) Increased yields from the demonstration plot data.

(5) Rate of return from "new" inputs using village specific cost and yield data.

The farmer interview questionnaire was administered to the farmers in the sample by an extension agent who was familiar with the village and who covered that district during his normal extension duties. This was essential because it provided a check as to the validity of some of the information given by the farmer, and it also insured cooperation since most farmers are more confident in the extension agents they know. The questionnaire providing background information on the villages was completed by the resident extension agent himself, since he would be more familiar with the village. Where there was no resident extension agent, an agent who made the most frequent visits to the village completed the questionnaire. In any case, this does not provide much problem since most of the desired information is in the divisional agricultural officer's files.

Besides the use of the questionnaires, various sources of data were exploited. These included:

(a) Consultations with agricultural research workers in Nigeria (mainly at the Ahmadu Bello University in Zaria, and the University of Ibadan);

(b) Consultations with divisional agricultural officials and cooperative officers of Kano State Ministry of Agriculture and Natural Resources; and

(c) Observations of the records, and consultations with senior officials of the Northern States Marketing Board. It cannot be overemphasized that government records proved most useful, particularly in calculating costs and returns from the services. Such data included:

(1) Government budget allocations for agriculture;
(2) Previous research cost estimates;
(3) Actual government expenditures on agricultural development programs;
(4) Costs of subsidizing the agricultural inputs in the packaged technology; and
(5) The results from various demonstration plots on groundnuts in Kano State.

The data thus obtained from the field work and questionnaires are used for the analyses in Chapters V-VII.

CHAPTER II

REVIEW OF ECONOMIC THEORY IN DETERMINING PRIVATE AND SOCIAL PROFITABILITY OF GOVERNMENT SERVICES

It has been shown that pursuit of profit leads to a Pareto optimum under conditions of perfect competition. For maximum economic efficiency, even socialist economies must allocate resources where rates of return are highest. If private costs (returns) differ from social costs (returns), society may need to intervene in a free enterprise economy to maximize net social efficiency. Also if the distribution of resources is considered inequitable in a free enterprise economy, society may wish to intervene by allocating resources (even if these bring a lower return per money unit of investment) to those with few than many resources.[1] Because the government's utility function cannot be easily stated, we are faced with a major conceptual problem of subjecting public investment decisions to economic analysis. This chapter reviews some of the economic theory involved in determining private and social profitability of government services. It is an attempt to present the key elements involved in measuring the economic payoffs from public investments and some theoretical problems surrounding such measurements. The literature on this subject is rather extensive and this is not a review of such literature.

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[1] Luther G. Tweeten, Foundations of Farm Policy (University of Nebraska Press, Lincoln, Nebraska, 1970), Chapter 16.

The concept of economic or social return, defined as the total return or productivity of all the resources committed to a project regardless of who in the society contributes them and regardless of who in the society receives the benefits,[2] is based on the assumption that resources are the most important limit to faster economic growth, defined here as a sustained increase in output or percapita income. The analysis allows for remuneration to labor and other inputs at market prices or shadow prices which are intended to approximate true opportunity costs. Everything left over is then compared to the capital stream necessary for the project. That project which maximizes returns to capital is given the highest rank. Although the analysis will determine the amount of the income stream generated over and above the costs of labor and other inputs, it does not specify who actually receives it.

On the other hand financial (or private) return, defined as the return to the equity capital contributed by individual financial entities participating in a project--farmers, businessmen, entrepreneurs, private corporations, public agencies, etc., is concerned mainly about income distribution and capital ownership. Once we know the contributors of equity capital to the project, it is a policy decision as to whether we wish to affect return to capital through income taxes, special lending terms, price subsidies, or any of the other policy tools open to the society.

Resources are of very limited amount and can be used in a great variety of ways such as building schools, conducting research, building

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[2]See J. Price Gittinger, Economic Analysis of Agricultural Projects (Baltimore, Maryland: Johns Hopkins Press, 1972).

dams and constructing steel mills. This problem may be viewed as comprising mainly of three aspects: "(1) the total amount of capital formation to be undertaken from current income; (2) the allocation of these investible resources among different sectors of the economy; and (3) the choice of technique to be used in the newly created sectors."[3]

The first is a public decision particularly in a less developed economy because individual decision units will not save unless there is some form of extra pressure on them and ways for them to do so. Thus, the government, through monetary and fiscal policies could effect to a great extent, the rate of capital formation. Both the allocation of investible resources among the sectors and the technique to be used in newly created sectors, are to be based on economic optimization conditions and, also dependent on the relative stage of economic development. It is likely that a less developed economy with abundant labor supply, labor intensive techniques may be heavily relied on.

Government involvement in the provision of goods or services is justified mainly where investments that businessmen would deem unprofitable are socially desirable. Circumstances surrounding the production, distribution and consumption of goods and services may favor government provision: (1) The circumstances that are conducive to government initiative may relate to economies of scale. The performance of activities can only be economically performed on such a very large scale that it may be infeasible or undesirable for private enterprise to undertake them. Large projects such as hydroelectric power, highways and large irrigation schemes are undertaken by governments for this

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[3]Henry J. Bruton, Principles of Development Economics (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1965), pp. 283.

reason. The circumstances surrounding conditions of consumption have to do with the concept of collectivity.[4] A collective good is defined as a "facility or service that is made freely available to all comers without user charge, either because to assess a charge on each occasion of use would be excessively cumbersome or because use is not voluntary or even clearly definable."[5] Such goods or services cannot be provided by private firms because they do not induce a flow of income to the provider, and as such, the responsibility for their provision falls on the government. Examples of such services include national defense, justice, streets and findings of scientific research. Since they are not sold, there are no market prices to assist in appraising their value. (2) Private investors may take an unduly short view of the consequences of their investments and this may be an important justification for investments dealings with the preservation of natural resources. (3) The desire to influence the distribution of income may sometimes be an incentive also for government involvement.

Several criteria for public investments have been used, but the most common ones are: (1) Benefits must exceed costs, to "whomsoever they may accure." Once this test is passed a project may be considered as justifiable. The rate at which benefits exceed costs, expressed as the benefit-cost ratio, influences the choice. (2) The "With and Without Principle." The development path of the economy is traced with and without the project. Benefits and costs are evaluated as the changes occur, with each development change being carefully identified. This

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[4]Robert Dorfman, editor, Measuring Benefits of Government Investments (Washington, D. C.: The Brookings Institution, 1970), pp. 4-6.

[5]Ibid.; Bruton, pp. 284-285.

prevents or avoids the possibility of attributing to the projects, events resulting merely from the passage of time. (3) The allocation of the limited investible resources is undertaken to achieve the largest possible increase in the capacity of the economy to produce goods and services. Since we are primarily concerned with the economy as a whole, the use of the social marginal productivity (SMP) criterion may prove appropriate. Using the SMP criterion simply involves the choice of projects such that the sum of present values of all projects is a maximum, subject to the limitation on the quantity of investible resources available and the production functions. The SMP, therefore, consists of the ratio of the present value of returns minus operating costs to the amount of capital invested, i.e., SMP = $\frac{V-C}{K}$, where V is the gross value of output, K is the quantity of capital, and C is total annual costs including interest and amortization.[6] The SMP is conceptually similar to benefit-cost ratio, except in specific circumstances.

The use of the SMP criterion is applicable to both private firms and government agencies. The problem, however, is generating the cost and revenue figures which measure the cost and benefits to the economy as a whole.

The benefit-cost ratio is often used as a tool for evaluating public sector projects. It may occasionally be employed in public investments undertaken by government corporations. Benefits are compared to costs by the use of the following three discounted measures of project worth:[7]

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[6] Ibid.; Bruton, p. 285.

[7] World Bank, Compounding and Discounting Tables for Project Evaluation (Washington, D. C., 1973), p. 35.

$$\text{Benefit-Cost Ratio} = \frac{\text{Present Worth of Benefits}}{\text{Present Worth of Costs}}$$

Net Present Worth = Present Worth of Benefits - Present Worth of Costs

Internal Rate of Return = That discount rate such that

Present Worth of Benefits = Present Worth of Costs

These three measures are essentially the same. The World Bank employs the internal rate of return most frequently, while the benefit-cost ratio and the net present worth are used only occasionally. Benefit-cost analysis is more necessary the greater the differences between project expenditures or receipts and the social costs or benefits, respectively. It would provide a measure of the magnitude of these differences. The analysis requires that adjustments be made so that actual receipts would adequately measure social benefits, and actual expenditures measure social costs.

Major problems involve conceptual difficulties such as definitions of benefits and there are also problems of measurement, e.g., social costs of taxation.

The Requirements for Private and Social Profit to Coincide

One of the suggestions made by the Consortium for the Study of Nigerian Rural Development [5] was that "underutilized resources of land, labor and capital are available that could be more effectively utilized if the gaps between social and private returns were closed by giving producers the world price for export crops and if new technology were discovered for the domestically consumed food, feed and livestock

crops."[8] This implies that a higher growth of agricultural resources may be attained by adopting a policy which closes the gap between private and social returns in order to motivate private small holders to do that which is socially desirable.

Some of the requirements for private and social profit to coincide includes: full employment (no involuntary unemployment or underemployment); profit maximization and absence of market imperfections; marginality; equitable distribution of wealth and government consumption; equality of the rate at which the firm could borrow and the rate at which society discounts future consumption; absence of external benefits and costs; and consumer sovereignty.[9]

Government action through regulatory framework can help bring about a coincidence of private and social profit. Some of these actions include:[10] "First, government usually take responsibility for seeing that large scale unemployment does not result from a deficiency of demand. Secondly, where competition plainly either does not or cannot work even approximately in line with the economic assumptions which ensure its social advantages, then certain controls are often introduced . . . . Thirdly, progressive taxation is used to achieve a more equal income distribution than laissez-faire might produce. Fourthly, governments often underwrite certain risks which private persons find it hard to estimate or incur . . ..

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[8] CSRD, Strategies and Recommendations for Nigerian Rural Development 1969-1985 (East Lansing, Mich.: Michigan State Univ. Press, 1969).

[9] Ian M. D. Little and James A. Mirrlees, Manual of Industrial Project Analysis in Developing Countries, Vol. 11 (OECD Development Centre, 1967).

[10] Ibid., Little and Mirrlees, p. 29.

Lastly, there is always a tremendous amount of legislation designed to see that people's private activities do not impinge unfavourably on others . . .."

Benefit-cost analysis can therefore be employed, with the appropriate government action to evaluate and plan public investments aimed at increasing and redistributing aggregate consumption, and to promote national self-sufficiency. The government might also wish to use project selection to help it increase savings. In that case relatively capital-intensive projectstend to restrain both consumption and employment, but promote savings and growth.

In assessing private profitability of government services, the main concern lies in the direct benefits or returns to those using the services. With regard to production services, for example, comparing these returns with the costs involved provides the basis for determining whether production (using these services) is profitable, and if so, the level of production that will maximize returns. The principle of marginal costs equals marginal returnsis the proper measure to use in determining optimum level of production.

Optimal allocation of the scarce resources also affectsthe rate of return, depending on the goal of optimization. Low return results in a low rate of savings. On the other hand, with a higher rate of return one is inclined to spend more on current consumption. Thus, the net effect of a change in the rate of return on the rate of savings depends upon which is the more powerful, the substitution effect or the income effect. In general, however, the rate of return seems to be positively correlated with the rate of savings.

In summary, we have recalled the applicability of the concept of profit maximization to both the capitalist and socialist society. The Social Marginal Productivity (SMP) criterion has been found to be appropriate for project selection both in private firms and government agencies. Generating the cost and revenue figures which measure cost and benefits to the economy as a whole could, however, pose a problem. The Cost-Benefit ratio could also be employed for evaluating government investments, and it has been indicated that certain governmental regulatory actions could make private and social profits coincide.

The main concern in this study is to evaluate agricultural investments for development. Agricultural services such as crop demonstration and mechanization involve considerable amount of public funds. There is a need, therefore, to look at the rate of returns to these investments and consequently determine if they are justifiable. These rates of return would be compared for the various services to aid in deciding optimum resource allocation.

Usually benefit-cost comparisons are undertaken prior to project selection. However, in this case, the interest is in evaluating projects currently being undertaken. The ultimate aim would be in determining their justification and to identify, if possible, ways of improvement.

CHAPTER III

CURRENT RESULTS IN THE EVALUATION OF GOVERNMENT SERVICES

Introduction

For agricultural development to proceed, agricultural technology (i.e., the way farmers sow, cultivate, harvest crops and care for livestock, including use of improved seed and fertilizer application) must change continuously. Each change in farming calls for additional changes if agricultural development is to be a coordinated process. Several programs have been devised in different parts of the world to enhance this development process. The basic approach has been to identify those technological inputs and supporting services which can significantly increase agricultural output. A. T. Mosher (33) has provided a useful classification of the necessary factors for agricultural development. A first group of factors, each of which he regarded as "essential", are "markets for farm products; constantly changing technology; local avilability of supplies and equipment; production incentives for farmers; and transportation."[1] All five essential factors or services must be available to enhance agricultural modernization.

In addition, five other elements, called "accelerators," when present could speed up the development process. These are: "education

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[1] A. T. Mosher, Getting Agriculture Moving (New York: Frederick A. Praeger, 1966), p. 61.

for development; production credit; group action by farmers; improving and expanding agricultural land; and national planning for agricultural development."[2] These differ from the essentials in that they are important but not indispensable. The ideal situation would be for all the essentials and accelerators to all be present. The main concern in this study, however, is to focus on programs aimed specifically at changing agricultural technology. Of particular interest are those new single or "package" technologies that have had pronounced effects on crop yields per acre, without structural changes in farm organization. In this chapter, some of the results from the use of improved agricultural technology are presented, especially the packaged approach. The rate of adoption of these technologies is also briefly discussed.

FAO Fertilizer Trials

The Food and Agricultural Organization of the United Nations for several years has supported and encouraged fertilizer trials on experimental farms in many countries of the world. These results have also been demonstrated to local farmers wherever possible. For many of these countries, the results are very encouraging, while in others less significant results were obtained due to lack of supporting services or growth factors.

In Turkey, for example, fertilizer use on wheat raised production by 52 percent and for each dollar spent on fertilizer, the increased value of the harvest was $2.60.[3] In Ghana, groundnut yields increased

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[2] Ibid., p. 121.

[3] Mosher, op. cit., pp. 75-76.

by 57 percent due to fertilizer use and each dollar spent on fertilizer increased the value of the harvest by $3.90.[4] Similarly, in Guatemala, fertilizer applied to cabbage raised the yield by 140 percent and each dollar spent on the fertilizer increased the value of the harvest by $63.90.[5] The general conclusion from these results is that fertilizer use, a new technology, increased yields substantially. But other conditions support the possibility of these increased yields. The presence of adequate soil moisture, the availability of the most suitable seed varieties and lack of serious pest and disease problems, are only a few of the conditions which give such successful results. The effect of this can be seen from some less successful results obtained in Syria and Colombia.

In Syria fertilizer on unirrigated wheat raised the yield by only 22 percent in comparison with 51 percent on irrigated wheat. In this case lack of moisture as well as lack of fertilizers were holding production down. In the Cauca Valley of Colombia, fertilizer on soybeans brought only 16 percent increase in yields. In this case, the need may be for new crop varieties capable of utilizing more plant nutrients.[6]

"Packaged" Technology

The above observations have led some experts in the field of agricultural development to devise programs involving "packages" of practices, whose combinations can result in higher output. For example,

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[4] Ibid., p. 76.

[5] Ibid., p. 76.

[6] Mosher, op. cit., p. 76.

in the village of Tegalega in West Java, Indonesia, 57 farmers increased maize yields 600 percent (from 800 to nearly 5,000 kilograms per hectare) by (1) using a new variety, (2) using recommended amounts and kinds of fertilizer, (3) changing the depth of planting the seeds, and (4) controlling the insect pests.[7] Such dramatic results are achieved usually only through a whole package of new techniques. A new technique, however, must promise quite a substantial return to be acceptable to the farmer. Without changes in the price of farm output, an increase in yields of from 40 to 100 percent can prove attractive to farmers in many developing economies.

In Nigeria, the "packaged" technology for crops has included: (1) recommended seed varieties, (2) fertilizers, (3) seed dressing, and (4) insecticides and herbicides. These farm inputs are provided to farmers, through the Extension Services Division of the Ministry of Agriculture and Natural Resources (MANR), at very nominal prices. The results obtained so far have been very encouraging. Through the use of this "package" approach, demonstration plots in the Northern provinces of Nigeria showed the following crop yield improvements over the traditional method in 1966. For groundnuts alone, despite poor rainfalls,

Crop	Percent Increase In Yields
Groundnuts	68.1
Cotton	69.7
Guinea Corn	63.0
Maize	118.6
Millet	61.6

[7] Ibid., pp. 77-78.

yield increases of about 58 percent were obtained for 1970 and 1971.[8] This shows again, that without structural changes in farm organization, farmers can increase their output simply by adopting a package of recommended practices.

Private and Social Returns

The rates of return which farmers received for adopting the government services of providing the "package" of practices depends on the incremental yields obtained, the cost of incremental inputs, and the value of increased output. In Chapter V, a detailed analysis of the private rate of return to groundnut programs is presented, while that of social rate of return is given in Chapter VI.

For our present purpose, it suffices to present a summary of the estimated net returns from the extension crop demonstration programs in Northern Nigeria in 1965.

The gross return per acre is the return including farmers' labor and management per acre. At the minimum wage of ₦0.40 per day, all crops except Maize in Zone III yield enough return to cover at least wages. The social B/C ratio is value of returns per acre of social cost per acre (see Table II).

From these results, it can be observed that using the recommended practices provided in the "packaged" technology may yield encouraging private and social returns especially for rice, yams and groundnuts. It may be of interest to note that though maize shows the highest yield increase from the package (118.6% in 1966), it has the lowest gross

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[8]Source: Rural Economy Research Unit, Ahmadu Bello University, Zaria, Nigeria.

TABLE II

KANO STATE CROP DEMONSTRATION PROGRAM: ESTIMATED RETURNS TO CROPS COVERED (PER ACRE)

Crop	Farmer Gross Return Per Acre (₦)	Net Return Per Man Day of Farm Labor (₦)	Social B/C Ratio (Wage @ ₦0.40)
Groundnut	36.00	0.76	1.73
Cotton	19.96	0.50	1.17
Guinea Corn	16.20	0.50	1.01
Millet	12.16	0.46	.96
Cowpeas	12.28	0.56	1.21
Upland Rice	35.32	0.66	1.36
Swamp Rice	78.46	0.96	1.66
Yams	74.40	1.00	1.45
Maize (Zone I)	17.84	0.40	.79
Maize (Zone II)	17.84	0.40	.96
Maize (Zone III)	10.96	0.30	.69

Source: Adapted from Jerome C. Wells, Government Agricultural Investment in Nigeria: 1962-67 (NISER., Ibadan: 1969), Table V. 5, p. 194.

margin per acre, lowest net return per man day and also lowest B/C ratio. This is because it is a low value crop compared to the others and as such, the incremental cost for using the "package" exceeds the value of the increased output.

Rates of Adoption of New Technologies

The rate of adoption of new technologies is influenced by numerous socio-psychological and economic factors. It also depends on the nature of the new technology, and the area and time of introduction. For the groundnut "packaged" technology in Kano State, a detailed analysis of the factors influencing the adoption is presented in Chapter VII. As a brief summary, however, the results show that all the farmers interviewed have heard of the inputs in the package. Ninety-five percent of them reported using fertilizer (superphosphates), 85.5 percent reported using the recommended seed variety; and 60 percent reported using seed dressing. For the "package" as a whole, only 39.5 percent reported complete adoption. Though this appears low, the results are not unusual, since farmers are quick to find out which of the inputs in the package have greatest influence on yield, and to decide to use only those inputs they can afford from the whole package. Hence it is common to see a farmer apply only fertilizer to a recommended seed variety or even a local variety.

In Western Nigeria, Clark and Akinbode (6) found that with respect to three recommended practices, "All but one of the 209 cocoa farmers interviewed had heard about the MANR recommended practices for controlling capsid insects and black pod disease. Slightly more than half (59 percent) were following the practices at the time of the study. Of

the maize growers, 84 percent had heard about the practices, but only one-third were following them in July-August, 1966. Practically all the poultry producers knew about the MANR recommendations and about one-half were following the practices."[9]

Among the main reasons given for not adopting the new practices in Western Nigeria were: "Lack of specific information about the practices; lack of credit facilities; lack of necessary equipment; and lack of technical knowledge and skills required to follow the advice received."[10] However, in many cases, profitability is the key factor in explaining acceptability of new technology. If an individual farmer is convinced that a new technology is profitable, he would be more willing to try it, if the additional costs are not too far beyond his means. For example, in the case of hybrid corn, Griliches observed that "one of the major factors accounting for the differences in the rate of acceptance of hybrid corn in different areas was the difference in the absolute profitability of the shift over from open pollinated to hybrid varieties."[11] Therefore, to modernize agriculture, not only are new technologies necessary, but they must be available at a profitable level.

Summary

Agricultural development requires the presence of some "essential" services, most of which the individual farmer in the less developed

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[9] Robert C. Clark and I. A. Akinbode, Factors Associated with Adoption of Three Farm Practices in the Western State, Nigeria. (Ile Ife: University of Ife Press, 1968), p. 2.

[10] Ibid.

[11] Zvi Griliches, "Hybrid Corn: An Exploration in the Economics of Technological Change," Econometrica, 25 (1957), 501-22.

countries cannot provide for himself. The government therefore must provide the essential services and in addition, certain "accelerating" factors if agricultural development is to proceed at a desirable rate. Several FAO fertilizer demonstrations - a single technology - have resulted in significant yield increases in different parts of the world. However, suitable supporting conditions must be present if the single technology is to lead to substantial output increases. Hence, technology in a "package" form has proved very useful. Such packages include a recommended variety of seed, seed dressing, fertilizer and other agricultural chemicals. These inputs used under favorable climatic conditions and with adequate soil moisture can increase yields substantially.

The experiences in Nigeria, so far, have shown encouraging results in the crop demonstration programs in the Northern States. With the exception of maize and millet, the use of the packaged technology provided through the Extension Services have yielded favorable private rates of return. The rates of adoption of the technologies have also been rather encouraging, though most of the farmers tend towards adopting single inputs, e.g., fertilizer, than adopting a whole package.

In view of all these, one can still suggest the continuation and possible expansion of these services. If local coordination of these services is achieved, agricultural modernization could proceed at a much faster rate. This requires the availability of farm supplies and equipment, and local testing of these inputs to convince the farmers of their results.

CHAPTER IV

AGRICULTURE AND GOVERNMENT DEVELOPMENT PROGRAMS

The discussion in this chapter is focused on the role of the government in the agricultural development of Nigeria. The need for government assistance in developing the agricultural sector is briefly discussed. The overall agricultural policies and budget allocations are given, followed by a brief description of the agricultural situation in Kano State.

From a welfare standpoint, an important question to be answered with regard to government agricultural investment policies is the distribution of benefits. An examination of the two budget allocations presented might provide some insights to the problem.

So far, the basic assumption in this study is that peasant farmers cannot raise their productivity substantially through their own efforts. They need improved technology and capital, which at present only the government and other public agencies can provide. This is necessary to ensure adequate food supply for the ever-growing population, and to increase the income and general welfare of the people.

David Norman [31] also suggested that it is the responsibility of government to ensure that the introduced technological changes are profitable to the farmers, that the institutional base is present to encourage them, e.g., extension services, improved credit and marketing facilities, and that the requisite inputs such as seeds and fertilizers

are readily available. He also concluded that relatively small increases in inputs and increases in potential profitability could mean substantially higher returns to the farmer under conditions not radically different from those which apply currently. This, however, must be accompanied by long term technological changes, in order to be effective.

In the Northern States of Nigeria, studies of agricultural development at the village level were not conducted to a large extent, except those done by the Rural Economic Research Unit (RERU), Ahmadu Bello University in Zaria. These were mainly socio-economic investigations of selected villages in the Northern States of Nigeria. From the three Zaria village studies, Norman [29] suggests that:

(1) The level of development of the infrastructure, particularly roads, is critical in determining the ease of marketing crops and the non-farm employment opportunities of rural people.

(2) Population density is a significant determinant of farming patterns.

(3) The lack of credit, at a reasonable cost, for purchasing durable and non-durable capital goods and hiring labor has a debilitating effect on farm incomes.

(4) Because of low incomes farmers are reluctant to change from the well proven, secure, traditional ways of doing things. To bring about substantial changes (e.g., intercropping to sole cropping) farmers need first to be convinced that the risk is no less than under the traditional system (e.g., the standard deviation in yield of an improved crop variety is no greater than that of the traditional variety) and that the innovation is profitable.[1]

The Consortium for the Study of Nigerian Rural Development (CSNRD) [6] also believes that at present agricultural development activities are best done by the public sector, and that public activities in the

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[1] D. W. Norman, An Economic Survey of Three Villages in Zaria Province (I.A.R., Zaria, 1972), p. 120.

areas of production, supply of inputs and marketing must be evaluated on the basis of their success and the efficient allocation of public resources. Some of these activities should also be evaluated to see if any of them could be better performed by the private sector. The Consortium recommended that "Nigerian rural development program should be to encourage and support the efforts of private smallholders."[2] It suggested that "Nigeria will obtain much more growth of her agricultural resources if she changes to a policy which closes the gap between private and social returns so as to motivate private smallholders to do that which is socially desirable."[3]

In discussing the distribution of benefits of agricultural investments in Nigeria, emphasis will be on the post independence period, because it is during this period that there has been definite planned development efforts particularly in the agricultural or primary production sector of the economy. Agricultural research prior to the first National Development Plan period, 1962-1968, was concentrated on the export crops such as groundnuts (peanuts), coffee, cocoa and oil palm. Since 1962, food crops, irrigation and mechanization as well as livestock have gained more emphasis.

When discussing distribution of benefits, attempts must be made to differentiate "direct" benefits from those that might be considered "indirect." These benefits are considered from the standpoint of the producer, the consumer, and finally the public sector or government.

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[2]CSNRD, Strategies and Recommendations for Nigerian Rural Development, 1969-1985 (East Lansing: Michigan State University Press, 1969), p. 6.

[3]Ibid.

It seems appropriate to take a look first at the government's agricultural policies and to observe the extent to which public investment programs have related to these policies. The agricultural development expenditures' distribution together with the policies provide us a better understanding of the distribution of benefits from these programs.

Agricultural Policy

Since the farming conditions differ in the country, with the Northern states most suitable for annual crops and livestock production, and the Southern states for tree and root crops, local government agricultural policies vary between the regions. During the development plan periods, the various institutions involved in the agricultural development are guided by the following objectives of agricultural policy:

(i) Ensuring food supplies in adequate quantity and quality to keep pace with increased population and urbanization, having regards to changing tastes and the need for fair and stable prices;

(ii) Expanding the production of export crops, with a view to increasing and further diversifying the country's foreign exchange earnings so vital in the development process;

(iii) Propagating the production of agricultural materials for extensive domestic manufacturing activities, especially in the field of agri-based industries;

(iv) Creating rural employment opportunities to absorb more of the increasing labor force in the nation, and minimizing the tendency for inadequate and inefficient use of human resources in the rural areas generally;

(v) Evolving appropriate institutional and administrative apparatus to facilitate a smooth integrated development of the agricultural potential of the country as a whole.[4]

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[4]Federal Republic of Nigeria, Second National Development Plan, 1970-74 (Lagos, 1970), p. 110.

As seen from the above policy statements, food supply, export earnings, and rural development are of major concern to the Nigerian governments. The public expenditure programs or budgets show us which facet of agriculture receives the greatest emphasis (Table III).

Within the First National Development Plan period (1962-1968), the emphasis was on tree crops, which are cocoa, oil palm, rubber, coconut and cashew (Table III). If budget allocation is an indication of policy, then the target or objective of policy was to increase export earnings since these tree crops are produced mainly for exports.

Besides increased government revenue, the fact that the investment allocation emphasizes tree crops, already favors the producers of these crops and the local governments of the region in which they are produced. More specifically, this program is more beneficial to the cocoa and palm oil and kernel producers in the Western and Eastern parts of Nigeria where they are produced. The increased income and export earnings which might accrue from this is also beneficial to the Western and Eastern states' governments. The gains these regional governments derive from this program would not be the same if they contributed the major share of the investment funds. In other words, distribution of benefits should also take into consideration the various contributions towards executing a project.

The distribution of benefits, with respect to tree crops projects can still be further broken down to the share of benefits between the small tree crops producers and the large plantation owners. Since most of these crops are produced on small family farms, it would be expected that there would be equitable distribution of benefits among these farmers. This is not necessarily the case with the large

TABLE III

SUMMARY OF PUBLIC EXPENDITURES FOR AGRICULTURAL DEVELOPMENT IN NIGERIA (1962-1968)

Projects	Total Allocation in ₦ (1 ₦ = $1.50 U.S.) (Million ₦)
Tree Crops	51.00
Agricultural Training, Research and Extension	9.40
Animal Health and Husbandry	5.20
Fisheries and Forestry	0.80
Land Use	1.80
Supporting Services for Agriculture	3.00

Source: Federation of Nigeria [16], p. 115.

plantation owners, in which case the governments are either partners or sole owners. In general, the plantation farmers gain more than the small farmers, as a result of their size. They also have more access to improve inputs and farm credit for which their crops are used as collateral. Consequently, any programs that increase their productivity, tends also to increase their farm income and plantation size, while the small farmers, though receiving relatively higher income, often maintain the same size of farm. It should be noted, however, that a depression in the cocoa or palm products market hits the larger farmers most.

Agricultural research, training and extension should be of general benefits to all farmers. But, to the extent that the research is concentrated on particular crops, the benefits derived from them tend to favor more the producers of those crops. Since the ratio of extension workers to farm families is exceedingly low, projects involving training and extension should have received higher priority.

Unfortunately, during the First National Development Plan period, considerably little emphasis was given to livestock production. Increased livestock production is of great benefit for the domestic food consumption, particularly since the level of animal protein consumption is very low. Table IV shows that between 1964 and 1969, there was no significant change in the number of livestock in Nigeria.

Investments for increased livestock production ought to have received more attention, especially since feasibility studies and simulation programs done by Nigerian universities and Michigan State University, respectively, point out the relatively high profitability of these projects.

TABLE IV

LIVESTOCK IN NIGERIA (IN THOUSAND HEADS)

	Cattle	Pigs	Sheep
*1951-55 to 1955-56	9,920	500	5,600
1964/65	11,080	720	7,500
1965/66	11,190	740	7,600
1966/67	11,300	760	7,700
1967/68	11,410	780	7,800
1968/69	11,500	800	7,900

Source: U. N., "World Economic Survey," 1970.

*The 1951-55 to 1955-56 figures are annual averages only.

The last important project in the first development plan was farm credit, which is considered a supporting project or service. Only N2.0 million was made available for farm credit during a period of six years. With well over 10 million farmers in the country during the period, the amount of credit made available was small compared to the credit needs of these farmers. We have noted earlier that besides technology, capital shortage is one of the major constraints in agricultural development of the LDCs. This, therefore, calls for more farm credit to be made available as an incentive for increased farm production. In terms of benefits, the past experience shows that only the big farmers, and even non-farmers receive the largest share of the little funds made available. Low-income farmers, who need the credit most, hardly receive any credit at all. This situation is likely to continue until more loan funds are available and better credit institutions are established.

Agricultural Development Projects 1970-1974

In terms of budget allocations, Table V indicates that agricultural development as a whole has received increased emphasis since the first development plan, 1962-1968. The project priorities also have drastically changed. For example, food crops now receive greater priority from that of 1962-1968 period, also agricultural extension ranks second only to export crops production. Both livestock, irrigation and mechanization have received increased attention. From this budget plan, one can deduce that some learning must have taken place over the last plan period.

The attempt on the government's part to bring a balance between food production and export crop production seems to be a wise step, at

TABLE V

BUDGET ALLOCATIONS FOR AGRICULTURAL DEVELOPMENT PROGRAMS IN NIGERIA (1970-1974)

Projects	Allocations	Million (₦)
I. Crop Production	62.18	
1. Export		30.28
2. Food		21.42
3. Forest		10.48
II. Agricultural "Knowledge"	33.16	
1. Extension		25.48
2. Research		4.70
3. Training		2.98
III. Livestock and Fishery	27.18	
IV. Irrigation and Farm Mechanization	25.04	
V. Agricultural Credit and Marketing	19.18	
VI. Other Supporting Services	32.82	

Source: Federal Republic of Nigeria, [19], p. 122.

least, in terms of the share of public funds between food and export crop producers. In particular, one should note that greater emphasis is now placed on agricultural extension which bridges the gap between research and practical application. Improved seeds and livestock breeds from research are made available to farmers through extension effort; and similarly, information regarding fertilizers and other agricultural chemicals are conveyed to farmers through extension.

Irrigation and mechanization projects are of great benefit to farmers in increasing their production. These services coupled with efficient credit programs would make the "best" use of public funds available to farmers in the country.

Share of Benefits from Agriculture in Nigeria

With respect to consumers, it seems that an appropriate measure of the benefits they receive is the price they pay for food. A high food price may be a result of shortage of food supply, an increased demand for food, or a prevailing price inflation in the country. It could also be any combination of the above factors. The consumer price index numbers for 1960-1969 are presented in Table VI.

The index numbers in Table VI indicate that food prices and other consumer items have been relatively unstable from 1960 to 1969. Nigeria has, for a long time, been basically a self-sufficient country in food, except for deficiencies in protein. But as a result of the "crisis" in the country 1966-1970, food prices have been sky-rocketing. This is

TABLE VI

CONSUMER PRICE INDEX NUMBERS
(ANNUAL AVERAGES 1963=100)

Year	Food	All Items
1960	94	91
1961	102	96
1962	108	101
1963	100	100
1964	101	102
1965	104	107
1966	122	116
1967	110	111
1968	106	113
1969	128	124

Source: U. N., "World Economic Survey," 1970.

primarily due to the reduction in food production, particularly in the war affected areas, and also the general inflation prevailing in the country. Therefore, projects for increasing food production are of benefit to the consumers, by making more food available and at lower prices.

The benefit distribution situation becomes more interesting when we look at the relationship between the shares of the government and producers. For this purpose, export crops are chosen here for illustration. Appendices C and D give detailed breakdowns on taxes and Marketing Board Trading surpluses earned on cocoa (a tree crop) and groundnuts (peanuts), respectively. These data are summarized here in Table VII.

Though price increases and decreases in general favor or hurt farmers, the distribution of gains from increased production and export earnings, between producers and the government may affect future productivity and overall development. It can be seen from Table VII that 31.9 percent of potential producer income for cocoa farmers was withdrawn in the form of taxes and government operated Marketing Board Surpluses. This is directly a loss in income to these farmers. Similarly groundnut (peanut) producers have lost 24.9 percent of their potential income.

There are several arguments for and against the policy of withdrawals. The governments believe that part of these earnings should be set aside for development purposes. To the extent that these withdrawals are reinvested in agricultural development or any supporting services, the producers may still benefit directly and/or indirectly. But if these withdrawals are used in subsidizing National Airlines and

TABLE VII

TAXES AND MARKETING BOARD TRADING SURPLUSES
EARNED ON COCOA AND GROUNDNUTS
(1947-1962)

	Cocoa	Groundnuts
1. Export Duties	N128,972.6	64,308.0
% Potential Producer Income	17.8%	12.9%
2. Marketing Board Trading Surplus	93,276.0	50,486.6
% Potential Producer Income	12.8%	10.4%
3. Produce Purchase Tax	5,105.8	7,996.4
% Potential Producer Income	1.3%	1.6%
4. Total Withdrawals	233,344.4	123,790.0
5. Producer Income	494,756.6	373,082.0
6. Potential Producer Income	726,191.0	496,872.0
7. Total Withdrawals as Percent of Potential Producer Income	31.9%	24.9%

Source: Gerald K. Helleiner, Peasant Agriculture, Government and Economic Growth of Nigeria (Homewood, Illinois: Richard Irwin, 1966).

other inefficient public corporations, or in building fancy government houses and hotels, or in fact any "conspicuous" development projects, the producers derive little or no benefit from these investments. Other people argue that as much as possible of the increased export earnings should be returned to the producers as increased prices, bonus, subsidies or infrastructure which would stimulate higher production. This division of opinion calls for studies to determine which policy would stimulate productivity and growth most.

Structure of Government Agricultural Services

In the Northern States of Nigeria, the Ministry of Agriculture and National Resources (MANR) is responsible for formulating policies regarding agricultural services. Each state differs with respect to specific policies, but in general they are very similar throughout the six Northern States. The following is a chart showing the organizational structure of the Ministry of Agriculture and Natural Resources with emphasis in the set up of extension services (see Figure 1). This structure is the same throughout the Northern States of Nigeria.

The Minister or Commissioner is responsible for formulating major policies for the Ministry, while the Permanent Secretary directs the general administration and sees that all policies are accurately followed. The major divisions: Animal Health (veterinary services), Animal Husbandry (livestock production services), Agricultural Services, Planning, Administration and Irrigation are each headed by a chief officer who coordinates programs within the respective departments or divisions .

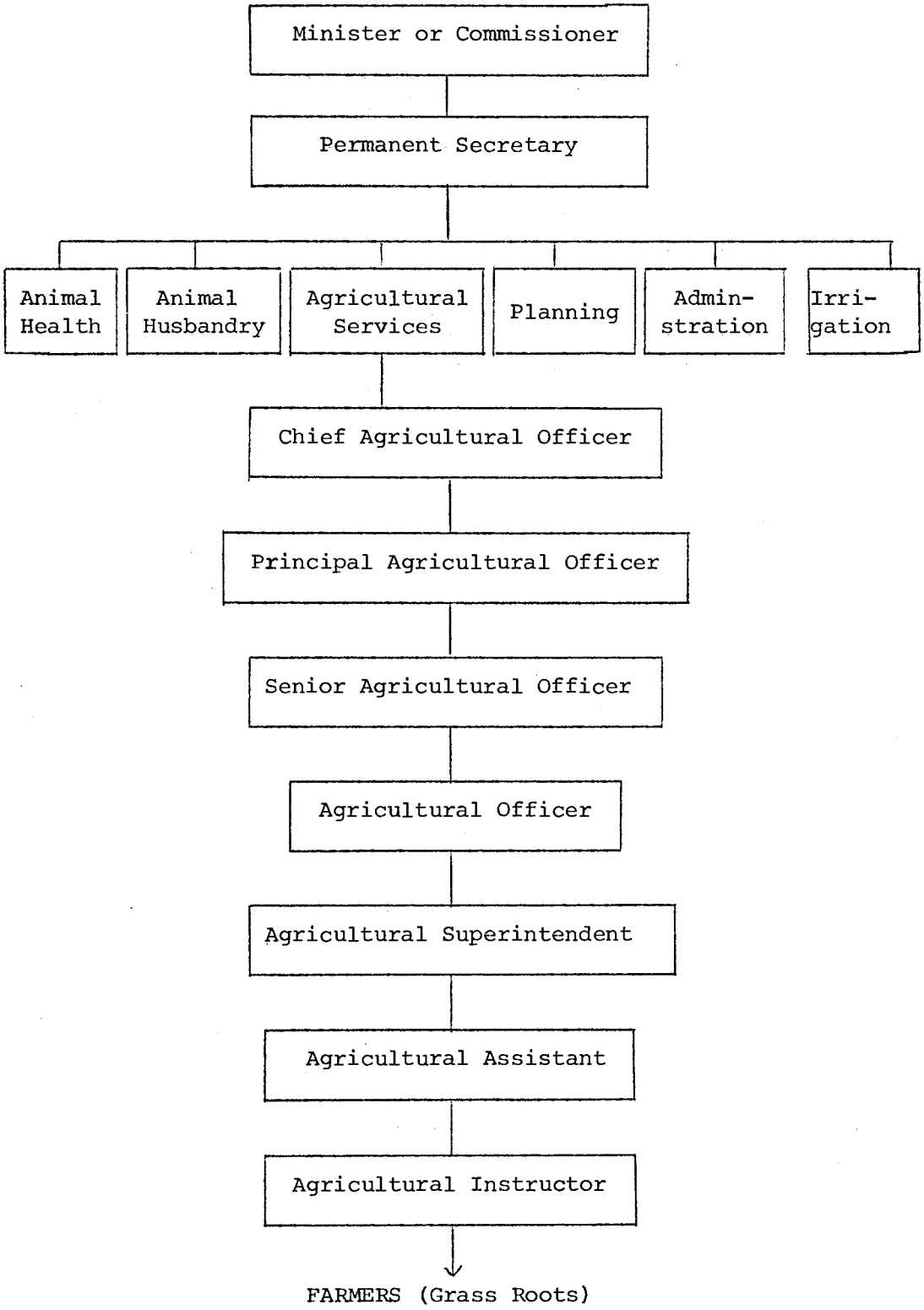

Figure 1. Organizational Structure of the Ministry of Agriculture and Natural Resources with Emphasis in the Set Up of Extension Services

Agricultural Services Division

All officers in the Agricultural Services Division with the exception of the Chief Agricultural Officer are involved in extension work at some level. These officers serve as liaison between the research farms and the farmers. They provide the farmers with the latest farming techniques, and also advise the researchers of the farm problems that need immediate investigation. Besides making farm supplies and equipment available to local village farmers, the officers of this division are responsible for the execution of the following major programs, which are of importance in this study.

Seed Multiplication Schemes

New and recommended variety of seeds released by the research centers are grown in the government farm centers. The seeds are harvested and distributed to farmers either free or for a nominal price. In most cases, the initial distribution is free and any subsequent supply is nominally paid. The objective of the scheme is to propagate cropping of recommended crops. Another objective of the scheme is to experiment with the local seed varieties as well as observe the results of any newer variety of seeds under field conditions before taking the seeds to farmers for adoption. This experimentation is conveniently formulated in order to win the faith and cooperation of farmers in extension services.

Crop Demonstration Unit

The objective of Crop Demonstration is to show to the farmers how to adopt growing of any new variety of seeds (crops released from

research) according to research specifications. The demonstration is done on the farmers' lands. Plots usually of one-quarter of an acre are randomly selected on individual farms so as to grow new varieties of crops according to research recommendations, e.g., planting date, amount and kind of fertilizers, and amount and kind of seed dressings (insecticides) needed if necessary.

Extension Demonstration Unit

The unit is concerned with the mass communication and public relations for the extension services. The unit is the propaganda organ as well as sales unit of agricultural extension services. The unit distributes agricultural leaflets (bulletins) and shows films (movies) to farmers about agricultural concerns. It also organizes group discussions, agricultural shows, guided (field) tours to research stations, government farms, and crop demonstrations in individual farms. The unit also guides farmers to form clubs and cooperative unions. It conducts seminars and in-service training for the staffs.

In addition to these programs, market and price information are provided to farmers through the Agricultural Extension staff. Some of these extension workers also participate in the teaching work at the Farm Training Centers.

Public-Sector Capital Expenditure on Agriculture In The Northern States

The areas of emphasis in agricultural development programs can sometimes be observed from the relative shares of the public-sector capital expenditures allocated to the respective programs. Budget

allocations both at the national and regional levels may be viewed as planning as well as a political tool. Nevertheless, one may safely assume that a program that receives the largest fund is of the greatest importance to the government, under normal circumstances. In Table VIII the public-sector capital expenditure on agriculture in the Northern States is presented.

Agricultural extension services alone received approximately 33.04 percent of the total capital expenditures for the Northern States as a whole. This shows the emphasis on agricultural extension services in this region of the country. Because of the drier climatic conditions in the North, irrigation schemes are also of high priority.

To help the reader understand the main differences between emphasis on agricultural programs and policies in the North and the Southern parts of Nigeria, a comparison is made here between the relative rankings of the various programs (see Table IX). These rankings are based on the programs' relative shares of the total agricultural capital expenditure budgets for 1970-74. The detailed budget allocations and rankings are given in Appendix B.

From these rankings, one can observe that program emphasis differs to a large extent between the Northern States and the Federation as a whole. The most striking differences are: (1) Agricultural research in the Northern States is undertaken by the Ahmadu Bello University in Zaria, North Central State (NC). Funds for research are part of the grants the states make for the university operations as a whole. Hence, none of the Northern States have agricultural research programs of their own. This is also the case in the Western State, where agricultural research is the sole responsibility of the University of Ife.

TABLE VIII

PUBLIC-SECTOR CAPITAL EXPENDITURE ON AGRICULTURE IN NIGERIA
1970-1974
(NORTHERN STATES) IN ₦ MILLION

		BP*	KN	KW	NC	NE	NW	TOTAL
1.	Food Crops	.884	1.580	.718	.532	.740	.432	4.886
2.	Export and Crops for Local Industries	0.200	--	.152	.370	.186	--	.908
3.	Irrigation (Including Rural Water Scheme)	0.570	14.482	.380	1.952	1.376	4.144	22.904
4.	Farm Mechanization	0.142	1.484	.270	.464	.300	.352	3.012
5.	Farm Training Institutions	.120	.216	.258	.120	.280	.320	1.314
6.	Agricultural Extension Services (Mainly Chemical Promotion, Seed Multiplication, and Agricultural Information)	3.932	13.638	1.962	3.000	2.466	2.282	27.280
7.	Agricutural Research	--	--	--	--	--	--	--
8.	Agricultural Credit	--	1.800	1.000	--	--	.092	2.892
9.	Agricultural Marketing	--	.378	--	--	2.366	.342	2.986
10.	Livestock	1.196	2.466	.920	1.226	3.108	2.358	11.274
11.	Fishery	0.040	.076	.032	.076	.098	.136	.458
12.	Forestry	.568	.192	.310	.330	1.500	1.200	4.100
13.	Miscellaneous Capital Expenditures	--	--	--	--	.546	--	.546
	Total	7.652	36.212	6.002	8.070	12.966	11.658	82.560

Source: Second National Development Plan, 1970-1974.
*BP = Benue Plateau; KW - Kwara; NE = North-East; KN = Kano; NC = North-Central; NW = North-West.

TABLE IX

COMPARISON OF DIFFERENT AGRICULTURAL PROJECTS IN NORTHERN NIGERIA AND THE FEDERATION BY RANKING (1970-1974)

Rank	Federation	Northern States Only
1	Export Crops	Agricultural Extension
2	Agricultural Extension	Irrigation
3	Food Crops	Livestock
4	Livestock	Food Crops
5	Irrigation	Forestry
6	Agricultural Credit	Farm Mechanization
7	Forestry	Agricultural Marketing
8	Fishery	Agricultural Credit
9	Farm Mechanization	Farm Training Institutions
10	Agricultural Research	Export Crops
11	Farm Training Institutions	Miscellaneous Capital Expenditures
12	Agricultural Marketing	Fishery

Source: Adapted from Federation of Nigeria [19].

(2) Export crops are of high priority in the Federation, but in the Northern States, only groundnut is a major export crop at present. Export crops which were of great importance in the past, such as cotton, sugar cane, kenaf, tobacco, etc., are now produced mainly for local industries. Hence, they now receive less emphasis in government programs. However, the various industries involved in their processing have programs aimed at encouraging higher production.

(2) In the Northern States, agricultural marketing and farm credit are handled by the Northern States Marketing Board, which is a semi-autonomous institution. These activities are operated through the various cooperative societies and unions. As such, not much state government funds were allocated for these services for the current development plan period. However, Kano (KN), North East (NE) and North West (NW) have some allocations for marketing. It is most likely that these allocations are for livestock marketing services, which are not handled by the Northern States Marketing Board. Similarly, only three of the six Northern States, Kano, Kwara (KW) and North West had allocations for agricultural credit. Since farm credit in the past has been mainly for export crop producers, the policy in the North was to channel the loans through the Marketing Board. This policy will be changing in the near future because more credit is now required for livestock production, irrigation and mechanization services and not just for export crops.

Summary

Agricultural development projects have received a high priority in the national development effort of Nigeria. Export crops still receive

the highest priority in the national agricultural development projects. While producers' income may have increased, a substantial portion of their potential income is being withheld as taxes and trade surpluses. Both producers and consumers would benefit from increased agricultural production, but the relative share of these benefits depends mainly on the nature of development projects and government's policies. In the Northern States great emphasis is placed on agricultural extension services (i.e., chemicals promotion, seed multiplication and agricultural information). Irrigation schemes have also received high priority in the Northern States, especially Kano State because of the recent drought conditions, irrigation is likely to receive greater emphasis.

CHAPTER V

EMPIRICAL RESULTS IN DETERMINING THE PRIVATE RATE OF RETURN TO GOVERNMENT SERVICES IN GROUNDNUT PRODUCTION

Profitability is of major importance in a farmer's decision regarding the adoption of a new technology. Hence the private rate of return to government services in groundnut production may be the main determinant in the use of these services. In this chapter the "packaged" technology yield responses, private costs and returns, and the aggregate production results for Kano State are discussed.

Government Services in Groundnut Production

In Kano State, government services in groundnut production are undertaken by the Extension Services Division of the Ministry of Agriculture and Natural Resources (MANR). Since 1962 research activities involving groundnuts, such as breeding, variety and fertilizer trials, are done by the Ahmadu Bello University in Zaria. The specific government services may be grouped as follows:

1. Seed multiplication
2. Crop demonstration
3. Fertilizer distribution
4. Distribution of other agricultural chemicals.

Seed multiplication and crop demonstration have been briefly described in Chapter IV. The basic facility is to make the recommended seed variety available to farmers at nominal prices, and to demonstrate to the farmers expected yield increases if the recommended practices are adopted. The extension services unit of the ministry also distribute fertilizers (superphosphates in the case of groundnuts), seed dressing, spraying and storage chemicals. This may be done directly by the extension workers or private agents appointed by the ministry. All these chemicals are provided to the farmers at subsidized prices. Other services provided include marketing and price information disseminated through the Extension Demonstration Unit. Farm credit, tractor hiring services and irrigation may also be available to groundnut farmers in different parts of Kano State. However, since these latter services are not limited to groundnut production, they are excluded from the following analysis. The government services of importance here are those provided in the "packaged" technology.

Yield Responses to Improved Technologies

The basic aim of the crop demonstration program is to show the farmer the difference in yield between the traditional method and the improved technology method. In making these comparisons, two underlying assumptions are of great significance, namely (1) that soil fertility and moisture content are identical on both the demonstration and the control or farmers' plots, and (2) that level of management is not significantly different among farmers in a given village. While the former assumption may not pose a serious problem, the latter could be a source of bias in the results. One can safely assume that

management ability among traditional farmers in a given area is basically the same, but when a crop demonstration is done side by side with a control plot in which a farmer uses the traditional method, there are cases where the farmer, on noticing the difference between his crop and the demonstration plot, decides to follow the practices done on the demonstration. While this may create a downward bias in the yield differences between the two plots, it is not a serious problem because after all, the demonstration is not an experiment but an effort to convince the farmer to switch to the new technology. In any case, it is assumed that this does not happen often enough to significantly affect the results obtained.

Yield responses to improved technologies in Kano State have been encouraging for goundnut production. For the seven year period, 1966-1972, Table X shows that an average crop improvement of approximately 78.2 percent was obtained in the "packaged" technology demonstration over the traditional method. This represents approximately 759 pounds per acre of groundnuts. The highest crop improvement of over 200 percent was recorded for 1968, and the lowest was about 30 percent for 1971. Several reasons could account for the annual variation in these crop yields, but the most important are (a) the timing and amount of rainfall for a specific year, (b) changes in the location of the demonstration plots, and (c) disease and/or pests, which may affect crop yields in a particular year. In summary, Table X shows that using government services in groundnut production, Kano State farmers could significantly increase crop yields when soil moisture and climatic conditions are favorable.

TABLE X

YIELD RESPONSES TO IMPROVED TECHNOLOGIES IN KANO STATE USING GOVERNMENT SERVICES IN GROUNDNUT PRODUCTION, 1966-1972 (LBS/ACRE)

Year	Demonstration	Control	Yield Increase	Percent Improvement
1966	2,005	1,103	902	81.8
1967	1,006	534	472	88.3
1968	1,473	465	1,008	216.8
1969	537	327	210	64.2
1970	1,802	1,101	701	63.7
1971	1,846	1,410	436	30.9
1972	3,449	1,862	1,587	85.2
Average	1,731.1	971.7	759.4	78.2

Source: Kano State Ministry of Agriculture and Natural Resources (MANR), Summer, 1973.

Private Costs of Using Improved Technologies and Government Services

In Kano State, most of the inputs in the improved technology are subsidized. Private costs represent the actual amount farmers pay for using the improved technologies and government services. Research and general extension work expenditures for making these new technologies available are regarded as developmental costs. The main justification for this is that such expenditures would generate future streams of income far beyond the period under present application. Moreover, since these activities cover almost all crops and livestock programs, estimating the portion of the expenditures for groundnut schemes is almost an impossible task. Therefore, the private costs of using the improved technologies are the costs of the incremental inputs in the recommended technology. For groundnuts, the incremental inputs per acre are:[1]

1. Extra Seed (lbs) = 20
2. Seed Dressing (pkt) = 1
3. Fertilizer - superphosphates (cwt) = .50
4. Added Man-days of Labor = 2

The new technology requires an extra 20 pounds of the recommended seed variety, one packet of seed dressing and 50 pounds of superphosphate fertilizer. An additional two man-days of labor are also required for planting the extra seed, applying fertilizer and following other practices not performed under the traditional method. The private costs per acre of the incremental inputs are:

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[1]These incremental inputs were estimated by the Ministry of Agriculture and Natural Resources.

1.	Extra Seed[2] @ ₦0.06/lb.	= ₦1.20
2.	Seed Dressing @ ₦0.06/pkt	= 0.06
3.	Fertilizer (superphosphates) @ ₦1.60/cwt	= 0.80
4.	Labor @ ₦0.45/day	= .90
	Total	₦2.96

The costs of seed dressing and fertilizer are standard among the various villages in Kano State, but seed and labor costs vary among villages. The average cost of seed was ₦0.10/lb while the average daily wage rate reported was ₦0.45. Therefore, a farmer using the new improved technology needs approximately three additional naira (4.5 United States dollars) per acre to cover the incremental private costs.

Private Returns from Using Improved Technologies and Government Services

The Northern States Marketing Board is the sole buyer of groundnuts produced in Kano and the rest of the Northern States. The board, therefore, determines the pricing policy for all products it purchases. For groundnuts, with only approximately 20 percent of the output consumed domestically, the world market price determines the price the farmer receives for his crop. The situation is gradually changing now because of the relatively larger share of groundnut production being processed locally for oil and cake. A recent change in policy also is

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[2]These costs were obtained from the field survey conducted in Kano, Summer, 1973. The farmer pays more for extra seed if he obtains his seed from the local village market. However, if he uses recommended seed varieties, obtained from government farms, he pays only ₦0.06/lb.

the new decree making the Federal Government the sole price determining body rather than the Marketing Board. This is an attempt to increase producer income by reducing or entirely removing export duty and Marketing Board surpluses. The surpluses are the differences between the world market price and the producer price. For example, during the period 1947-1961, groundnut farmers received only 75.1 percent of their potential producer income.[3] The withdrawals were broken down as follows:

Withdrawal	Percent Potential Producer Income
Export Duties	12.9
Marketing Board Trading Surpluses	10.4
Produce Purchase Tax	1.6
Total	24.9

As a matter of policy, these withdrawals are for development purposes, but as an incentive for stimulating higher production, one may question the wisdom of such a high indirect tax on the producers.

To estimate private returns to the Kano State groundnut producers, the actual producer price paid to farmers is to be used. These prices are listed as the following:

Season	Producer Price Per Ton (₦)
1966/67	₦84.12
1967/68	72.70
1968/69	52.00

[3] G. K. Helleiner, Table V-F-11, Peasant Agriculture, Government and Economic Growth in Nigeria (Homewood, Illinois: Richard Irwin, 1966). Details given in Appendix D.

1969/70	59.80
1970/71	63.30
1971/72	67.60
1972/73	80.60
Average	68.59

Note: These prices are for standard grades only. Special grades have slightly higher prices.

Source: Northern States Marketing Board, Kanduna, Nigeria, Summer, 1973. More details are given in Appendix H.

One of the major problems in projecting returns for groundnuts and other export crops is the high price fluctuations. As indicated above, for the seven year period 1966/67 to 1972/73 groundnut producer prices have fluctuated widely.

Returns Per Acre for Groundnut Production

Returns of groundnut production per acre are estimated for the 1966-72 period. The yield responses given in Table X for the same period were for unthreshed (i.e., in shell) groundnuts. However, since the prices quoted above are for shelled groundnuts, these yields must be converted to shelled weights. The estimated threshing percentages for groundnuts in Kano State are 68 for demonstration plots and 62 for traditional or control plots.[4] Hence, Table XI shows the returns per acre for groundnut production in Kano State, 1966-1972.

As indicated in Table XI, the new groundnut technology increased returns per acre almost 100 percent over the traditional technology.

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[4]Rural Economy Research Unit, Institute for Agricultural Research, Samaru-Zaria, Nigeria. Estimates were from the analysis of the results of the crop demonstrations.

TABLE XI

RETURNS PER ACRE FOR GROUNDNUT PRODUCTION
KANO STATE, 1966-1972

Year	Demonstration Plots		Control Plots	
	Yield (lbs.)	Value (₦)	Yield (lbs.)	Value (₦)
1966	1363.40	51.12	683.86	25.66
1967	684.08	22.18	331.08	10.76
1968	1001.64	23.34	288.30	6.70
1969	365.16	9.74	202.76	5.38
1970	1225.36	34.62	682.62	19.30
1971	1255.28	37.84	874.20	26.36
1972	2345.32	87.04	1154.44	41.50
Average	1177.17	37.96	602.46	19.38

Source: Yield figures were obtained from Kano State Ministry of Agriculture and price figures from the Northern States Marketing Board [36].

For the seven year period under study, the highest return per acre for the packaged technology was ₦87.04 in 1972 and the lowest was ₦9.74 in 1969. The highest return for the traditional method (control) was ₦41.50 per acre in 1972 and the lowest return of ₦5.38 per acre was for 1969. The major factor affecting the returns appears to be price rather than yield.

Incremental Returns Per Acre

Earlier in this chapter, the incremental cost per acre for adopting the new technology was estimated at about ₦2.96. The incremental value for groundnuts from the improved technology is given in Table XII.

As indicated in Table XII, the improved technology gave an average of 95.87 percent increase in returns per acre for the 1966-1972 period. After subtracting the incremental cost per acre of ₦2.96, the improved technology using government services results in an approximately 81 percent increase in net returns per acre to groundnut producers. Hence, the improved technology is profitable to the farmers.

Aggregate Production Results for Kano State

Since the results obtained per acre of groundnut production in Kano State show encouraging private profitability rates, one might show, therefore, what impact this would have on overall groundnut production at the Kano State level. Some assumptions are made with respect to the price level for groundnuts and also about the number of extension or government workers needed to achieve the expected results.

The following basic price assumption is made: since most of Nigeria's groundnuts are sold on the world market, a 20 percent increase

TABLE XII

GROSS PRIVATE RETURNS FROM TRADITIONAL AND IMPROVED GROUNDNUT PRODUCTION TECHNOLOGY IN KANO STATE 1966-1972 (₦ PER ACRE)

Year	Value of Returns from Improved Technology (₦)	Value of Returns from Traditional Method (₦)	Incremental Returns (₦)
1966	51.12	25.66	25.46
1967	22.18	10.76	11.42
1968	23.24	6.70	16.54
1969	9.74	5.38	4.36
1970	34.62	19.30	15.32
1971	37.94	26.36	11.48
1972	84.04	41.50	45.54
Average	37.96	19.38	18.58

in aggregate production, for example, would have little or no impact on the world market price.

To illustrate the impact of the improved technology on aggregate groundnut production in Kano State, the following data for 1973 are presented as background information:[5]

Current groundnut acreage	= 1,100,000 acres
Production	= 480,000 tons
% Loss - Damage	= 5% (i.e., 24,000 tons)
Planting seeds	= 39,281 tons
Exports	= 150,000 tons
Local processing	= 400,000 tons
Consumption	= 40,179 tons
Total demand	= 653,460 tons
Deficit	= 173,460 tons

The foregoing statistics show the need for increasing the present groundnut output in Kano State. The current estimated deficit of 173,460 tons represents about 36 percent of the current output level. It is made up of imports and interstate transfers. With the increasing domestic demand for groundnut oil and cake, this deficit is likely to become larger unless an accelerated increase in production occurs. This can be achieved by a combination of the following factors:

(a) Increasing the adoption of the "packaged" technology

(b) Increasing the acreage devoted to groundnuts

(c) Decreasing exports

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[5]See Kano State Year Book, 1969 and also Kano State MANR, Plan and Program for the National Food Crops Accelerated Production Campaign Covering the Period 1973-1980 (Kano, Nigeria, 1973), pp. 3-21.

A typical farm family in Kano State, consisting of approximately seven members cultivates about 6.8 acres of crops. But approximately only 1.1 acres of this is cultivated for groundnuts.[6] The remaining is devoted to guinea corn (sorghum), millet and other crops. Groundnut production could, therefore, be increased also be devoting more acreage to the crop either by diverting acreage from other crops, cultivating land presently under fallow or bush, or planting more acres using the improved technologies.

Assuming the latter, the additional acres of improved groundnuts may be calculated by dividing the groundnut deficit in pounds (173,460 tons x 2,240 = 388,550,400 pounds) by the difference in yields per acre between demonstration and control plots (1,731.1 - 971.7 = 759.4 pounds). This results in approximately 511,654 additional acres.

The effect of this increase in the acreage of improved groundnuts would be a total increase in farm income of approximately ₦7,992,035 for Kano State, or an increase of about ₦8.0 per farm family.

Summary

The improved groundnut technology discussed in this chapter showed an increase in yield of approximately 78.2 percent over the traditional method. With the incremental input cost per acre for extra seed, seed dressing, fertilizer and labor amounting to only ₦2.96, and gross incremental return per acre of ₦18.58, the private profitability for using this technology is thus very high.

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[6] Kano, MANR, op. cit., p. 7.

In Kano State the 1973 agricultural statistical estimates show a groundnut deficit of 173,460 tons. This deficit may be eliminated by (a) increasing the adoption of the "packaged" technology, (b) increasing the acreage devoted to groundnuts, and (c) decreasing exports. This would require additional 511,654 acres of improved groundnuts. Total farm income in Kano State would be expected to increase by approximately ₦8.0 million under the improved technology. Obviously, additional extension workers would be needed to accomplish this increase. The policy implications of this are discussed in Chapter VIII.

CHAPTER VI

EMPIRICAL RESULTS IN DETERMINING THE SOCIAL PROFITABILITY OF GOVERNMENT SERVICES IN GROUNDNUT PRODUCTION

Private profitability of the "government services" for groundnut production was discussed in the last chapter. Here the empirical results in determining the social profitability of the "services" are presented. The "services" discussed are the same as those previously mentioned, namely the provision of the improved inputs in the "packaged" technology together with supporting services such as the crop demonstration programs, and agricultural information.

Procedure

The social benefits from government services are calculated by using the following formula:

$$NSB = GR - PC - PbC$$

i.e. (net social benefits) = (gross returns) - (private costs) - (public costs). Another way of stating this is that the net social benefits from the services is equal to gross returns (including government tax payments) minus social costs.[1] Externalities are not included. The public costs referred to here include subsidies and other costs not paid

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[1] Social costs = private costs + public costs.

by the individual farmer but borne by the public sector. Thus, in estimating the social costs of the recommended practices, the full cost to government of providing materials is used, together with a ₦0.45 charge per man-day of additional labor. The non-subsidized prices of farm inputs per acre are given in Appendix E for the seven most important crops of the region. Using these cost estimates, incremental social costs (sum of private and public) per acre for the incremental inputs are as follows:

Social Incremental Costs[2]

1.	Seed dressing 1 pkt @ ₦.10/pkt	= .10
2.	Extra seed 20 lbs @ ₦.06/lb	= 1.20
3.	Fertilizer (.5 cwt) @ ₦3/cwt	= 1.50
4.	Added man-days of labor (2 @ ₦0.45/day)	= .90
	Total	₦3.70

The incremental social cost is therefore about ₦4.0 per acre of groundnut. This, however, represents only a part of the actual cost of the program, because research and extension costs have been regarded as developmental costs. The estimated incremental social cost per acre of groundnuts represents the cost of the additional inputs required in the improved technology, which otherwise are not used in the traditional method.

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[2]Kano, MANR, op. cit., pp. 4-6. Note also that the market wage rates may differ from ₦0.45. With unemployment, the social wage rate may be less than ₦0.45.

Cost of Extension and Research

It would have been very useful if estimates were available for the cost of extension and research programs on groundnuts, but such estimates are not available directly for any part of Nigeria. This may be attributed to the difficulty in making such estimates, arising from the fact that research and extension allocations are usually spread over more than one crop at a time. However, the following cost assumptions are made for Kano State to enable a more realistic estimation of the social profitability of the groundnut package. It is important to note that these are only rough estimates and most likely undervalue the actual social costs for extension and research on groundnuts.

Extension Services Costs

The average annual extension service (mainly seed multiplication and chemical promotion) budget allocation for the 1970-1974 period for Kano State is approximately ₦3.4 million. Since groundnut is one of the most important crops in Kano State, one can assume that at least 20 percent of this sum is spent on groundnuts.[3] Therefore, the estimated annual cost of seed multiplication and chemical promotion is about ₦0.68 million.

The estimated cost per demonstration is approximately ₦80.0. This cost only includes administration costs and not subsidized input

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[3]Estimate of groundnut's share of the value of total agricultural output in Kano from the Digest of Statistics, Vol. 21 (Lagos: Federal Office of Statistics, April, 1972); Table 7, Chapter IV).

costs.[4] Since there are currently an average of 340 groundnut demonstrations per year in Kano State (344 for 1972/73 and 336 for 1973/74), the average current annual cost for crop demonstrations is ₦27,200.

Research Costs

Since no research costs are directly borne by Kano State government (see discussion in Chapter IV), it is assumed that the social cost for research on groundnuts in the state is zero. This is obviously an understatement, but trying to estimate this cost from existing information would only be a meaningless exercise.

Total Social Costs

Summarizing the public and private costs of improved technologies and government services, we have the following:

(a) Fixed costs for Kano State

Seed multiplication and chemical promotion	= ₦680,000
Demonstration	= ₦ 27,200

(b) Direct public and private costs = ₦3.70 per acre

Since there are approximately 1.1 million acres of groundnuts grown annually in Kano State,[5] the fixed cost above becomes about ₦0.64 per

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[4] Wells, op. cit., p. 174. Wells' estimate was ₦70 per demonstration in 1965. Because of recent wage and price increases, this is now estimated to be about ₦80.0 per demonstration. The overhead costs include personnel and transportation.

[5] This is the Kano State MANR estimate. See Plan and Program for the National Food Crops Accelerated Production Campaign Covering the Period, 1973-1980, p. 7. This fixed cost is being charged to the total groundnut acreage rather than the improved technology acreage alone because the services are available to all groundnut producers who desire.

acre. Therefore, the total incremental social cost per acre is estimated at ₦4.34.

Receipts from Groundnuts

To determine the social return per acre of groundnuts, it is necessary to adjust world prices to Kano State basis. The suggested groundnut parity price formula for Kano State is one based on (a) 65 percent of the London based world market price, and (b) 80 percent of the basic price paid by local millers.[6] This formula becomes $\frac{(a) + (b)}{2}$. For example, the 1972/73 London price per ton was about ₦241.00, while the local miller's price was ₦156.00. Therefore, parity price =

$$\frac{156.65 + 124.8}{2} = ₦140.8$$

Ordinarily, this should be the base price. However, farmers were paid only ₦80.6. The difference was marketing costs including transportation charges, export duties, Marketing Board trading surpluses and produce purchase tax. The ₦80.6 per ton received by farmers actually represents only about 75 percent of their potential income. Under no withholdings their receipts would have been approximately ₦107.5 per ton which is parity price minus marketing and transportation costs.[7] Since the export duties, trade surpluses and purchase taxes are receipts to the government or public, the price to use in estimating social returns for 1972/73 groundnuts would be ₦107.5 per long ton.

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[6] Ibid., p. 28.

[7] The parity price assumes half of the groundnut production is exported, while the other half is for domestic usage. Unfortunately, no information is available on government marketing and transportation costs.

Social Profitability Per Acre

In determining the social profitability of the groundnut scheme the producer prices given below are converted to the social price as explained above. That is, the Producer Price x $\frac{100}{75}$ = Social Price.

Season	Producer Price (₦) (per ton)	Social Price (₦) (per ton)
1966/67	84.1	112.1
1967/68	72.7	96.9
1968/69	52.0	69.3
1969/70	69.8	79.7
1970/71	63.3	84.4
1971/72	67.6	90.1
1972/73	80.6	107.5
Average	70.0	91.4

Source: Northern States Marketing Board. These prices are for standard grades only.

Using the above prices, the gross social incremental value per acre may be calculated for the "packaged" technology by the following formula:

(Incremental yield per acre due to technology) X (Social Price) = Gross social incremental value per acre

For the period 1966-1972, this becomes the following:

Year	Incremental Yield* Per Acre (lbs.)	Gross Social Incremental Value Per Acre (₦)
1966	679.54	34.00
1967	353.00	15.27
1968	713.34	22.06

1969	162.42	5.78
1970	542.74	20.45
1971	381.08	15.33
1972	1190.88	57.15
Average	574.7	24.29

*The incremental yield (threshed groundnuts) per acre was obtained by subtracting yields from traditional method from that of the new technology. See Chapter IV, Table IX.

Thus the average gross social incremental return per acre for the seven years observed is about ₦24.29. Subtracting the average incremental social cost per acre of ₦4.34, the net incremental social return per acre becomes ₦19.95. As mentioned earlier, this is probably overvalued because of the inaccurate research and extension cost estimation. Nevertheless, the social profitability of groundnut "packaged" technology is high enough to justify its undertaking and possible expansion.

Public versus Private Profitability

Earlier in this chapter it was stated that social costs are the sum of the private and public costs (or costs borne by the public sector). Similarly, social returns (profitability) are the sum of private returns (profitability) and public returns (profitability). The aim here is to compare public costs (subsidies) in the groundnut production technology, to the public profitability (indirect government producer taxes).

On the cost side, the incremental social cost per acre of ₦4.34 represents private incremental cost per acre of ₦2.96 (estimated in Chapter V) and public incremental cost per acre of ₦1.38.

Gross private incremental return per acre was estimated in Chapter V to be approximately ₦18.58, while the gross incremental social return per acre, estimated above, is ₦24.29. Hence, gross public returns (amount taken away from producers through taxation) equals ₦5.71.

This means that the groundnut farmer in Kano State receives only ₦1.38 per acre in subsidies, while losing ₦5.71 per acre in indirect taxes. That is, the groundnut producer gets back only 24.2 percent of the deductions from his crop per acre. This situation has several policy implications which are discussed in more detail in Chapter VIII. It is important, however, to mention here that from equity considerations, the non-users of the improved technology for groundnut production lose more since they are not benefiting from the subsidized technology.

Kano State Level

The provision of the "government services" for groundnut production in Kano State has been determined socially profitable. At the current estimated average participation rate of about 200,000 acres in the State,[8] the expected social profits would be approximately ₦3.99 million annually. This is equivalent to a return of ₦14.5 for every ₦1.0 of public investment. Should the current extension efforts bring a rapid increase in the average participation of groundnut producers, the amount of social benefits yielded would be substantially increased. Consequently, the extension services designed to increase this

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[8] Acreage participation rate is the estimated percentage of total groundnut acreage actually following all the recommendations of the improved technology "package," i.e., of the estimated 1.1 million acres under groundnut cultivation, about 200,000 acres are cultivated using the full recommendations. This estimate is based on MANR survey and this study's field work.

participation rate in Kano is desirable and should be expanded. The public profitability rate, however, is expected to decrease as more indirect taxes of the producers are removed. The cost of bringing late adopters to participate in the scheme may be much higher than those early innovators among the groundnut farmers.

Summary

The social profitability of the "government services" for groundnut production in Kano State was estimated to be higher than the private profitability. The social profitability per acre of improved groundnuts was estimated at about ₦19.95 as opposed to approximately ₦15.62 estimated for the private incremental profitability rate. The main reason is that as of now, producers have received only about 75 percent of their potential income, the rest being indirect taxes. These taxes, while revenue to the public, represent costs to the producers, hence the higher social profitability rate. The need for, and difficulty of estimating, extension and research costs for the groundnut scheme was also pointed out. For the Kano State as a whole, the scheme yields about ₦14.5 for every ₦1.0 invested, even under the current low acreage participation level. The social benefits to the State can be significantly increased if more participation is achieved. However, the new policy of eliminating export duties, purchase tax and trading surplus will reduce government profitability rate of the program, but not social profitability.

In comparing the amount of subsidies received by Kano groundnut farmers to the portion of their producer income taken away in taxes,

subsidies per acre represent approximately 24.7 percent of total government deductions per acre. Hence, a higher price incentive may be more beneficial to all farmers than the present subsidy scheme.

CHAPTER VII

RESULTS IN THE "ADOPTION OF TECHNOLOGY" MODEL

One of the main objectives of this study was to identify the significant economic factors which influence the adoption of the "packaged" technology. Previous studies conducted in several developing countries have tended to place more emphasis on socio-psychological factors as the impediments to rapid acceptance of new farming techniques. In this study emphasis is on identifying those economic factors which influence adoption, and which lend themselves to controls through appropriate policy programs. This chapter presents a brief summary of the main results obtained.

The Model

In determining the adoption level of a new technology in farming, one is interested in estimating a function which relates the rates of adoption, to several socio-economic factors. Such factors include age of farmer, literacy level (or ability to read in English or a local language), contact with extension services, farm income, farm credit, profitability rate of the new technology, incremental costs of the technology, and the location of the villages where the technology is being introduced. Obviously all these factors cannot be included in a single model because of the interdependencies among these variables. For example, profit rate and incremental cost are interdependent. Age

and literacy rate are expected to be highly correlated. Similarly, factors such as income and credit may be supplementary as well as interdependent, because ordinarily, it is high income families that are able to obtain credit more easily than low income families.

Because of the interrelationship described above, several models were tried using multiple regression techniques. However, only the model which was judged most accurate and which includes all the variables significant at the five percent level is described here. The function may be summarized as:

$$Y = f\ (E, C, L)$$

In other words, the rate of adoption (Y) is a function of the level of contact with extension services (E), cost of the new technology (C), and location of the village (L).[1] The function is only for a particular point of time.

Rate of Adoption

The rate of adoption (Y) is a measure of the extent to which the farmer uses improved seed varieties, seed dressings, and fertilizers. A complete adoption is regarded as one in which the farmer follows all the recommendations in the "package" for at least two consecutive years. The farmers were ranked according to the score obtained from their response to questions 1 and 2 on the use of package inputs on groundnuts.[2] A "yes" answer was scored 1, a "no" answer scored 0, except for

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[1] In all the numerous trial runs made, these were the only variables significant at the 5 percent level for all observations.

[2] See questionnaire Form F in Appendix J.

questions 1 (b) and 2 (b) regarding the use of local seed variety, on which a "yes" was scored 0 and a "no" was scored 1. This is because complete adoption would require that the farmer plant the recommended and not the local seed variety. All the farmers in the survey villages reported planting the improved seed varieties on at least part of their acreage and using fertilizer. The variation in the rates of adoption were mainly due to not applying seed dressing and/or the planting of local seed varieties, instead of the recommended variety. Only in the two villages of Danbatta Division and one in Hadejia Division did all ten farmers interviewed report complete adoption.[3]

The scale used in computing the adoption rate has a maximum of eight points, representing complete adoption. As Table XIII indicates, only 34 percent of the farmers interviewed reported complete adoption. Hence the 20 percent acreage participation rate assumed earlier seems reasonable. The largest portion of the respondents, 38 percent, had a score of six which represents mainly those farmers who reported using all the recommended inputs except seed dressing, and who also still continue planting local as well as the improved seed varieties.

The average score for the three administrative divisions of Kano State was:

Hadejia	6.9
Danbatta	6.7
Gumel	6.1

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[3]Complete adoption rate should not be confused with the acreage participation rate mentioned in the previous chapter. The main difference is that complete adoption refers only to the use of all recommended inputs, and not necessarily that all the farmer's groundnut acres are cultivated under the "packaged" technology scheme. For example, a farmer may report using all recommended inputs, but applies them to only 30 percent of his groundnut cropland.

TABLE XIII

RELATIVE DISTRIBUTION OF ADOPTION RATES OF THE "PACKAGED" TECHNOLOGY FOR GROUNDNUTS IN KANO STATE

Rates	Number of Respondents	Percent
8.0	79	34.3
7.0	30	13.0
6.0	89	38.7
5.0	13	5.8
4.0	10	4.3
3.0	9	3.9
	230	100.0

These rates are satisfactory, particularly when one observes in Table XIII that 86 percent of the respondents have a score of six or better.

Contact with Extension

Though some farmers may get information on new technology from other villagers, their ability to understand and use the technology properly depends to a great extent on their contact with the agricultural extension services. The farmers interviewed were asked the following four questions:

1. Did you visit any groundnut demonstration plots in your village last year? _____ (Yes/No)
2. Did you visit any government farm last year? _____
3. Did any extension worker visit your house or farm last year? _____
4. Do you read any extension newspapers, posters, etc.? _____

A scale was obtained with a maximum of four points, one for any "yes" answer and 0 for a "no" answer. Approximately 16.5 percent of the respondents reported full contact with all the extension work aspects mentioned above, while 5.7 percent indicated no contact at all. Most of the farmers have reported visits to groundnut demonstration plots and visits with extension agents. On the other hand, less than 20 percent of them visit government farms, and only approximately 15 percent read extension newspapers and posters. For the entire sample, the distribution of the scale points are the following:

Scale	Number of Respondents	Percent
4.0	38	16.5
3.0	79	34.3
2.0	77	33.5
1.0	23	10.0
0	13	5.7
	230	100.0

These results are not very satisfactory, since only 50 percent of the respondents have a score of three and above, meaning that only half of the four aspects of extension work in question have been made avilable to farmers.

Incremental Cost of Technology[4]

The incremental costs per acre were described in Chapter V for the individual farmer. This represents the additional cost of the inputs required in the improved technology, i.e., extra seed, seed dressings, fertilizer, and the cost of additional man-days of labor. Fertilizer and seed dressing unit costs were the same for all villages, because the prices for these chemicals are fixed by the government. The prices were N1.60 per cwt and N0.06, respectively.

Costs of additional labor and seed, however, varied among the survey villages. The average costs reported are given below for the three administrative divisions in Kano State.

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[4]One of the models tried had profit rate instead of incremental costs, i.e., Y = f (E, P, L) where P stands for profit rate, but P was not significant in the equation obtained. Therefore, in this sample of farmers, it is the cost of the technology and not profitability that determines adoption.

Division	Labor Rate/Day	Seed Cost/Lb.
Danbatta	₦0.54	0.07
Gumel	₦0.41	0.05
Hadejia	₦0.38	0.05

Both wage rates and seed prices are highest in Danbatta villages, while Hadejia villages had the lowest costs for the two inputs.

Location

Location was measured in miles from the nearest government farm center. This determines the accessibility of the villages to the input supplies required by the new technology, and also contact with extension workers. Table XIV is the distribution of the distances in miles, of the villages surveyed, from the nearest farm center.

As indicated in Table XIV, a majority of the villages are located 10-29 miles from a government farm center. This poses some problems, especially for transportation. Since most extension agents in the state still use bicycles and motorcycles, there is a limit as to the number of villages the agent can effectively work. There should be a resident extension agent in each village of 500-1,000 people, but this goal is far from being attainable in the near future. It also poses transportation problems for farmers, who travel on foot or bicycles, to obtain the required inputs as well as visit government farm centers.

Sample Size

The general procedure for selecting the villages and the sample of farmers was discussed in Chapter I. About 250 farmers were interviewed altogether, but only 200 of these were used for the statistical analysis

TABLE XIV

RELATIVE DISTANCES OF SURVEY VILLAGES FROM NEAREST GOVERNMENT FARM CENTERS IN KANO STATE

Distance in Miles	Number of Sample Villages
Less than 10	3
10 - 19	8
20 - 29	7
30 - 39	1
40 - 49	1
50 - 59	3
60 - 69	2

of the model. The rest had either missing observations on some of the variables or the respondents failed to answer some of the questions. The sample size was, therefore, 200 farmers from 20 villages.

In estimating the regression equation below, two sample sizes were used, one with N=20, i.e., using each village as an observation, and the other in which N=200, in which case each farmer was a separate observation. In this latter case, observations on some of the variables were the same for the farmers within the village. An example of this is location, in which the ten farmers in a survey village have the same location (in miles) from the nearest government farm center. Hence dummy variables were used for villages and administrative divisions. The estimated regression equation given below is for this latter case.

Interpretation of the Regression Equation

In a typical village in the Northern States of Nigeria, the adoption of a new agricultural technology may be affected by extension contact, farm credit, income, cost or profit rate, location, literacy, and age. These factors were included as variables in the regression. The size and statistical significance of a coefficient determined the final selection of variables in the regression equation.

The results are as follows (with standard errors in parentheses).

$$Y = 24.437 + 0.224E - 9.474C + 0.085L$$

$$(6.542) \quad (0.072) \quad (3.160) \quad (0.020)$$

$$R^2 = .63$$

$$N = 200$$

where Y = Adoption Rate (scale, 0 to 8)

E = Extension Contact (scale, 0 to 4)

C = Incremental Cost (N)

L - Location (miles)

Only incremental cost of the improved technology is found to be inversely related to the adoption rate. This is to be expected since the higher the cost of the technology to the farmer, the less he is able to afford it. Both extension contact and location of the village affect the adoption rate of the new technology, though their coefficients are smaller than that of incremental cost. All the estimates are statistically significant by the usual criteria.[5]

The coefficient of determination (R^2), indicates that the set of variables explained nearly two-thirds of the variation in the observed adoption rate. The unexplained variation is attributed to errors in the data, unaccounted interaction among variables, and missing variables. Some of the missing variables include measures of management ability, attitude toward work, and innovation. The R^2 is in line with those obtained in similar studies dealing with predictions of individual human behavior.

The F-test was applied to test the significance of the entire regression equation. The observed F, 14.45, is significant at the one percent level, which means that a high probability exists of correlation between adoption and the linear combination of the independent variables.

The estimated regression equation, thus, may be interpreted as meaning that a unit change in the scale of extension contact (say

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[5]The observed significance level (Prob > |T|) for the variables were intercept (0.0003); E (0.0023); C (0.0031); L (0.0001). The F-test indicates that the estimated regression equation is statistically significant.

from 3 to 4) would give a corresponding increase in the scale of adoption rate of 0.224. A decrease of 0.95 in the adoption rate scale results from a N0.10 increase in incremental costs.

The location results need some explanation. With the pricing policy of the "packaged" technology inputs, formulated to eliminate the effect of location, one would expect that the location variable would be insignificant. In any case, one would also expect an inverse relationship between location and the adoption of technology. But this is not always the case, as some studies in Northern Nigeria[6] indicate also that farmers in villages located farther away from the towns (where government farm centers are situated) engage in more intensive cultivation and have higher average farm income.

Social Returns to Extension Services

Though actual costs of extension services for groundnut production in Kano State are difficult to estimate, the above estimated regression equation may be used in a logistic sense to derive, at least, a crude measure of the returns to extension services or contact. Such a measure would enable one to determine the economic justification for expanding the extension services for groundnut production.

The basic approach would be (1) to estimate the value of a one percent increase in the adoption of the new technology, and (2) to estimate the cost of the required increase in extension contact.

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[6] P. E. Ochala. A Socio-Economic Study of Two Selected Villages in Northern Nigeria: The Effect of Proximity to an Urban Center and Transport Route on Agricultural Production (M. A. Thesis, Beirut, Lebanon: American University of Beirut, 1971).

A one percent increase in adoption rate (acreage) of groundnuts represents approximately 11,000 acres (i.e., 1 percent of 1.1 million acres). Since the net social incremental return for groundnuts in Kano State was estimated at approximately ₦19.95 per acre, the additional 11,000 acres would yield ₦219,450 in incremental social profits.

A one percent change in the extension contact scale yields a 0.08 percent increase in the adoption rate scale. Assuming that the required increase in extension contact can be achieved by attaining the necessary increase in the number of extension workers, approximately two full-time extension workers are needed for contact with the additional 2,200 farm families.[7] The additional cost required per extension worker may be broken down as follows:

Salary (1 Agricultural Assistant)	=	₦1,000 per annum
Transportation (1 Agricultural Assistant	=	500 per annum
Miscellaneous Allowances (1 Agricultural Assistant)	=	250 per annum
Total		₦1,750 per annum

Therefore, the additional extension contact would cost about ₦3,500 per annum for the two extension workers. This cost would obviously be much higher if the training costs of these new employees and other overhead costs are solely borne by the State. Nevertheless, the returns to extension contact, estimated at ₦62.7 for every 1₦ of additional extension cost, is considerably high. This rate of return may be biased upwards and cannot be used for major extension services expansion decisions. However, even if all costs are included, it would still be

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[7] FAO [15] recommends one extension worker per 1,000 farm families in Nigeria.

economically justifiable to expand extension services for groundnut production in Kano State.

Summary

The identification of economic factors affecting the adoption of new agricultural technologies is one of the main objectives of this study. Several factors were included in the original trial model. The size and significance level of the variables determined their inclusion in the final model which was $Y = f(E, C, L)$. This means that the adoption rate of the improved technology (Y) is functionally related to contact with extension services (E), additional cost imposed by the technology (C), and the location of the village or region to the government agricultural centers (L).

All the variables in the model were significant at the one percent level. Extension contact, cost of technology and the location of extension centers relative to the villages appear to be important determinants of the adoption of new improved technologies. The policy implications of this are discussed in detail in the next chapter.

CHAPTER VIII

POLICY IMPLICATIONS FOR THE USE OF GOVERNMENT SERVICES IN GROUNDNUT PRODUCTION IN NORTHERN NIGERIA

Having determined the private and social profitability of using "government services" for groundnut production in the Northern States of Nigeria, particularly Kano State, and identifying the most important factors affecting their adoption, the policy implications involved are discussed in this chapter. The focus is on evaluating present policies in line with the results of the study, and suggesting possible policy changes.

The Changing Role of Groundnut Production in the Nigerian Economy

Nigeria has for a long time been the largest world exporter of groundnuts. The crop has also been a major foreign exchange earner for the economy. Local processing or milling of groundnuts has increased so much within the last few years that the quantity of groundnut exports has been reduced almost by half of its historical level.

There has also been a gradual but continuing decline in groundnut output, not only because of the poor rains, but also because farmers in Kano State area are now growing more food crops. This is due to

the relatively higher prices received for food crops such as guinea corn, rice, millet and vegetables. All these observations indicate a need for the reexamination of the current public policies regarding groundnut production. Among the policy implications to be examined here are: (1) subsidies, (2) agricultural extension activities, (3) locational aspects of input supplies, (4) agricultural credit, and (5) food production programs.

Subsidies

Subsidies at a level ranging from 25 to 50 percent of the basic cost of farm inputs played a major role toward increasing the use of technology on Kano State farms. But subsidies have certain fundamental limitations. In the first instance they may be provided at very high levels while the demand or overall volume of consumption of inputs is low. In this respect, subsidies may be classified as a self-starter, but when the demand expands to the take-off point, the starter should be released. Otherwise the weight of the subsidy is subject to becoming unbearable. For example, the current level of subsidy is estimated to be ₦795,000 for one hundred thousand acres of groundnuts. At this level it would require almost ₦16 million to meet the minimum demand for 1.1 million acres of groundnuts, 2.4 million acres of guinea corn and 2.0 million acres of millet. This is in addition to the input requirements for the remaining million acres of land devoted to other crops in the state.[1]

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[1] Figures are based on MANR estimates. Estimated subsidy costs per acre for guinea corn and millet are ₦3.25 and ₦3.15, respectively (Cf [25]), p. 36.

Since adoption of technology is more sensitive to costs of the new technology than it is to profitability, subsidies in the form of keeping costs down will tend to increase the number of farmers using the new technology.

But again, there are some equity problems. The amount of subsidies received per acre of groundnut production is far less than the amount the government takes away from the producer in indirect taxes. From the estimate in Chapter VI, groundnut subsidy in Kano State amounted to N1.38 per acre, while the producer was indirectly taxed N5.71 per acre. This implies that the non-users of the new technology are also subsidizing the adopters of the improved technology for groundnut production. Hence a higher producer income may be more beneficial from a welfare point of view. The price incentive also would prevent further diversion of farm acres to other crops.

Extension Activities

It is important to determine the cost versus returns from extension services. In Chapter VI it was estimated that the net social incremental return for groundnuts in Kano State was approximately N19.95 per acre.

A one percent increase in the adoption rate (acreage) of groundnuts in Kano State represents approximately 11,000 acres, which would yield N219,450 in net incremental social profits.

With the cost of an additional two extension workers needed for the increased groundnut production estimated at N3,500, the returns to extension contact are approximately N62.7, for every 1N of additional cost. This is regarded as a considerably high rate of return.

Unfortunately, there are no specifically stated policies for agricultural extension activities in Northern Nigeria. However, some activity reorganization may help to improve the effectiveness of the extension services. These necessary changes or improvements include:

(1) Bringing research results to farmers on time. The farmers surveyed in the Kano State area indicated that on the average, it took three to five years for a new recommended farm practice to reach a majority of the farmers in villages. The time span is shorter, of course, for villages with resident extension agents. Timeliness is of great importance in disseminating research findings.

(2) Improving the extension worker-per-farmer ratio. The present number of extension workers is considerably low to bring about the necessary contact between the agents and farmers. In the Kano survey, a majority of the farmers had very little direct contact with the extension agent. Consequently, they expressed difficulty in receiving farming news and getting their farm problems to the attention of research workers. The analysis of the benefits of extension contact made above justifies the provision of more extension workers.

(3) Training of extension workers. The interview with the lower level extension workers (agricultural assistants and below) revealed a severe deficiency in the farm management skills of their work. While these young workers have fairly good training in crop production, their knowledge of farm planning, management and simple economics of farming is rather poor. Since farmers need assistance in these areas for their most frequent decisions, emphasis in the training programs should reflect this aspect. Specifically, there is a need for more training

in farm record keeping, farm budgeting and planning, and agricultural marketing and prices.

With respect to extension services personnel, a program designed at training agricultural extension agents is of immediate priority. The facilities at the Samaru and Kabba schools of agriculture should be exploited to their fullest. The writer suggests that the funds saved from a reduction in the input subsidy scheme currently used could be diverted to a rapid training program. Serious campaigns and incentive plans should be formulated to attract young high school leavers to enroll in these training programs. The new proposed School of Agriculture for Kano State is indeed a timely coincidence for engaging in a rapid training program for extension workers.

Location

Results from the "adoption of technology" model with respect to location seem contradictory. On one hand, the sign on the location variable is contrary to normal expectation. On the other hand, farmers in the villages reported that the inavailability of the farm inputs in their respective villages at the times needed, was a major reason for not adopting the new technology. Therefore, what the farmers reported and the results obtained from the model, conflict. However, the overall objective of the extension services division should be to have a resident extension agent in every village of about 1,000 farm families. Since this objective cannot be attained in the near future, it is important, however, to ensure that supply of the recommended agricultural inputs be available as close as possible to their source of use. Among

the reasons given by farmers who reported not using the new inputs were:

(1) High cost (84%)

(2) Supplies not available in village (71%)

(3) Inputs not available when needed (52%)

This indicates the necessity of having these inputs available in the villages where they are needed and at the correct time.

Another aspect of the location problem is transportation for extension agents. The Kano survey revealed that about 75 percent of the extension workers who participated in the field survey use bicycles as their means of transport. Consequently, an agent must be located close enough to the villages of his operation for the successful performance of his duties. It would also be helpful if more landrovers and other vehicles were available for use and supervision of extension work.

Agricultural Credit

The need for agricultural credit to help farmers buy the required inputs in the improved farming technology has been stated often. In fact, the new Nigerian Agricultural Bank is a response to this need. Certainly, an effective credit plan is preferable to an input subsidy scheme in the opinion of the writer. However, to safeguard the proper use of the credit to farmers, credit should be made available in kind rather than cash wherever feasible. This would at least prevent the use of farm credit for non-agricultural purposes.

A typical farm with one acre each of groundnuts, guinea corn and millet in Kano State would require the following amount of subsidies per acre:

Crop	Amount of Subsidies Per Acre (₦)
Groundnut	1.38
Guinea Corn	3.25
Millet	3.15
Total	8.08

Such a three acre farm would require approximately ₦8.08 in subsidies. A more efficient use of public funds would be to reduce subsidies by limiting them to only those inputs deemed most profitable, but are currently receiving low application levels. Such a new policy should be used in preference to a general subsidy (25-50 percent) level on all inputs which now prevails in Kano State.

However, farmers in Kano State would require more credit, because the "packaged" technology would cost more because of the reduction in subsidy. This credit in kind would include fertilizers and other chemicals, improved seed varieties and other farm supplies. Repayment could also be tied to the crop production. That is, a farmer could choose to pay back the loan either in cash or kind. Though the administration of this type of credit plan may be more difficult in view of the transportation and personnel time involved, it would prove more effective in ensuring that the recommended inputs are used correctly. Here again, the inputs must be available in the right places and at the right times.

Food Production Programs

The general result of this field study of Kano groundnut farmers indicates that the program is at a satisfactory level. That is, besides increasing extension contact and making the inputs available

in the right locations on time, the "packaged" technology for groundnut technology has been introduced to Kano State farmers on a sufficiently large scale. The cost of bringing more farmers to adopt this technology is likely to be more than the initial period of introduction. Increasing acreage participation is a matter of cost and not lack of information regarding the technology. As more of the farmers can afford to purchase the required inputs (through higher producer prices and adequate farm credit plans), the acreage of groundnuts cultivated under the new technology should increase.

Since the improved technology for groundnuts has shown a satisfactory private and social rate of profit, the program should be expanded to cover the major food crops. The recent drought, which affects the Northern parts of Kano, North West, North Central and North East States, has drastically increased the demand for food crops in Nigeria. This is evidenced by the soaring food prices. While some farmers have seized this opportunity to divert their cropland to the more profitable food crops, it is still necessary to formulate programs similar to the groundnut scheme to accelerate food production. Besides the drought, the recently estimated population of Nigeria at approximately 80 million calls for an immediate expansion of food production.

Estimates given in Appendix D show that cowpeas, upland rice, wheat, guinea corn and millet are profitable if cultivated using the improved technology. In fact, upland rice is the most profitable per acre of the major crops. Though the input costs are higher than that of groundnuts, the estimated returns to labor and management per acre given in the appendix are satisfactory enough to suggest the expansion of these programs. Adequate credit plans, such as farm credit in

kind suggested earlier, could be applied also to the food crops production.

Summary

The role of subsidies for inputs in the improved agricultural technology for groundnut production has been examined. Groundnut subsidy is ₦1.38 per acre as opposed to ₦5.71 per acre in withdrawals. It was suggested that an incentive price scheme, however, may prove more desirable than the high-cost input subsidy plan currently used.

The need for more trained extension agents was also stressed, particularly in areas of farm management. Consequently, it is suggested that future training programs should emphasize this aspect. Returns to extension services were estimated at about ₦62.7 for every 1₦ of additional cost.

Farmers in Kano State also indicated inaccessibility to the farm inputs required in the new technology and also direct contact with extension agents. Hence, it is suggested that farm inputs must be made available as close as possible to their source of use. These inputs could also be integrated into a credit-in-kind plan.

Finally, it is recommended that the "packaged" approach should be expanded to other crops which preliminary estimates show are profitable.

CHAPTER IX

SUMMARY AND CONCLUSIONS

Agricultural development requires a continuously improving production technology. The "package" approach to increasing groundnut output, using government services in Kano State of Nigeria, is the subject of this study. The improved technology and services evaluated include (1) a "package" of technical inputs (i.e., improved seed variety, seed dressings, fertilizers and other agricultural chemicals), and (2) a package of supporting services (mainly agricultural extension activities and agricultural information). The crop demonstration program which was designed to show the groundnut farmers the correct usage of the newly recommended inputs and the resulting yields forms the focus of the field study which was conducted in Kano State in the summer of 1973. About 250 farmers were interviewed by questionnaire, of which 200 answered all questions. This was a satisfactory response rate. The analyses of the results obtained through the survey were presented in Chapters V through VII of this report.

The methodology used is presented in Chapter I. Specific objectives of the study and the underlying hypotheses were also stated in the first chapter. The summary and conclusions presented here are based on these stated objectives and hypotheses.

A review of economic theory in determining private and social profitability of government services was presented in Chapter II.

The main differences between social and private returns were also pointed out. The Social Marginal Productivity (SMP) criterion has been found to be appropriate for project selection both in private firms and government agencies. The problem lies, however, in generating the cost and revenue figures which measure cost and benefits to the economy.

Cost-benefit ratios could also be employed for evaluating government investments, and it was indicated that certain government regulatory actions could make private and social profits coincide. Usually benefit-cost comparisons are undertaken prior to project selection, but in this study, the interest was in evaluating the project currently being undertaken with the aim of determining its profitability and identifying possible bottlenecks.

Current results in the evaluation of government services is discussed in the third chapter. It was shown that several FAO fertilizer demonstrations indicate that a single technology such as fertilizer application has resulted in significant yield increases in different parts of the world. If a single technology is to lead to substantial input increases, however, suitable supporting conditions must be present. Hence, the need for a "packaged" approach. Such packages include the inputs mentioned earlier. The experiences in Northern Nigeria indicate more than 60 percent yield increase from the "packaged" technology for crop production. The rate of return from groundnuts is very satisfactory. The adoption rates of the improved technologies have also been satisfactory though most of the farmers interviewed tended to adopt single inputs rather than a whole package. This is because of the additional costs involved.

A description of agriculture and government development programs in Northern Nigeria is presented in Chapter IV. This is to provide the reader background information on the government's role in Nigerian agricultural development. For the first development plan period (1962-1968) about ₦71.2 million was allocated for agricultural development, of which ₦51.0 million or 71.5 percent was for agricultural training, research, and extension work. During the second plan period (1970-1974), the budget allocation for agricultural development programs increased to about ₦199.6 million, which shows a dramatic emphasis on agriculture. In this plan, the interest was more for crop production than agricultural extension, training and research.

Export crop production, besides being a source of foreign exchange, was also a major source of tax revenue. Between 1947-1962, cocoa farmers were having 31.9 percent of their potential income withheld, while groundnut producers had 24.9 percent of their potential income withheld. These withholdings were from export duties, producer purchase tax and Marketing Board trading surplus. This is a high indirect tax for farmers. Groundnut farmers in Kano State receive back only 43 percent of the amount withheld in subsidies. Appropriate pricing policies to ensure this move are now being formulated.

In Northern Nigeria, the emphasis is still on agricultural extension services (mainly chemical promotion, seed multiplication, and agricultural information). In the current development plan period, approximately 33 percent of the agricultural capital expenditures is allocated for extension services. Agricultural research in this region of Nigeria is conducted by the Ahmadu Bello University, hence there are no State government allocations for research.

The empirical results in determining the private profitability of the "government services" in groundnut production was discussed in Chapter V. An average yield improvement of about 78 percent was determined for groundnuts.

The incremental cost per acre of groundnuts was ₦2.96, representing the cost of 20 pounds of extra seed, one packet of seed dressing, half-hundred weight of superphosphate fertilizer and additional two man-days of labor.

The average producer price for groundnuts was ₦68.59 for the 1966-1973 period. Based on these producer prices, the incremental rate of return per acre was estimated at an average of ₦18.58, representing more than six times the incremental cost per acre. With higher producer prices, the private profitability rate would be higher.

It is estimated that continuous use of the government services for groundnut production in Kano State would eliminate the groundnut deficit, currently estimated at 173,460 tons. The increased output, however, is not expected to result in any significant price changes for groundnuts since the prices producers receive are still determined to a large extent by world market price.

About 511,654 more acres of improved groundnuts are required to eliminate the deficit. The effect of this increase on farm income would be a subsequent increase of about ₦8.0 million in farm income for Kano State. To achieve this, additional numbers of extension workers would also be necessary. This could be attained by expanding agricultural

training programs and/or hiring additional extension personnel from outside Kano State.

In Chapter VI the empirical results in determining the social profitability of "government services" in groundnut production is presented. The incremental social cost is based on the non-subsidized cost of the inputs. This was estimated at ₦3.70 per acre. At an estimated cost of ₦80 per demonstration, the annual cost of crop demonstration is currently about ₦27,200 for Kano State. Cost of seed multiplication and chemical promotion (fertilizer subsidy) is estimated at ₦680,000 annually. Therefore, the estimated total social costs are about ₦4.34 per acre. Net social profit per acre was determined to be approximately ₦19.95. Assuming an acreage participation rate of 20 percent, the estimated social return was determined to be ₦14.5 for every ₦1.0 of public expenditure.

It was also estimated that the groundnut producer in Kano State receives only ₦1.38 per acre in subsidy out of the ₦5.71 per acre withheld by the government. This represents only 24.2 percent of the deductions per acre.

The results of the "Adoption of Technology" model was presented in Chapter VII. Multivariate regression techniques were used to identify the significant variables affecting the adoption rate of the improved technology. Extension contact, cost of technology and nearness to government farm centers (location) were found to be the significant factors affecting the adoption of the technology. Other factors such as age of farmer, literacy, income, though included in the original model were not statistically significant in the sample

observed. The returns to extension were estimated at ₦62.7 for every additional ₦1 of extension expenditure.

The policy implications of these findings were discussed in Chapter VIII. The major policy recommendations made by the writer are (1) a producer price incentive should be used in preference to an input subsidy scheme currently being followed; (2) a credit plan, which emphasizes loans in kind should be used where feasible. This could be used along with a small cash loan for hiring extra labor and other incidental farm expenses. The aim is to encourage more use of the recommended inputs, and the prevention of farm credit being used for non-agricultural programs; (3) the present program of introducing improved groundnut technology should be expanded to food crops. The increasing population of Nigeria and drought problem necessitates rapid food production. The "packaged" technology approach could prove a useful tool for achieving the needed food production increase. Preliminary estimates show that these food crops can also be profitable. The input costs, however, are higher for these crops; consequently, an appropriate credit plan is very necessary.

The first two recommendations stem from the fact that the adoption of the improved groundnut technology in Kano State was more sensitive to costs of the technology than profitability. Hence subsidizing the input costs might increase the number of farmers adopting the technology. But, since the groundnut producer in the state has more money taken away than he receives in subsidy, it implies that the non-adopters also pay for the subsidy the adopters receive. Therefore,

it is suggested that a higher price incentive would be beneficial to both users and non-users of the new technology.

For efficient use of public funds, it is also suggested that the subsidy program could be tied to a credit plan. This should preferably be a credit in kind, with only those inputs which have high output response being subsidized to enable more use of them.

The recommendation of extending the "packaged" technology approach to other food products is based on the encouraging profitability estimates made by the Kano State Ministry of Agriculture and Natural Resources. It could also lead to a more efficient use of the scarce extension resources.

In conclusion, the "packaged" technology for groundnuts in Kano States have favorable private and social rates of return. Hence the provision of the government services are economically and socially justifiable.

As a final suggestion for further use of government services in agricultural development in Northern Nigeria, new technologies should be introduced simultaneously where there are no conflicts in resource use and objectives. In terms of extension personnel and resources, the introduction of an improved technology can be introduced simultaneously with that for guinea corn or any other food crop. Unless for economic reasons, concentration is desired for a single crop, considerable resources can be saved when an agent demonstrates the increased profitability of two or more crops in a particular village. Just as a "packaged" technology is found to be more desirable than a single input technology, an integrated multicrop program (such as

groundnut, guinea corn, or millet) could demonstrate the impact of farm planning as well as new technologies on production.

There is also a great need for estimating research costs for the various agricultural projects. Even though these would eventually be regarded as developmental costs, not passed over to the farmer, the estimates are useful in determining public costs and profitability of the projects. As much as feasible, the research centers should keep records of research expenditures on an individual experiment or breeding program. This would enhance estimates of the research costs on a particular crop or fertilizer trial. The importance of this cannot be overemphasized.

Program budgeting and expenditure records on specific extension projects will also be useful in evaluating cost and returns of the extension services.

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APPENDIXES

APPENDIX A

AGRICULTURAL DEVELOPMENT PROJECTS
1962-1968

NIGERIA

Project Number	Title	Total Allocation in £'000
	I. Tree Crops: Ministry Schemes	
1	Rubber Planting Scheme	2,975
2	Palm Grove Rehabilitation Scheme	1,920
3	Cocoa Planting Scheme	600
4	Farm Settlement	6,125
5	Cross River Scheme	2,500
6	Minor Crops	100
	Total	£14,220
	II. Tree Crops: E.N.D.C. Plantation Schemes	
7	Oil Palm Plantations	2,028
8	Rubber Plantations	6,650
9	Cocoa Plantations	2,398
10	Coconut Plantations	88
11	Cashew Plantations	195
	Total	£11,359
	III. Agricultural Training, Research and Extension	
12	Extension Training Programme, including Veterinary	3,269
13	Livestock Extension	240
14	Extension Service (Senior Staff)	559
15	Community Development	920
16	Agricultural Information	258
17	Agricultural Research	465
	Total	£ 5,711
	IV. Animal Health and Husbandry	
18	Regional Livestock Centre	300
19	Poultry Centre	280
20	Brooder Units	386
21	Obudu Cattle Ranch	242
22	Animal Feed Mill	920
23	Trypanosomiasis Units	47
24	Veterinary Services (including Hides and Skins)	456
	Total	£ 2,631

APPENDIX A (CONTINUED)

Project Number	Title	Total Allocation in £'000
	V. Fisheries and Forestry	
25	Fisheries	227
26	Forestry	176
	Total	£ 403
	VI. Land Use	
27	Niger Delta Scheme	267
28	Soil and Land Use Survey	600
29	Land Registration and Consolidation	130
	Total	£ 997
	VII. Supporting Services for Agriculture	
30	Machinery Pool	100
31	Processing Machinery	400
32	Agricultural Credit	1,000
	Total	£ 1,500

Source: Federal Ministry of Economic Development, Lagos, "National Development Plan, 1962-68," pp. 263-4.

APPENDIX B

PUBLIC-SECTOR CAPITAL EXPENDITURE ON AGRICULTURE, 1970-1974 (NIGERIA) ₦ MILLION

State	Total	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
BP	3.826	0.442	0.100	0.285	0.071	0.060	1.966	--	--	--	0.598	0.020	0.284	--
EC	12.639	2.299	5.480	--	0.100	0.150	0.400	1.160	0.800	--	1.300	0.150	0.800	--
KN	18.106	0.790	--	7.241	0.742	0.108	6.819	--	0.900	0.139	1.233	0.038	0.096	--
KW	3.001	0.359	0.076	0.190	0.135	0.129	0.981	--	0.500	--	0.460	0.016	0.155	--
LG	5.755	1.500	0.245	0.400	0.300	--	0.315	0.240	--	--	0.595	2.000	0.160	--
MW	6.510	1.673	1.989	--	0.040	--	0.225	0.172	--	--	0.938	0.422	1.050	--
NC	4.035	0.266	0.185	0.976	0.232	0.060	1.500	--	--	--	0.613	0.038	0.165	--
NE	6.483	0.370	0.093	0.688	0.150	0.140	1.233	--	--	1.183	1.554	0.049	0.750	0.273
NW	5.829	0.216	--	2.072	0.176	0.160	1.141	--	0.046	0.171	1.179	0.068	0.600	--
RV	6.376	1.480	0.589	--	0.244	--	0.071	0.181	--	--	0.419	1.500	0.190	1.702
SE	8.462	0.683	2.231	--	0.974	1.172	1.095	--	1.500	--	0.471	0.079	0.257	--
WN	17.622	2.992	6.790	--	1.606	--	1.165	--	1.500	--	1.669	0.602	1.298	--
FD	34.023	1.143	2.319	--	--	--	--	1.373	6.000	--	1.212	0.817	1.159	20.000
Total	132.667	14.213	20.089	11.852	4.770	1.979	16.912	3.126	11.246	1.493	12.241	5.799	6.964	21.975
% of Total	100	10.71	15.14	8.93	3.59	1.49	12.74	2.35	8.47	1.12	9.22	4.37	5.24	16.41
Ranking*		3	1	5	9	11	2	10	6	12	4	8	7	

KEY TO COLUMNS:

(1) Food Crops
(2) Export and Crops for Local Industries
(3) Irrigation (including rural water scheme)
(4) Farm Mechanization
(5) Farm Training Institutions
(6) Agricultural Extension Services (mainly chemical promotion, seed multiplication, and agricultural information)
(7) Agricultural Research
(8) Agricultural Credit
(9) Agricultural Marketing
(10) Livestock
(11) Fishery
(12) Forestry
(13) Miscellaneous Capital Expenditures (including Federal Government to agriculture, and special agriculture schemes.

*In ranking these services, based on budget allocations, the miscellaneous items are excluded. If the £20 million federal government allocation in column (13) is broken down, the ranking may be altered a bit, particularly that of agricultural research which receives the bulk of Federal Agriculture budget.

APPENDIX C

TAXES AND MARKETING BOARD TRADING SURPLUSES EARNED ON GROUNDNUTS, 1947-1961

	Export Duties		Marketing Board Trading Surplus		Produce Purchase Tax		Total Withdrawals			
	£000's	% of Potential Producer Income	£000's	% of Potential Producer Income	£000's	% of Potential Producer Income	£000's	Producer Income £000's	Potential Producer Income £000's	Total Withdrawals as % of Potential Producer Income
1947-48	873.6	8.3	4,267.2	40.5	---		5,140.0	5,376.0	10,516.0	48.8
1948-49	1,065.9	8.0	6,137.0	45.7	---		7,202.9	6,201.6	13,404.5	53.7
1949-50	620.4	8.8	2,444.0	34.6	---		3,064.0	3,985.6	7,049.6	43.4
1950-51	675.9	10.9	3,002.7	48.5	---		3,678.6	2,513.5	6,192.1	59.4
1951-52	2,524.5	14.4	4,851.3	27.6	---		7,375.8	10,185.7	17,561.5	42.0
1952-53	2,638.9	13.5	3,505.8	17.9	---		6,144.7	13,449.7	19,594.4	31.4
1953-54	2,929.9	12.0	3,588.6	14.7	424.6	1.7	6,943.1	17,515.0	24,458.1	28.4
Subtotal 1947-48 to 1953-54:										
	11,329.1	11.5	27,796.6	28.1	424.6	0.4	39,549.1	59,227.1	98.776.2	40.0
1954-55	2,633.0	16.6	-133.1	-0.8	372.8	2.4	2,873	12,969	15,842	18.1
1955-56	3,314.0	14.3	1,075.5	4.6	530.2	2.3	4,920	18,303	23,223	21.2
1956-57	2,554.0	13.6	3,075.0	16.3	357.9	1.9	5,987	12,812	18,799	31.8
1957-58	3,059.0	13.6	-4,041.5	-18.0	714.7	3.2	-268	22,686	22,418	-1.2
1958-59	3,195.0	13.6	-1,970.2	-8.4	533.4	2.3	1,758	21,675	23,433	7.5
1959-60	2,686.0	13.2	828.4	4.0	445.4	2.2	3,960	16,464	20,424	19.4

APPENDIX C (CONTINUED)

	Export Duties		Marketing Board Trading Surplus		Produce Purchase Tax		Total Withdrawals			
	£000's	% of Potential Producer Income	£000's	% of Potential Producer Income	£000's	% of Potential Producer Income	£000's	Producer Income £000's	Potential Producer Income £000's	Total Withdrawals as % of Potential Producer Income
1960-61	3,384.0	13.3	-887.4	-3.5	619.1	2.4	3,116	22,405	25,521	12.2
Subtotal 1954-55 to 1960-61:										
	20,825.0	14.0	-2,053.3	-1.4	3,573.5	2.4	22,346	127,314	149,660	14.9
TOTAL	32,154	12.9	25,743.3	10.4	3,998.1	1.6	61,895	186,541	248,436	24.9

Source: Helleiner, op. cit., Table V-F-11.

APPENDIX D

CROP INPUT COST ANALYSIS PER ACRE
(SUBSIDIZED PRICES OF FARM INPUT)

Input	G'Nuts	G'Corn	Millet	Cotton	Cowpeas	Rice Upland	Wheat
Seeds	40 lbs N1 . OK	20 lbs 60K	5 lbs 15K	15 lbs --	20 lbs N1 .80K	30 lbs N3 .12K	70 lbs N4 .40K
Supa	84 lbs N1 .20K	112 lbs N1 .60K	112 lbs N1 .60K	112 lbs N1 .60K	56 lbs 80K	-- --	112 lbs N1 .60K
Sulfa	-- --	112 lbs N2 . OK	112 lbs N2 . OK	112 lbs N2 . OK	-- --	112 lbs N2 . OK	224 Lbs N4 . OK
Seed Dressing	6 Pkts 30K	3 Pkts 15K	1 Pkt 5K	-- --	-- --	-- --	10 Pkts 50K
Spraying Chemical	-- --	-- --	-- --	DG/V.20 3 Galls N4 .20K	DG/V.20 3 Galls N4 .20K	-- --	-- --
Storage Chemical	GM/A. 1 Pkt 20K	GM/A. 1 Pkt 20K	GM/A. 1 Pkt 20K	-- --	GM/A. 1 Pkt 20K	-- --	-- --
Total Cost of Input	N2 .70K	N4 .55K	N4 . OK	N7 .80K	N7 . OK	N5 .12K	N10.50K

COMPARATIVE CROP PRODUCTION INCOME ANALYSIS PER ACRE

Yield and Returns	G'Nuts	G'Corn	Millet	Cotton	Cowpeas	Rice Upland	Wheat
Yield in Tons	RP - .8 Tons TM - .4 Tons	RP - .6 Tons TM - .3 Tons	RP - .6 Tons TM - .3 Tons	RP - .8 Tons TM - .4 Tons	RP - .4 Tons TM - .2 Tons	RP - 1 Ton TM - .5 Tons	RP - 1 Ton TM - .5 Tons
Money Value	RP N64 . 8K TM N32 . 4K	RP N36 . OK TM N18 . OK	RP N36 . OK TM N18 . OK	RP N52 . 27K TM N26 . 13K	RP N64 . OK TM N32 . OK	RP N200. OK TM N100. OK	RP N170 . OK TM N 35 . OK
Differences	RP N32 . 4K	RP TM N18 . OK	RP TM N18 . OK	RP TM N26 . 13K	RP TM N32 . OK	RP TM N100. OK	RP TM N 35 . OK
Net Cost of Inputs	N 2 .70K	N 4 .55K	N 4 . OK	N 7 . 80K	N 7 . OK	N 5 .12K	N 10 .50K
Income to Labor and Management	N29 .30K	N13 .45K	N13 .80K	N19 . 33K	N25 . OK	N 94 .88K	N 24 .50K

RP = Recommended Practices
TM = Traditional Methods
The prices of Farm Input and commodities are subjected to change and analysis of input and profit have to be altered accordingly.
Source of data was taken from Package Demonstration Report and checked with the Extension Research Liaison Services Samaru.
Source: Kano State Manr., op. cit., Table 3.

APPENDIX E

CROP INPUT COST ANALYSIS PER ACRE
(NON SUBSIDIZED PRICES OF FARM INPUT)

Input	G'Nuts	G'Corn	Millet	Cotton	Cowpeas	Rice Upland	Wheat
Seeds	40 lbs N1 .00K	20 lbs .60K	5 lbs 15K	15 lbs --	20 lbs N1 .80K	30 lbs N3 .12K	70 lbs N4 .40K
Supa	84 lbs N2 .25K	112 lbs N3 .00K	112 lbs N3 .00K	112 lbs N3 .00K	56 lbs N1 .50K	-- --	112 lbs N3 .00K
Sulfa	-- --	112 lbs N3 .50K	112 lbs N3 .50K	112 lbs N3 .50K	-- --	112 lbs N3 .50K	224 lbs N7 .00K
Seed Dressing	6 Pkts 60K	3 Pkts 30K	1 Pkt 10K	-- --	-- --	-- --	10 Pkts N1 .00K
Spraying Chemical	-- --	-- --	-- --	DG/V.20 3 Galls N8 .40K	DG/V.20 3 Galls N8 .40K	-- --	-- --
Storage Chemical	GAM.A 1 Pkt 40K	GAM.A 1 Pkt 40K	GAM.A 1 Pkt 40K	-- --	Est. Cost of Sto N6 .00K	-- --	-- --
Total Cost	N4 .25K	N7 .80K	N7 .15K	N14.90K	N17.70K	N6 .62K	N15.40K

COMPARATIVE CROP PRODUCTION INCOME ANALYSIS PER ACRE

Yield and Returns	G'Nuts	G'Corn	Millet	Cotton	Cowpeas	Rice Upland	Wheat
Yield in Tons	RP - 0.8 Tons TM - 0.4 Tons	RP - 0.6 Tons TM - 0.3 Tons	RP - 0.6 Tons TM - 0.3 Tons	RP - 0.8 Tons TM - 0.4 Tons	RP - 0.4 Tons TM - 0.2 Tons	RP - 0.8 Tons TM - 0.4 Tons	RP - 1.0 Tons TM - 0.5 Tons
Money Value	RP - N 64. 8K TM - N 32. 4K	RP - N 36. OK TM - N 18. OK	RP - N 36. OK TM - N 18. OK	RP - N 52.27K TM - N 26.13K	RP - N 64. OK TM - N 32. OK	RP - N160. OK TM - N 80. OK	RP - N 70. OK TM - N 35. OK
Differences Between RP and TM	N 32. 4K	N 18. OK	N 18. OK	N 26.13K	N 32. OK	N 80. OK	N 35. OK
Cost of Inputs	N 4.25K	N 7.80K	N 7.15K	N 14.90K	N 17.70K	N 6.62K	N 15. 4K
Gross Income to Labor and Management	N 27.79K	N 10.20K	N 10.85K	N 11.23K	N 14.30K	N 73.38K	N 19.96K

RP = Recommended Practices
TM = Traditional Method
The prices of Farm Input and commodities are subjected to change and analysis of input and profit have to be altered accordingly.
Source of data was taken from Package Demonstration Report and checked with the Extension Research Liaison Services Samaru.

APPENDIX F

CROP DEMONSTRATION YIELDS (KANO STATE)

	CROPS	DEM	CONTROL	AVERAGE DEM	AVERAGE CONTROL
			1966		
1.	G'Nut	17,306	4,724	52	491
2.	G'Corn	2,888	1,393	412.3	199
3.	Millet	1,735	315	322	52.3
4.	Rice	1,194	1,030	597	51.5
5.	Cowpeas	869	640	144.5	106.4
6.	Wheat	10,180	3,621	2,036	724
7.	Cotton	597	376	149.1	94
8.	Vegetable	6,992	1,858	582.6	154.8
			1967		
1.	G'Nut	3,221.6	1,797.8	32.2	17.9
2.	G'Corn	3,287.1	1,490	32.8	14.9
3.	Millet	2,097.8	1,150.2	20.9	11.5
4.	Rice	1,923.8	1,055	19.23	10.5
5.	Cowpeas	1,080	118	10.8	1.18
6.	Wheat	262	159	87.3	53
7.	Cotton	525	223	5.25	2.23
8.	Vegetable	--	--	--	--
			1968		
1.	G'Nut	1,473	465	147.3	46.5
2.	G'Corn	2,075	1,300	296.2	188.6
3.	Millet	2,040	1,036	340	122.4
4.	Cowpeas	621	314	122.1	62.4
5.	Rice	540	280	270	140
6.	Wheat	2,695	1,982	449.1	330.2
7.	Cotton	953	393	190.3	78
8.	Vegetable	--	--	--	--
			1969		
1.	G'Nut	537	327	44.9	27.2
2.	G'Corn	1,028	596	149	85.1
3.	Millet	935	716	90.35	70.16
4.	Rice	1,207	595	201.1	99.1
5.	Cowpeas	579	259	72.2	32.4
6.	Wheat	495	468	82.4	78
7.	Cotton	760	406	69.09	36.8
8.	Vegetable	--	--	--	--

APPENDIX F (CONTINUED)

	CROPS	DEM	CONTROL	AVERAGE DEM	AVERAGE CONTROL
			1970		
1.	G'Nut	1,802	1,101	18.02	11.01
2.	G'Corn	2,075	1,300	20.75	13
3.	Millet	2,040	1,036	20.4	10.36
4.	Rice	540	280	270	140
5.	Cowpeas	621	314	122.1	62.4
6.	Wheat	2,695	1,982	449.1	330.2
7.	Cotton	953	393	190.3	76.1
8.	Vegetable	235	150	235	150
			1971		
1.	G'Nut	1,846	1,410	184.6	141
2.	G'Corn	3,706	3,306	370.6	230.6
3.	Millet	3,585	2,451	358.5	245.1
4.	Rice	485	274	485	274
5.	Cowpeas	986	765	246.5	191.2
6.	Wheat	--	--	--	--
7.	Cotton	515	257	171.6	85.6
8.	Vegetable	--	--	--	--
			1972		
1.	G'Nut	3,449	1,862	344.9	186.2
2.	G'Corn	3,056	2,871	305.6	287.1
3.	Millet	2,038	1,764	203.8	176.4
4.	Rice	1,759	901	351.8	180.2
5.	Cowpeas	2,383	2,200	238.3	220
6.	Wheat	--	--	--	--
7.	Cotton	2,166	1,255	216.6	125.5
8.	Vegetable	--	--	--	--

APPENDIX G

ECONOMIC EVALUATION OF THE KANO STATE GROUNDNUT SCHEME: TWO LEVELS OF EFFECTIVENESS CONTRASTED WITH TRADITIONAL FARMING

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Sec 1 Participating Acreage (thousands)											
Alt I	33.3	59.9	83.2	103.2	119.9	133.2	146.5	159.8	173.1	186.4	199.7
Alt II	33.3	63.3	91.6	118.2	143.2	168.2	193.2	218.2	243.2	268.2	293.2
Sec 2 Increased Aggregate Output on Participating Acreage (tons)											
Alt I	4,462	8,027	11,149	13,829	16,067	17,849	19,631	21,413	23,195	24,978	26,760
Alt II	4,462	8,482	2,274	15,839	19,189	22,539	25,889	29,239	32,589	35,939	39,389
Sec 3 Increase in GDP, based on FOB Price of £75/Ton (£1,000)											
Alt I	334.6	602.0	836.2	1,037.2	1,205.0	1,338.7	1,472.3	1,606.0	1,730.6	1,873.4	2,007.0
Alt II	334.6	636.2	920.6	1,187.9	1,439.2	1,690.4	1,941.7	2,192.9	2,444.2	2,695.4	2,946.7
Sec 4 Cost of Program to Government, £											
Alt I	104,970	128,910	149,880	167,880	182,910	194,880	206,850	218,820	230,790	242,760	254,730
Alt II	104,970	131,970	157,440	181,380	203,880	226,380	248,880	271,380	293,880	316,380	338,880
Sec 5 Taxes Collected on Increased Output, £ (at £9 per ton)											
Alt I	40,158	72,243	100,341	124,461	144,603	160,641	176,679	192,717	208,755	224,802	240,840
Alt II	40,158	76,338	110,466	142,551	172,701	202,851	233,000	263,151	293,301	323,451	353,601
Sec 6 Net Costs of Program to Government, £											
Alt I	64,812	56,667	49,539	43,419	38,307	34,239	30,171	26,103	22,035	17,958	13,890
Alt II	64,812	55,632	46,974	38,829	31,179	23,529	15,880	8,229	579	-7,070	-14,721
Sec 7 Annual Increases in GDP Per £1 Gross Outlay by Government on the Program											
Alt I	3.2	4.7	5.6	6.2	6.6	6.9	7.1	7.3	7.5	7.7	7.9
Alt II	3.2	4.8	5.8	6.5	7.1	7.5	7.8	8.1	8.3	8.5	8.7
Sec 8 Annual Increases in GDP Per £1 Net Outlay by Government on the Program											
Alt I	5.2	10.6	16.9	23.8	31.4	39.0	48.8	61.5	78.9	104.3	144.4
Alt II	5.2	11.4	19.6	30.6	46.1	71.8	122.2	266.5	4,221.4	2/	2/

Source: H. C. Kriesel, op. cit., p. 2.

APPENDIX H

TOTAL GROUNDNUT PURCHASES AND PRODUCER PRICES
1950-51 - 1972-73

Season	Total Purchases (In Long Tons)	Producer Price Per Ton
1950/51	131,051	N.A.
1951/52	400,594	N.A.
1952/53	401,161	N.A.
1953/54	414,697	N.A.
1954/55	372,776	45:14:=d
1955/56	530,215	Standard Grd. = 45:18:9d A Special Grd. = 46:18:9d
1956/57	357,932	Standard Grd. = 42:10:0d Special Grd. = 46:0:9d
1957/58	714,698	Standard Grd. = 42:10:9d Special Grd. = 47:10:8d
1958/59	533,354	Standard Grd. = 38:6:6d Special Grd. = 43:6:6d
1959/60	445,441	45:4:5d
1960/61	619,051	46:4:6d
1961/62	687,986	43:11:6d
1962/63	871,518	40:5:=d
1963/64	785,859	40:5:=d
1964/65	642,741	42:14:6d
1965/66	933,427	43:11:3d
1966/67	1,026,822	42:1:3d
1967/68	687,439	Special Grd. = 38:7:=d Standard Grd. = 36:7:=d
1968/69	768,917	26:=:=d
1969/70	645,381	29:18:=d
1970/71	281,322	31:13:=d
1971/72	301,101	33:16:=d
1972/73	541,654*	40:6:=d

Notes: (1) N.A. = Not Applicable
(2) * = Figure as at 3/5/73 - it will slightly exceed this by the end of the season.

Source: Northern States Marketing Board.

APPENDIX I

ESTIMATED PRODUCTION TARGETS FOR CROPS 1970-85
KANO STATE

Units - In Thousand Tons (100)

YEARS	SORGHUM	MILLET	MAIZE	RICE	WHEAT	ACHA	CASSAVA
1970	800	600	36	2	3	3	68
1971	864	639	39	2	3	3	72
1972	933	681	42	2	4	4	76
1973	1008	725	45	2	4	4	80
1974	1086	772	49	3	5	5	85
1975	1175	823	53	3	6	6	90
1976	1269	876	57	3	7	7	95
1977	1371	933	62	3	8	8	100
1978	1481	994	67	4	9	9	106
1979	1599	1059	72	4	10	10	112
1980	1727	1128	78	4	11	11	118
1981	1865	1201	84	5	12	12	125
1982	2014	1297	91	5	13	13	132
1983	2175	1362	98	6	15	15	139
1984	2349	1451	106	7	17	19	147
1985	2537	1545	115	7	19	21	156

YEARS	SWEET AND IRISH POTATOES	COCO-YAMS	GROUND-NUT	COWPEAS	BERNI-SEED	CASHEW	COTTON
1970	2	6	415	189	4	0.009	4,456
1971	2	6	446	203	5	0.009	4,185
1972	3	7	480	218	5	0.011	4,511
1973	4	7	516	235	6	0.011	4,863
1974	4	8	555	253	6	0.018	5,242
1975	4	8	597	272	7	0.045	5,651
1976	5	9	642	292	7	0.311	6,092
1977	5	9	690	314	8	0.578	6,567
1978	5	10	742	338	8	1.468	7,179
1979	5	11	798	363	9	2.358	7,631
1980	6	12	858	391	9	3.692	8,226
1981	6	13	922	420	10	5.472	8,968
1982	7	14	992	452	10	7.251	9,560
1983	7	15	1066	486	11	9,920	10,306
1984	8	16	1146	522	11	12.589	11,110
1985	9	17	1232	562	12	15.258	11,977

APPENDIX J

KANO STUDY QUESTIONNAIRE

Form F: Farmer Interview

Part I: General Background Information

1. Village _____
2. Division _____
3. Interview No. _____
4. Age of Family Head _____
5. Number of Wives _____
6. Number of Children _____

Part II: Use of "Package" Inputs on Groundnuts

A recommended groundnut technology requires the use of improved seed variety, seed dressing and fertilizers:

1. Do you use any of these this year?	YES	NO
a) Improved Seed Variety	___	___
b) Local Seed Variety	___	___
c) Seed Dressing	___	___
d) Fertilizer	___	___

2. Do you plan to use any of these next year?	YES	NO
a) Improved Seed Variety	___	___
b) Local Seed Variety	___	___
c) Seed Dressing	___	___
d) Fertilizer	___	___

3. If you do not plan to use any of these next year, please give reasons for your decision.

a) _____

b) _____

c) _____

d) _____

4. How many years ago did you start using:

	Number of years ago
a) Improved Seed Variety	_____
b) Seed Dressing	_____
c) Fertilizer	_____

5. If you no longer use any of the inputs, when was the last time you used it:

	Number of years ago
a) Improved Seed Variety	_____
b) Seed Dressing	_____
c) Fertilizer	_____

6. Please give reasons why you stopped using the inputs:
   a) Improved Seed Variety _____
   b) Seed Dressing _____
   c) Fertilizer _____

Part III: Farm Credit

1. Did you receive any loan last year from:

	How Much	Interest Rate
a) A cooperative society? _____ Yes/No	_____	_____
b) Local government or N.A.? ___ Yes/No	_____	_____
c) A licensed buying agent? ___ Yes/No	_____	_____
d) A bank? ____ Yes/No	_____	_____

Part IV: Contact with Extension Service

1. Did you visit any groundnut demonstration plots in your village last year? _____ Yes/No
2. If yes, how many times? _____
3. Did you visit any government farm last year? _____
4. If yes, how many times? _____
5. Did any extension worker visit your house or farm last year? _____ Yes/No
6. If yes, about how many times? _____
7. Do you read any extension newspapers, posters, etc.? _____ Yes/No

Part V: Farm Mechanization

1. Have you ever used the tractor-hiring unit? _____ Yes/No
2. If yes, how many acres have been cultivated for you? _____
3. Do you use decorticators for shelling your groundnuts? _____ Yes/No
4. If yes, where do you get it from? _____
5. Do you use any ploughs? _____ Yes/No
6. If yes, where do you get the ploughs from? _____

_____

Part VI: Irrigation

1. Do you have any irrigated land? _____ Yes/No
2. If yes, what type of irrigation is it? _____
   a) Pump _____
   b) Well _____
   c) Other _____
3. How much did you pay last year for using irrigation? _____
4. If you have irrigated land, what crops do you plant on them?

_____

Part VII: Literacy

1. Did you ever go to school? _____ Yes/No
2. If yes, did you attend English school or Arabic? _____
3. How many years did you attend school? _____
4. Can you read an agricultural extension newsletter in:
   a. English _____Yes/No
   b. Hausa _____Yes/No
   c. Arabic _____Yes/No

Part VIII: Farm Income

1. How much money did you get from crop sales last year? _____
   a. From groundnuts _____
   b. Other crops _____

2. How much money did you get from livestock sales last year?_____

   a. From cattle _____

   b. From poultry _____

   c. Other livestock _____

3. How much money did you get from non-farm occupation last year?

   _____

	Name of Occupation	Amount Earned
a.	_____	_____
b.	_____	_____
c.	_____	_____

VITA

Peter Ebilayi Ochala

Candidate for the Degree of

Doctor of Philosophy

Thesis: AN ECONOMIC EVALUATION OF GOVERNMENT SERVICES FOR AGRICULTURAL DEVELOPMENT IN THE NORTHERN STATES OF NIGERIA: THE CASE OF GROUNDNUT FARMERS IN KANO STATE

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Egume, Nigeria, August 15, 1944, the son of Mr. and Mrs. Nathaniel Ochala Akpachi.

Education: Graduated from St. Augustine's Secondary School, Kabba, Nigeria, December, 1961; received the Bachelor of Science degree, with a major in Agricultural Economics, from the University of Wisconsin, Madison, Wisconsin, in 1968; received the Master of Arts degree from American University of Beirut, Beirut, Lebanon, with a major in Development Administration, in 1971; completed requirements for the Doctor of Philosophy degree at Oklahoma State University in December, 1974.

Professional Experience: Agricultural Assistant, Northern Nigeria Ministry of Agriculture, 1962-1965; Agricultural Officer, Kwara State Ministry of Agriculture and Natural Resources, Ilorin, Nigeria, 1968; Assistant Research Fellow/Lecturer, Rural Economy Research Unit, Ahmadu Bello University, Zaria, Nigeria, 1969-1970.