Thesis

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An econometric study of the production efficiency of rural farmers ins Southeastern Nigeria under structural adjustment programme

JUNE 1997

AN ECONOMETRIC STUDY OF THE PRODUCTION EFFICIENCY OF RURAL FARMERS IN SOUTH-EASTERN NIGERIA UNDER THE STRUCTURAL ADJUSTMENT PROGRAMME

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AN ECONOMETRIC STUDY OF THE PRODUCTION EFFICIENCY OF RURAL FARMERS IN SOUTH EASTERN NIGERIA UNDER SAP

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CERTIFICATION

Mbanasor, Jude Anayochukwu, a Postgraduate student of the Department of Agricultural Economics with Registration Number PG/Ph.D/92/13580 has satisfactorily completed the requirements for course and research work for the Degree of Doctor of Philosophy in Agricultural Economics. The work embodied in this Thesis is original and has not been submitted in part or full for any other Diploma or Degree of this or any other University. We accept it as conforming to the required standard.

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DEDICATION

This work is dedicated to the grace and mercies of God, my hope for eternal glory.

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TABLE OF CONTENTS

CHAPTER TWO: LITERATURE REVIEW

CHAPTER THREE: RESEARCH METHODOLOGY

CHAPTER FOUR: RESULTS AND DISCUSSIONS

CHAPTER FIVE: SUMMARY, RECOMMENDATIONS AND CONCLUSION

LIST OF TABLES

Tables

LIST OF FIGURES

Figure **Pages**

ABSTRACT

This study was conceived against the persistent inadequacy in food supply despite the potential benefits inherent in Structural Adjustment Programme measures on the production efficiency of rural farmers. SAP had recognised agriculture as the sector where the process of growth could be stimulated through the efficient use of resources. Yet the impact of the programme on rural agricultural production has remained a subject of controversy since the programme was put in place in 1986.

The research was conducted with a view to providing micro-level data for planning, policy formulation and implementation, and to provide a guide to farmers in the use of resources under SAP. It was conducted in South Eastern Nigeria, using disaggregated data, comprising secondary and cross-sectional data. Two enterprises, namely, cassava based crop mixtures and fish farming were purposively selected due to their relevance in the study area.

Data generated were analysed using descriptive statistics, production functions, multiple regression, chow tests, enterprise budget, profit functions, sensitivity tests, marginal value products\marginal factor cost ratio, correlation matrix and t-tests.

Evidence from the invetigation indicated that the cassava based crop farmers were significantly different in their production behaviour prior to, and during SAP. They were technically more efficient before SAP than during SAP. There was no absolute allocative

efficiency in the use of resources within the two periods. They were allocatively inefficient in the use of farm size and local inputs since SAP, unlike before SAP. Similarly, modern inputs, labour, and other investments were allocatively better utilized during SAP than before SAP. The study highlighted that cassava based crop farmers needed to increase their use of farm size, labour, local inputs and other investments by over 144%, 44% 210%, and 8% respectively and reduce the use of modern inputs by 43% inorder to achieve maximum allocative efficiency of resources. It was observed that SAP measures had not significantly improved the economic efficiency of this enterprise.

The fish farmers were on the other hand technically more efficient during SAP than before SAP. They were alloctively, more efficient in the use of pod, labour and modern inputs during SAP than before SAP. They were however, in efficient in the use of local inputs during SAP. They under utilized ponds, labour and other investment expenses during SAP. The fish farmers needed to increase their ponds, labour, other investment expenses and local inputs by over 92%, 9%, 86% and 156% respectively inorder to achieve optimum allocative efficiency in the use of resources during SAP. The enterprise was economically more efficient during SAP than before SAP.

Comparatively, the fish farmers were productively more efficient than the cassava based crop farmers.

On the basis of elasticities and returns to scale, the study indicated that output elasticity

in respect of each of the resources in the cassava based crop enterprise within the two periods was less than unity, an evidence of marginal returns to each of the resources used. The enterprise exhibited a decreasing returns to scale before SAP and that of increasing returns to scale during SAP.

The fish farmers on the other hand showed diminishing marginal returns to individual resources within the two periods. The sum of elasticities within the two periods were less than unity, an indication of decreasing returns to scale. Labour was identified to be the most important variable that have affected the value of output of cassava based crop enterprise, while other investment expenses were for rural fish farmers during SAP.

SAP had positive impacts on the levels of output of the two enterprises. The findings further revealed that net returns between the two enterprises differed significantly within the periods. It was identified that the fish enterprise unlike cassava based crop mixtures might not withstand future policy distortions arising from output, input prices, and value of output.

It recommended the establishment of commodity exchange and futures market as a strategy that would improve the rural farmers production efficiencies, especially as it would offer the farmers favourable marketing and pricing environment. Moreso, without the attractive and competitive marketing arrangements like comex, the full benefits of other incentives embodied in SAP may not be realised.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Economic adjustments to changing conditions have been practiced for a very long time, even though it may not have been known by the term structural adjustment. In recent years however, structural adjustment considerations have been initiated in a large number of developing countries. It can be distinguished from economic policy making in earlier era as it involves many individual reform measures put together in a single package, worked out in explicit consultation with international agencies, and tied to some additional loans (Sarris, 1987; Bishay, 1988).

Since the late 1970's and early 1980's developing countries have experienced a number of unfavourable developments in their external economic environment. These developments, often combined with inappropriate domestic policies, have led to the emergence of large external and domestic imbalances. Sequel to this most developing countries, including Nigeria, have undertaken measures to restructure their economies and improve their balance of payment situation, known as Structural Adjustment Programme (SAP), (FAO, 1989; Gittinger, 1988). Structural Adjustment Programmes were initiated because of the inability of these nations to

service adequately, the accumulated foreign indebtedness, which may have been brought about by a combination of past borrowing policies, changes in world market situations, and inappropriate domestic policies (Yagci *et al* 1985; Donovan, 1984).

In agriculture, there are several policies that are widely employed in SAP and some others that are specific to the country concerned. The more widely used ones include raising real producer prices of agricultural output (used for example in Nigeria, Bolivia, Kenya, and Togo), reduction of subsidies on inputs, especially fertilizer, irrigation and credit (used in Nigeria, Turkey, Malawi, South Korea, and Pakistan). Others are, the reduction of the operating costs of parastatal enterprises or divesting them (used in Panama, Malawi, Ivory Coast, and Nigeria), and the implementation of programmes on land surveys, and sales of public land to small farmers (operational in Thailand, Jamaica and Dominican Republic) (FAO, 1989).

The rural economy in Nigeria is predominantly agricultural. Its development requires a continuous inflow of new ideas and information on how the enterprises in the agricultural economy could be better carried out, which would enable the rural populace to fully or more gainfully utilize the available resources (Ogutande, 1992). Rural agricultural production has witnessed one of the greatest transformations since the introduction of SAP in Nigeria.

SAP was introduced in July 1986 as a result of the phenomenal decline of the Nigerian economy, attributed largely to the structural differentiation in the Nigerian economy (Nwalia, 1986). It aimed at altering and re-aligning aggregate domestic expenditure and production

patterns, so as to minimise dependence on imports, enhance non-oil export base and bring the economy back to the path of steady and balanced growth (Federal Govt. of Nigeria, 1986).

The programme had recognised the crucial role of agriculture as the sector where the process of growth stimulation could easily be quickened by SAP measures. With specific reference to this sector SAP policy measures in use included institution reforms, pricing policy and specific production schemes. The institutional reforms in this sector were aimed at improving services to the farmers as well as removing distortions and disincentives confronting agriculture. Other reforms included the abolition of commodity boards, banning or restricting the importation of food crops, the establishment of the National directorate of Employment (NDE), the intensification of the activities of the Directorate of Foods, Roads and Rural Infrastructure (DRRI), the establishment of the Nigerian Agricultural Insurance company as well as the strengthening of world bank-assisted Agricultural Development Programmes (ADPS).

A comprehensive policy reform package such as is contained in SAP, was therefore thought to be inevitable for stabilising the agricultural economy. The measures were expected to remove all forms of price distortions so as to give the much desired incentives for stimulating domestic production and broadening the supply base of the economy. The measures were expected to help boost production of food and exportable crops inorder to ensure significant level of self-sufficiency in basic food items.

The Nigerian rural farmers, otherwise called smallholder farmers, produce the larger percentage of the total food supply (Olayemi, 1980). Olayemi defined a rural farmer as one who controlled a small farm size with an average low farm income and still operated in a traditional setting. He noted that Nigeria was an agricultural country dominated by rural farmers.

In view of the fact that increased agricultural production is apt to increase the rural farmers efficient use of resources , it is therefore imperative that efficient use of resources under SAP be studied, if any benefit is to be expected from government increasing expenditure on their provisions. In other words, while loan availability to rural farmers under SAP may afford them the opportunity to invest in modern resources, the utilization of these resources in such a manner as to realise the full output gains cannot be taken for granted.

It has, therefore, become imperative to determine the level of efficiencies in resource-use among rural farmers under SAP using two selected enterprises, namely cassava based crop mixtures and rural fish farming inorder to ascertain the impact of SAP on agricultural production in South Eastern Nigeria.

1.2 Problem Statement

The persistent inadequate food supply in Nigeria has become a topical issue to the citizenry and most recently, to a number of international financial bodies including IMF, World bank and a host of others. The rate of growth in food demand in Nigeria was 3.7 percent per annum as against annual food production growth rate of 2.5%, indicating a supply deficit of

1.2% per annum (FAO, 1984). The deficit seemed to have worsened in the most recent times, thereby necessitating various policy measures.

The ability of SAP to improve the economic fortunes of Nigeria has remained a subject of controversy since the programme was introduced in July, 1986. SAP which was introduced partly as a result of phenomenal decline in food production, seems not to be addressing the issue. The results of previous studies have indicated mixed impacts thereby necessitating a more thorough and exhaustive analysis of the production efficiencies of the rural farmers. More so in a recently concluded research on SAP, (Mbanasor, 1991) observed that most rural farmers were aware of SAP's embodied package and had responded to the use of the relevant resources. Yet their output per hectare was still low let alone meeting the export potentials which SAP sought to realise.

From 1975 - 1985, Nigeria developed rapidly from a multi-product export economy to a dominant mono-product export economy. Crude petroleum grew from 90.5% to 97.5% while others, including agriculture, were between 6.8% to 2.7% (Table 1.1). Osuntagun *et al* (1992) showed that since the introduction of SAP, the programme appeared to have reached a high point in 1988, when non-oil share of the total exports including agriculture reached 9.0%. Since then the story has been dismal. They further showed that non-oil exports share of the total exports in four years (1986 to 1990) was lower than that between 1976 to 1980. The most recent trend, 1990 to 1993, showed less than 2.3%. This rather poor performance has been blamed on

Table 1.1: Comparative Position of Petroleum and Other Exportables from 1975 - 1993 (=N= Million)

Year	Total Export	Crude Petroleum	% of Petroleum Export	% of Other Export
1975	5116.1	4766.3	93.2	6.8
1976	6343.4	5917.8	93.3	6.7
1977	7976.6	7453.6	93.4	6.6
1978	6632.6	6004.9	90.5	9.5
1979	10,106.8	9436.8	93.4	6.6
1980	14,186.0	13,632.3	96.1	3.9
1981	11,023.3	10,680.5	96.9	3.1
1982	8206.4	8003.2	97.5	2.5
1983	7502.5	7201.2	95.9	4.1
1984	9088.0	8840.6	97.3	2.7
1985	11,720.8	11223.6	95.8	4.2
1986	8920.5	8368.4	93.8	6.2
1987	30360.0	28208.6	92.9	7.1
1988	31192.8	28435.4	91.2	8.8
1989	57971.2	55061.8	95.0	5.0
1990	109885.6	106626.0	97.0	3.0
1991	121533.1	116855.8	96.2	3.8
1992	205,611.7	201,383.9	98.0	2.0
1993	218,765.2	213,778.2	97.5	2.3

Source: Derived from: IMF, International Financial Statistics,1986;
CBN Statistical Bulletin, 1992;
CBN Annual Report ,1989 - 1993.

a number of external and domestic constraints, especially the inefficient use of resources (FAO, 1991; Eluagu, 1995).

Inspite of the potential benefits inherent in the efficient use of resources under SAP, which was expected to rectify the short comings of previous stabilisation and adjustment programmes, rural farmers, who constitute more than 80% of farmers in Nigeria (Ijere, 1991); seem not to be efficient in the use of resources under SAP and their output per hectare is still low. The critical consideration pertaining to the assessment of the impact of SAP on agricultural production is its efficiency. FAO (1991) noted that only efficient utilization of resources under SAP could re-kindle hope in Nigeria's self-sufficiency and export base potentials. Efficiency gives greater attention to the use of resources, particularly modern inputs, and institutional reforms, like insurance scheme, land reform, subsidies removal and avoidance of domestic price control.

Consequently the study was conceived against the persistent inadequate food supply inspite of SAP measures. It is believed that such a study would provide valuable insight on the extent to which the objective and expectations of the programme have been achieved, as a basis for possible review of the design and/or the implementation of the programmes, more so, as previous studies have concentrated on the use of aggregate data, thereby presenting a holistic view. This study has restricted itself to South Eastern Nigeria and the smallholder farmers with regard to cassava based crops and fish farming. They were chosen because cassava based

crops constitute the major supplier of carbohydrates in Southern Nigeria (NRCRI, 1985), while fish constitutes the cheapest and largest supply of protein to the area (Ejoh, 1988). It is of the view that the understanding of these farmers in relation to resource use efficiencies prior to and during SAP would assist the government in her dream of food self-sufficiency.

1.3 Objectives of the Study

The broad objective of this study is to analyse the impact of SAP on rural farmers production efficiency in South Eastern Nigeria.

Specifically, the study will:

i. determine the impact of SAP on the level of production of cassava based crop and fish enterprises and the relationship between socioeconomic factors and total output.

ii. evaluate and compare the production efficiencies of the farmers prior to and during SAP.

iii. compare the relative importance of resources within the periods and their returns to scale.

iv. compare the costs and returns within the periods, and determine the sensitivity of the two enterprises to policy distortions beyond SAP

v. Identify constraints of SAP to production efficiency among the two categories of farmers, and

vi. discuss the implications of the findings for future policy measures to moderate the adverse effects while promoting the positive effects of the programme on the farmers.

1.4 Hypotheses of the Study

Drawing from the specific objectives, this research was guided by the following three hypotheses:

(a) SAP has no significant impact on the level of cassava-based crop and fish productions.

(b) The farmers are not more efficient since SAP than before SAP in the selected enterprises.

(c) Selected socio-economic variables have no relationship with rural farmers output during SAP.

1.5 Justification of the Study

Nigeria's economic problems have been largely blamed on over dependence on oil and the consequent "Dutch disease" phenomenon associated with the oil boom (Pinto, 1987). Taylor (1987) observed that oil resource and the economic power which it gives, would not guarantee a permanent improvement in the living standard of the majority of Nigerians unless there is improvement in the efficiency and effectiveness in the methods of producing food and agricultural raw materials. In line with the above, the findings of this study will reveal the efficiency of resource-use prior to and during SAP, especially as there are contradictory views on the impact of SAP. . This would increase the value of current output as well as improving the prospects for the rate of growth over time, which will negate the need for subsidy in this production sector.

Though a lot of studies have been conducted on the efficient use of resources none has delineated cassava-based crops and fish production prior to, and during SAP using disagreggated data from South Eastern Nigeria. (Shultz, 1964; Hoper, 1965; Singh, 1975; Ogunfowora et al, 1974; Mijindadi, 1980; Shairo, 1983; and Olagoke, 1990).

This analysis has therefore provided current information that would guide the rural farmers in decision making under SAP and the government in formulating appropriate policies toward self sufficiency in food production. Although the study is limited to South Eastern Nigeria, it is believed that the findings will be useful in other developing countries in view of the structural similarities of their economies. Information provided should be useful to researchers, students, policy makers and policy implementors.

1.6 Limitations of the Study

The study is limited in scope to the rural farmers in south eastern Nigeria. It is also restricted to cassava based crops and rural fish farming as representatives of the major suppliers of rural food diet, carbohydrate and protein respectively.

Given the wide range of secondary data, considerable problems were encountered in the process of data collection. The difficulty had to do with the observed variations in the data collected from the various official sources including the Federal Office of Statistics (FOS), ADP contact farmers, Federal and State ministries of agriculture and natural resources. The heterogeneity of these data constrained the study in cross checking and double-checking the information for pre-SAP period.

1.7 Plan of Research Report

This study report consists of five chapters. The first highlights the purpose and objectives of the study, while chapter two gives an overview of relevant literature to the subject including theoretical framework. Chapter three presents the methodology adopted in the study, while chapter four discusses in detail the findings of the study.

Finally, chapter five contains a summary of the major findings and conclusion of the study, as well as policy recommendations arising largely from the study which could assist in further consolidation of the gains of SAP while moderating its undesirable side effects.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Basis of the Nigerian Structural Adjustment Programme

Yagci (1985) explained the term Structural Adjustment Programme (SAP) as the implementation of policies and institutional changes necessary to modify the structure of an economy, so as to enable it maintain both its growth rate and the viability of its balance in the medium term. This study, which was purely empirical, examined how these policies and institutional changes in Nigeria have influenced rural farmers production efficiencies, which are vital to increased food production.

Bishay (1988) reported that structural issues are not new concepts in development economics, as most recent literatures would indicate, rather, they are structural transformations, which development economics is all about.

In their own assertion, Spooner and Smith (1991) observed that during the 1980s, while retaining the general thrust of its original applications, the concept has developed a new specific meaning in terms of current dialogue on policy reform in developing countries. As Gittinger (1988) puts it, structural adjustments are undertaken by many governments, in response to the debt crisis of the 1980s.

In tracing the genealogy of SAP, Goldstein (1986) noted that over the decade ,1963 to 1972, when the volume of world trade grew by an average rate of 8.5% and economic growth stood at about 5% a year, there was hardly any serious discussion on adjustment programmes. He further observed that from 1971 to 1973, an average of only eight countries a year had international monetary fund supported adjustment. However, from 1980 to 1982, the world economy suffered a serious recession resulting in a slow economic growth of less than two percent in the developing countries and of the order of one percent in industrial countries. The volume of world trade was virtually stagnant. The number of countries especially developing countries undertaking fund supported adjustment increased sharply in response to these external payment deficits.

This was exactly the position of Nigeria. As indicated by Anyanwu (1992), Nigeria was a country with abundant natural and human resources, but it was sad to observe that these resources have been wrongly utilized over the years. Nigeria used to be sustained by the agricultural products until the sharp increase in oil price in the 1973/1974 fiscal year. These price increases, brought a lot of revenue to the nation's purse but proper husbanding and management of the revenue were thrown over boards ie. the period of oil boom. This era according to Ahmed (1988) was characterised by proliferation of public sector institutions and enterprises, while private sector firms did depend largely on imported inputs. I t was an era of "white elephant" projects, huge and expensive project of doubtful utility or viability.

But by 1981, came the glut in the world oil market. The eventual collapse of the crude oil market brought along with it problems for Nigeria. This culminated into Nigeria becoming a poor nation after swimming in the ocean of money. This formed the background of what is today known as Nigerian Structural Adjustment Programme.

Lancaster (1973) and Martin (1959) agreed that the concept of the Structural Adjustment had its origin in European and America economic settings. This programme, they argued, was employed by different governments to correct the economic imbalance resulting from the depression of 1918 - 1955. They observed that the Structural Adjustment Programme (SAP) is carried out when the machinery of production in the economy is producing at a level below expectation or is over producing, that is, when the economy experiences under-employment of resources or over employment such that there is a resultant imbalance in the structure of the economy.

Robey (1959) asserted that we are concerned not with devising specific measures for meeting immediate problem but with developing a basic understanding which can serve as a guide in the indefinite future, which he termed economic stability. He further observed that SAP was brought about by market forces which guide the economy and tend to keep production in rough adjustment. More so, Olomola (1988) noted that impact studies of agricultural programmes in many parts of the world have focussed on the capability of the package to improve the total production on rural farms and its useful role in resource allocation, utilization and productivity.

Shiff (1980) reported that the increase in inflation has made groups and institutions to find avenues to protect themselves from its effect. He however gave a prescription approach to adjustment in which he observed that if the economy of any country is to be dynamic and productive in 1980s, it must be able to respond to a wide range of changes. He then gave the methods to be adopted in stabilizing the economy in the following ways:

i. the economy could be brought into stability by bringing about changes in trade and investment patterns.

ii. Shift in the economic importance of different regions of the economy.

iii. the employment and locational impact of technological innovations and productivity increase.

iv. changes in environmental standard and other regulatory requirements and

v. increase emphasis on free market pricing and deregulation.

These stabilization doses are very much enshrined in the Nigerian concept of the Structural Adjustment Programme except some recently re-regulated macro-economic variables such as interest rate, fixing of the value of Naira to the major convertible currencies, as well as deposit rate. This was based on the realistic exchange rate of the Naira to the major currencies which is vital, if Nigeria's dream of self sufficiency is to be achieved.

Uzoaga (1987) termed it economic stabilization. In this, he looked at the policy setting of adjustment with regard to its application to the Nigerian economy and observed that for the

economy to be brought into stability and moderate forces the government has to remove such destabilizing factor as balance of payment deficit, excessive dependence on foreign goods and low productivity by the industries by establishing laws and decrees that limit excess. He outlined the steps involved in this pursuit as:

a. reduction of the dependence of the economy on a narrow range of activities

b. balanced development of the different sectors of the economy.

c. increased dependence on local, human and material resources, and

d. a-national re-orientation.

If these steps are taken in line with the efficient use of resources, the Nigerian bid to become self sufficient in food production would in no distant time be attained.

A critical view of the discussion will portray adjustment as a prelude to economic stabilization. However, the approach of Robey (1959) shiff, (1980) and Uzoaga (1987) seem to be more relevant to the Nigerian situation as they gave a more presumptive and realistic look at the programme. By and large, for the economy to be brought back on its perfect stand via increased agricultural production, the rural farmers who account for about 90% of food production in Nigeria must utilize efficiently the resources under SAP, if the programme is to succeed and the huge government investment on the programme justified.

2.2 Characteristics of Structural Adjustment Policies

Norton (1987) observed that once a strategy has been identified for a structural adjustment programme, there are many different kinds of policies that can be implemented in

order to carry out the programme. Most of the policies utilized so far have both a macro-economic and a sectoral expression. At the level of the agricultural sector, he noted that pricing policy means the administration of output prices, irrigation charges and other input prices. While rural wage policy include the implicit tariffs on food imported by government agencies and optionally, the interest rate on agricultural credit. These were examined in relation to those policies implemented in Nigeria.

Gaiha (1991) noted that even when the structural adjustment policies were economy-wide rather than sector-specific, the agricultural sector is likely to be affected, mainly through changing relative prices and intersectoral resources flow. The observation of Gaiha is exactly the case in the Nigeria situation as the agricultural sector has dominated all the issues relating to the Nigerian structural adjustment policies.

The policy measure employed in the structural adjustment programme may be as follows, Monetary and financial policy, fiscal policy, pricing policy, trade policy, institutional measure and land policy (Norton 1987).

Below is the summary of the principal policies used for Structural Adjustment Programme;

Table 2.1 Summary of the Principal Policies used for Structural Adjustment Programmes

Type of Policy	Macro-economic Instruments	Agricultural Instruments
1. Pricing Policy	- Exchange rate - Wage rate - Interest rate	- Administered output prices - Implicit tariffs on government imported goods Rural wage policy - Irrigation charge - Other administered input prices - Agricultural interest rate
2Fiscal Policy	-Expenditure reduction -Tax charge -Tariffs -Subsidy changes	-current expenditure reduction -public investment reduction -Increased taxes and changes -Agricultural tariffs -Changes in subsidies
3. Monetary policy	- Money supply target	- Target for agricultural credit availability - Agricultural interest rates
4. Trade policy	- Tariff and quotas (Foreign exchange rationing or trade liberalization) - Export subsidies	- Tariff and quotas (foreign exchange rationing or -trade Liberalization) - Export subsidies
5. Institutional reform	- Monetary management rules - management of parastatals - Divestiture of public enterprises - Improving capabilities of ministry staff - Education and training programme - Other regulatory measures	- marketing board reform - Divestiture - Improvement of grading standards - Plant and animal hygiene regulations - Upgrading ministry staff - Improved agricultural research - Agricultural education - improved parastatal management - co-operative management - Formation of water user's groups.
6. Land Policy	- Cadastral surveys - Land taxes zoning	- Cadastral surveys - Land taxes - leasing policy on public lands - sales policy on public land - land tilting - unification of scattered parcel

Source: Adapted from Norton (1987)

This work will however be limited to the agricultural sector instruments adopted in Nigeria.

2.3 Nigeria's SAP Embodied Agricultural Package

Federal Ministry of information and culture (FMIC, 1989) enumerated the agricultural sector embodied package as follows:-

a. The liberalization of agricultural loans so that rural farmers and others could obtain loan, up to N10,000 without collateral.

b. Abolition of import duty on agricultural equipment.

c. Establishment of the Directorate for foods, Roads and Rural Infrastructure (DFRRI) to discourage rural - urban migration, encourage farmers to stay on their farms and facilitate the evacuation of agricultural products from rural areas.

d. Establishment by the National Directorate of employment, agricultural programmes designed to train school leavers in farming and allied skills.

e. Creation of agricultural insurance scheme to protect farmers investments and encourage the flow of credit to agriculture.

f. Liberalization of trade on agricultural commodities.

In addition, some institutional and structural reforms, have been introduced, such as the winding-up of the commodity boards, coupled with the adoption of appropriate exchange rate policy. Also, under the package land use Decree was re-examined to ensure that land availability was not a constraint to the development of the agricultural sector, hence the government established NALDA (National Agricultural Land Development Authority).

NALDA was established in 1991 to provide gainful income and employment opportunities for rural people and youths, promote and support optimum utilization of the nation's rural land resources, encourage and support economic-size farm holding and promote consolidation of scattered fragmented agricultural holdings, and facilitate appropriate cost-effective mechanisation of agriculture (Okoro, 1992).

FMIC (1989), noted that Agricultural Development Project (ADP) would intensify their activities under SAP in the areas of agricultural extension, inputs supply, on-farm adaptive research and rural infrastructural support. FMIC (1990), further reported that government had launched a new National small farmers' credit programme which was designed not only to provide production credit to an average rural farmer but also to provide harvest credit. The government had also directed that farmers be given credit without unnecessary difficulties. The central bank has therefore directed that the ratio of commercial banks rural lending be according to deposit mobilized within an area and it should be raised from 45% to 50%.

Furthermore, the existing grace period on agricultural loans for small scale farmers growing staples and seasonal cash crop was raised to one year. Also cash crop with relative long gestation periods such as oil palm, rubber and cocoa plantations, were to enjoy four years grace period under SAP.

2.4 Impact of SAP on Nigeria's Agricultural Production

Umebali (1992) reported that the price of agricultural products went up significantly during SAP. For instance, Cocoa price rose from =N=1,600 per tone before SAP to =N=4,000, N7,500 and N11,000 in 1986, 1987 and 1988, respectively. The same trend applied to the prices of other non-oil cash crops. He also noted that the index of agricultural production, which increased on the average by only 0.4 percent a year between 1981 and 1985, increased by 2.6 percent during SAP. Furthermore, he noted that the ban on the importation of some food items, the re-structuring of the River Basin Development Authorities (RBDAS), the Directorate of Food, Road and Rural Infrastructure (DFRRI) have had positive impact on agricultural production. It was further observed that the staple food crops production increased on the average by 5.3 percent annually between 1986 and 1988 but the fishery sub-sector recorded little or no increase in 1987 and 1988.

Anyanwu (1992) showed a pre-SAP production average of 86.2 and a SAP average of 132.2 between 1983 - 1985 and 1986 - 1988, respectively, on the agriculture sub-sector. He attributed this performance on the encouragement SAP gave to the export of agricultural products.

Keke (1992) observed that cassava production had been influenced under SAP. He reported that the staple crops of Southern Nigeria, grew tremendously with output of 9,618,976 metric tonnes in 1986 to 15,424,560 metric tonnes in 1987. Maize, which together

with sorghum and millet formed the staple food in the Northern part of Nigeria, also grew in output from 2,121,946 tonnes to 2,945,420 tonnes over the same period. These increases were necessitated by the increase in the supply of inputs by government under SAP from 24.1 percent to 58.5% from 1987 to 1988.

In 1988, Livestock production increased by 2.5% compared with an increase of 2.11% in 1987. Pork, beef and mutton recorded increases but there was decline in poultry production due to shortages and high cost of poultry feeds. Soyabean, palm produce, ginger, coffee, cotton, and groundnut also recorded, increased production. Palm oil rose from 650,000 tonnes in 1986 to 715,000 tonnes in 1987 and 785,000 tonnes in 1988 (FMIC, 1989).

Gross Domestic Product (GDP) was found to be increased by the agricultural sub-sector within SAP to the tone of 32.2%, which was a big increase from what it used to be before the introduction of SAP. Crops alone accounted for 25.96% while Livestock contributed 8.95% (FMIC, 1990). Mbanasor (1991) observed that SAP reduced the number of off-farm employment, thereby influencing positively the number of rural farmers engaged in farm employment. He further observed that under SAP subsistence objective among rural farmers was fast giving way to commercialization objective. Okoro (1992) observed substantial increases in farm-gate prices of products. For instance, a tone of ginger, and cotton increased from N800 to N1000, and N1000 to N1200 in 1986/87 respectively. He also reported that SAP had a significant impact on the agro-based industries in the local sourcing of the raw materials.

Most of these reports showed some increases in output since SAP. These increases may not have resulted from rural farmers, who account for about 90% of our total food supply, especially as most of these reports were from government sources. More so, increase in total output may not necessarily mean efficient utilization of SAP embodied agricultural package, which this study is investigating.

2.5 The Role of Rural Agricultural Production in the Nigeria Economic Development

Udom (1975) observed before the inception of SAP that the allocation of resources in rural agriculture should remain flexible, in order to allow for adjustment and changes in an economy, where growth and development are to be considered. He noted that growth and development problems arise if an effective demand for a particular product failed to bring about necessary adjustments in its supply, whether the products emanate from a declining sector or not. This is exactly the objective of the structuralist approach under the present dispensation.

Oke (1990) described it as a comprehensive economic reform measure designed to achieve both internal and external balance with minimum cost to the economy, otherwise known as economic development.

Helleinen (1965) reported that rural agricultural activities will continue to contribute to Nigeria's economic development or structural transformation in the following ways:-

i. through provision of linkages, whereby every primary economic activity will induce attempts to supply through domestic production, the inputs needed in that activity.

ii. the derived demand or backward linkage effects where every activity that does not by its nature, cater exclusively to final demand will induce attempts to utilize its output as inputs in some new activities.

iii. through provision of markets for developing industry and,

iv. through the provision of tax revenue for the public development effort.

Rural cassava and fish productions are very much on course as regards Helleinen's view, especially with the SAP - embodied agricultural package. What is required now is the efficient use and allocation of these existing SAP - resources.

Arua (1985) regretted that ever since independence, most, if not all rural agricultural development programmes have only brought temporary relief, if any, to the rural populace and certainly not development. He believed that most of the agricultural programmes failed because they were only political devices designed to pay lip service to agriculture, and perhaps induce the people into believing that really the government cared for them. More especially, most of these programmes were not production oriented, even if, they were not directed towards the rural farmers. This has resulted in the people relying on subsidies and relief from government and gradually lost the ability to practice their only noble profession. It is believed that these constraints to economic development raised by Arua would be ameliorated by the efficient use of SAP - package.

2.5.1 The Role of Cassava in Nigeria's Economic Development

Cassava is one of the most significant staple food crop in the Nigerian economy today. Its yearly output amounts to over N1.4 billion. This output level is only 40% of the potential, leaving a deficit of nearly 21 million tonnes to catch up with domestic demand. It can be utilized as feed for livestock, starch for industrial uses, pellets, alcohol, adhesives and pharmaceutical (Olayide, 1983; Uzo 1986; Ejiofor and Akaka 1987, NRCRI, 1986; IITA, 1985; Nnoke *et al* 1987, Obeta 1990,and Ezedimma 1990). Ezeilo(1979) noted that cassava is an important food crop for man and animal. He further observed that cassava products are tradeable on international markets and as such, earn foreign exchange to the country.

IITA (1993) reported the development of calcium oxalate crystals in the form of druses prismatic and raphides in cassava. Their distribution was found to vary among species and in different parts of the crop, which are vital to Nigeria economic development.

In order to increase its wide range of acceptance IITA (1993) has introduced 22 cassava genotypes in the humid forest agroecology and their performances were found to be generally equivalent to that of the best popular check (30572). Two genotypes (717672 and 1095 - D) were identified to be significantly higher in dry yield than the best check (30572). Resistance to pests and diseases of the genotypes were found to compare well with that of the best check, which has been released and adopted widely in Nigeria. By this, the role of cassava in the Nigeria diet has been extended efficiently in the humid forest agro-ecology. More so, IITA has further identified clones that are suitable in severe drought area of Nigeria (Sudan Savannah).

2.5.2 Rural Fish culture in Nigeria's Economic Development

Mgbenka (1990) reported that fish is the cheapest source of all essential amino requirements of man, especially sulphur and amino acids.

Muhammad (1994) noted that fish is an important source of protein in Nigeria especially as there is no known religious rejection of it as taboo, which gives it an advantage over pork, beef or mutton. More so, it is preferred to other sources of protein because of its considerable low cost of production.

Isu (1991) identified rural fish culture as highly profitable with net return of about N3,631.17/ha for only a production season of nine months. He further observed that the return to labour for a 3 - hectare fish pond was found to be greater than the salary of a graduate on a grade level of 08 step 4 by N1,240.92. It could be observed that rural fish culture has contributed positively to gainful employment and will contribute more if resources are efficiently utilized under SAP, hence, reducing the high rate of unemployment in Nigeria.

Stephen *et al* (1985) added that fish plays an important role in trade, mainly in the creation of exports or in the saving of the need to import, in both developed and under-developing economies including Nigeria.It plays a stimulating role in Nigeria's economic activities by the provision of employment and income as well as food.

Furthermore, Fineman - Kalio (1990) reported a profit before tax of N23,715.35 per annum from an investment of N35,800, in commercial fish pond per hectare. The reports above, showed that rural fish farming is highly profitable and as an essential component of an average Nigerian diet, its marketing will not be a problem, hence the need to increase production through efficient use of available resources during SAP.

Isu (1991) observed that many were of the view that an average Nigerian derives virtually all his caloric energy supply through starch foods especially cassava, and another way of improving his diet is to increase the level of fish consumption, which is very cheap. It is on the basis of this view that the analysis of rural fish farming and cassava production is very relevant under the Structural Adjustment Programme.

2.6 Marketing of Agricultural Products Under SAP

Ekezie (1992) noted that the marketing pattern relevant to Nigeria under SAP is that which would ensure sound market structure flexibility inorder to handle variations in supply and demand, for a variety of agricultural product.He identified price support and price control strategies as necessary ingredients in the marketing of agricultural product.

Madu (1992) observed that with the scrapping of agricultural commodity Boards, SAP ensured private sector participation in the marketing of Agricultural products. He observed that marketing of agricultural products under SAP was determined by market forces and the influence of the world market prices, especially that of the cash crops. He noted that under SAP,

state government operated buffer stock schemes, whereby agricultural commodities were purchased and sorted during periods of relative surplus for re-sale during periods of scarcity , in order to stabilize agricultural product prices.

Ndubuisi (1992) described marketing under SAP as inefficient as there were no facilities for good refrigeration, more so as those facilities were out of reach of the rural farmers.

Umoh(1992) noted that in the marketing mix, channels and middlemen were important under SAP as direct sales were usually not very easy. He concluded that for effective and efficient marketing of agricultural products under SAP, the following conditions must prevail.

(a) Production planning, which involved modernizing the agricultural method and processes;

(b) Establishing and developing local markets with sufficient facilities, to provide avenues for the buying and selling of agricultural products;

(c) Developing an effective distribution system.

(d) Setting up of effective pricing standards for agricultural products, and

(e) Designing effective and efficient means of promotion of agricultural products.

Ibe (1992) identified three most common deficiencies in the food marketing system in Nigeria as middlemen factors, logistic factors and weak institutional framework. Under the middlemen factor, he identified the channels of distribution and anti-competitive activities of middlemen who form market/sellers associations. The long line of largely superfluous middle

men sooner culminate into high prices of agricultural products, thereby placing the buyers at disadvantages. He further observed that for improved marketing, their activities should be checked effectively through

(a) dissolution of market unions or seller's associations throughout the country;

(b) reduction of the possibly interminably long-line of channel members involved in food marketing in the country through encouraging the formation of more consumer co-operatives with appropriate incentives, and

(c) formation of food marketing Companies at the local government areas.

Finally, Mbanasor (1991) observed a tremendous increase in marketing outlets since SAP, a situation he described as development.

2.7 Efficiency and Structural Adjustment Programme (SAP)

In static terms, efficiency may be defined as maximizing the present value of output from a given level of inputs. Alternatively when the goal is to achieve a particular social objective, efficiency may be defined as cost minization. Either way, key factor determining efficiency is the pricing of inputs and outputs to reflect relative scarcities, (Nwosu 1992)

In a dynamic context, efficiency requires capital and labour to be priced , according to their marginal productivites at international prices. In other words, labour costs per unit of output must be kept internationally competitive and interest rates should reflect the cost of foreign borrowing, (World bank, 1983).

It is believed that the inherent character in the above definitions refer to the production efficiency in relation to world economy. But this study concentrated on that of individual farmer in the use of resources within the periods. Interesting, all the indices observed were used in relation to individual farmers inorder to asses appropriately the efficient use of resources using disaggregate data of South Eastern Nigeria.

Yotopoules and Nugent (1976) defined production efficiency using two components, one is the price efficiency indicating that, factor proportion h that isocost covered are tangent to the production Isoquants with the given factor price. The other is technical efficiency which they defined in the sense that the producer should operate on their production possibilities curve and never inside. These definitions, however, lack the explanation whether the factor prices in use were distorted or not which is very vital in efficiency assessmen

Lau and Yotopoulos (1971) and Yotopoulos and Lau (1973), showed that small and large farms price efficient but not equally technically efficient, as the small farms are technically more efficient. The report seem to suggest that farmers will always adjust their product mix and factor proportion efficiently to whatever price they face. But in the face of realities, this has been found not to be true.

Norton (1987) noted that structural adjustment package need to be efficient, inorder to determine the possibilities for structural reforms in agriculture, i.e such reforms that may have the potential to lift the secular trend in agricultural growth. And at the very least, the package should not worsen problem of low rural incomes and inadequate domestic food supply. It is

viewed that only efficient utilization of resources under SAP could bring Nigerian structural reforms, into reality as mere provision and even utilization may not lead to Nigeria's agricultural development.

Norton (1987) argued that the low level of agricultural technology should not be considered as a structurally inefficient technique as it is more prone to relative resources endowment, and as such a great range of technologies may be encountered. What matters is the management technique. For example , in wheat production, most Egyptian farmers use techniques that are comparable to gardening in terms of labour intensities and lack of mechanisation, yet their yields are among the highest in the world. He identified production and distribution patterns as instrumental to efficient use of resources. He finally identified the following elements as vital to efficient use of resources under SAP namely,

(a) the available technologies of production

(b) the endowments of fixed resources

(c) the decision of producer (Profit maximisation, risk aversion, satisfaction of family food needs).

(d) market environments

(e) Policy environments.

He further observed that structural inefficiency may arise when

(i) Some existing packages are not fully utilized

(ii) the marginal productivity of the package is higher than the cost of providing more of it.

(iii) prevailing prices of goods and factors less than the opportunity cost.

Inefficient use of resources under SAP can occur when there is oligopoly power in markets, or when the policy environment has no defined secured land tenure or when prices are fixed by fiat, at levels that depart significantly from their economic equilibrium level (Norton, 1987). Most of these instruments are not strictly implicated in the case of Nigeria. However, this study determined the extent of their implication. It was noted that subsidized prices cannot be considered to be economic efficiency prices, especially as it has been found to weaken the validity of the traditional prescription, in use of border prices as guides to domestic pricing policy.

Sarris (1987) noticed that production efficiency may be marred under SAP by the very existence of distortion in the availability of SAP- package. Such distortion, he enumerated as monopolistic element in administration, bureaucratic controls, legal or geographical obstacles. Efforts have been made in the case of Nigeria to reduce the geographical obstacles by concentrating relevant package to appropriate ecological zones. But in the case of bureaucratic methods, much has not been done to eliminate them as they are found to be very much in practice.

Spooner and Smith (1991), in their study identified the concepts of efficiency during structural Adjustment Programme (SAP). These are;

(a) allocative efficiency in which resources are to be allocated in line with opportunity cost, if the value of total output is to be maximized.

(b) Operational efficiency in which the unit cost of production are minimized through the appropriate technology,

(c) economic efficiency in which they combined allocational and operational efficiency, in order to reflect the satisfaction of the consumer at prices which indicate the minimum sustainable costs of production.

They noted that production would be inefficient by the holding down of interest rate under SAP, as it would reduce savings and will invariably lead to credit rationing. This was the case with Nigeria. It is not yet believed that the lowered interest rate in Nigeria would make production inefficient because government institutionalized credits are being used. More so concerted efforts are also being pursued through the National Directorate of Employment in administering of loans to farmers under SAP.

Finally, they observed that SAP package should be concentrated on the production of tradeable if efficiency is to be achieved.

2.8 Constraints to Efficient Use of Resources by the Two Categories of Rural Farmers.

Inspite of the benefits accruing from SAP, the rural farmers are confronted with the high cost of production which has resulted in the prevailing high price of every consumer item. More so, most agro-based industries were operating below installed capacity (Umebali, 1992). It may

be argued that the resultant factor to the high price of every consumer item could be attributed to the inappropriate exchange rate policy, as most rural farmers still feel that they were better off prior to SAP, because of the real value of their products . Though it could be agreed that rural farmers income has increased under SAP but the high rate of inflation prevalent, might have affected the efficient use of SAP-package.

Mbanasor (1991) identified lack of funds, high cost of labour, inadequate fertilizer, lack of government support, diseases and pests, poor extension services, non-availability of agro-chemicals, and poor transport facilities as militating against rural farmers' use of the SAP package. While, Mbanasor's work examined this in relation to the responses of rural farmers, this study examined it in relation to their production efficiency. Furthermore, his work was restricted to Imo State with particular reference to arable crop farmers .This study examined it using cassava based crop mixtures and rural fish farmer in the whole of South Eastern Nigeria.

Orebiyi and Onu (1992) noted that inadequate supply of items of the Sap package is the greatest constraint to rural farmers efficient utilization of resources under SAP. Umebali and Akubuilo (1992) observed the high rate of unemployment and retrenchment as serious constraints to the use of SAP package. One may agree to some extent, as it has been found by some authors that lack of money is a constraint to the use of SAP package. One may disagree on the other hand that unemployment and retrenchment have resulted from the inefficient use

of resources under SAP because it is believed that most retrenched workers and the unemployed are happily going back to agriculture, due to SAP package administered through the National Directorate of Employment.

Ojo (1987) summarised the constraints militating against rural farmers full utilization of SAP package as :

(a) the environmental constraints, which principally consist of wide fluctuations in climatic condition as well as incidence of pest and diseases;

(b) increasing pressures on land resources, low fertility, erosion, conservation, and unprogressive land tenure system;

(c) labour and manpower constraint, which involves shortages and high cost of labour on the farms, low labour productivity due to the application of poor techniques and manpower shortages which affect the implementation of government programmes;

(d) the capital problem, arising from the disproportionate share of government's spending going in agriculture, the misdirection of government's funds as well as inadequate and top-sided distribution of credit facilities.

(e) technological problems such as ineffective agricultural research,extension and inadequate utilization of modern inputs and

(f) marketing and price constraints, which have not provided the effective link agricultural products.

2.9 Theoretical Framework:

The theory and evidence of the efficacy of SAP could be traced to Keynes' General Theory of Employment, Interest and Money. Prior to Keynes (1970), economists generally believe that complete stabilization of the economy was not possible and that recession might be necessary to correct imbalances in the economy, inorder to return to an equilibrium growth path. Keynes suggested that recession might be eliminated through correct demand management policies relying mainly on discretionary fiscal policies.

SAP has generated a lot of vocal advocates as well as critics, although there is reasonable consensus in literature that SAP has become the most popular response to financial crisis whose foundations are traced to macro-economic policy distortions (World Bank, 1986).

Chibber *et al* (1986) noted that most countries that suffered from structural imbalances departed from pursuit of free market pricing policies. In the absence of free market pricing, there would be inefficiency in resource allocation, which worsened as the countries tried to use administrative measures to cope with dwindling foreign exchange earnings and shortfalls in public revenue.

Other factors that often precipitate the introduction of SAP are internal and external imbalances arising from price distortions. These problems have often constrained output levels and economic development generally. Consequently, orthodox fund (IMF) sponsored SAP usually calls for demand management and related stabilization policies (Quarcoo 1990).

CBN/NISER (1992) identified one of the most serious distortions in the context of SAP as the pursuit of fixed exchange rate system which led to currency over-valuation, hence foreign exchange rationing. Other identified sources of distortions included restrictive trade, price control policies and direct government involvement in production. Restrictive trade was found to offer considerable protection to domestic industries, foster import dependence and impose heavy implicit taxation on farmers. Price control measures were found to cheapen inputs including scarce resources. The overwhelming direct government involvement in Production of goods and services encouraged the emergence of large parastatal institutions which were mostly inefficient and unpofitable which had serious impact on the size of public expenditure and publice debt burden.

Quarcoo (1990) observed that demand management solution are sometimes not adequate remedy, especially for deeply-rooted structural botlenecks which should more effectively be tackled through supply-side policies. CBN/NISER (1992) observed that the economic problems of most developing countries could only be redressed, if they adopt, on a sustainable basis a mix of appropriate economic measures that included the removal of macro-economic distortions, restoration and maintenance of balance of payments viability in an environment of price stability which would ensure sustainable rates of economic growth.

2.10 Analytical Framework

There are several approaches in evaluating the impact of SAP on the various sectors of the economy. They include before/after approach, times series projections otherwise known as counterfactual approach, the production function approach, the response model approach and other non-econometric assessment approaches(Ogbu,1991; Adiele,1989;and Oni,1989).

Inview of the crucial nature of this study, efforts were made to provide a very comprehensive and balanced picture of the impact of SAP on production efficiencies by making use of before and after approaches, inconjuction with producation and econometric approaches. These methods involve comparing the selected indicators before the implementation of SAP and after SAP was put in place. The differences between "before" and "after" were then subjected to the appropriate test of significance. The methods have gained wide - spreade acceptance. However, the basic problem include, their implied assumptions that other factors not associated with the programme, but which might have influenced the economic outcomes, remained unchanged.

2.10.1 Production Function:

In order to describe the technical relationships between independent variable and the dependent variable within the period, this study relied on the framework of production functions. Mijindadi(1980) described it as the rate at which resources were transformed into products, given a known way of organizing production. Many functional forms may be used to

desreibe production relationships (Dillon, 1977) but in this study, the Linear,quardratic and Cobb-Douglas functions were used. The choice of appropriate functional forms was determined empirically by the fitting of various functional forms that are feasible and the bestfit was seleicted based on economic, statistical and econometri criteria. Also guidelines on the algebraic forms to be used came from previous studies (Heady and Dillon, 1961; Ugwu, 1990; Okorji, 1989; Olomola, 1988; Olagoke, 1990;).

The Cobb-Douglas production function was mainly used because:

(i) it was very convinient in interpreting elasticities of production;

(ii) the estimation of its parameters involved fewer degrees of freedom than other forms; and

(iii) the computations involved in fitting the Cobb-Douglas were considerably less than others.

It assumed the general form:

$$A = J_o X_1^{J_1} X_2^{J_2} \ldots J_k^{J_k} U \qquad (1)$$

where,

A = level of output;

$X_1 \ldots X_k$ = resources inuse within the two periods (before and during SAP);

$J_1 \ldots J_k$ = Parameters estimated;

J_o = constant term;

U= error term (Chennareddy, 1967).

The production function was estimated by the use of single equation. This is because most studies on resource allocation using cross-sectional data have used single equation approach (Marschalk and Andres 944; Massel and Johnson, 1968; Youmans and Schulz, 1968). The production function model was used in estimating resource -use efficiency for at least two reasons.

(a) it showed the extent to which total output could be imputed to the specific resource, and

(b. it gave marginal factor and productivity which were useful in evaluating the allocative efficiency of the resources prior to and during SAP(Johnson, 1984).

In using this function, effort was made at minimising practical and theoretical constraints in its use.These constraints included many observations,variability in the environment, managerial ability, specification bias and simultaneous equation bias (Pindyck and Rubinfeld, 1991).

2.10.2 Measuring production efficiency

Production is said to be efficienly organised under conditions of competition in output and input markets, when marginal value product is equal to the marginal factor cost for each input (Olomola, 1988; Olukosi and Ogungbile, 1989).

Chennareddy (1967) noted that the appropriate method for testing production efficiency of a production unit is, first, to hypothesize the behaviour of producers and, secondly, to formulate a statistical model on the basis of such hypothesis. He further stated that from the production model, marginal value products (MVP) would be obtained.

For a test of the production efficiency and allocative efficiency, for each parameter used in this study, the common procedure for computing the ratio of marginal value products to the marginal factor costs, a proxy of its unit price, was followed according to the approaches of Singh (1979), Olomola (1988), and Nwosu (1991).

The procedures adopted by Chow (1960), Olomola (1988), Onyenweaku and Fabiyi (1991), and Lau and Yotopolos (1971) were applied to differentiate the production efficiencies before SAP (defined as 1983 - 85) and during SAP (defined as 1993 - 1995). Based on this framework, this research determined the production efficiency and allocative efficiency in the use of resources by the two sets of farmers prior to, and during SAP. This method has been criticized for relying on average values. Nevertheless it provided a useful guide in deciding whether or not the level of rural agricultural production within the periods could be efficiently

increased by making adjustments in the pattern of resource use and allocation within the periods.

In terms of definition of variables used in assessing the efficiencies, the gross value of total output was defined as the value of crops produced in the mixture (cassava based crop mixtures) and the value of all types of fish produced, both evaluated at the prevailing prices within the periods specified for this study.

The gross farm size was measured in hectares. The information on cost of land/pond was obtained through interviews especially where rent was paid. The opportunity cost of land was used in determining owner's farm cost.

Labour refers to both hired and family labour. It was measured in man-days of eight hours. It was achieved through interviews and occasional field observations. In addition, through ADPs and paid enumerators records were obtained of the number of hours spent by each worker on each farm on a specific day during the period. Conversion was not deemed necessary as each labour employed was assumed to be very efficient in the operation. Moreso wage rate in the study area was found to be non-discriminatory.

Modern material inputs refer to the sum of the value of improved planting materials, insecticides, herbicides and fertilizer (for cassava based crops mixture), while improved fingerlings, feed, fertilizer and drugs were used in the case of fish farming.

Local material inputs were the sum total of the value of traditional planting materials of the crops in the mixture, while traditional materials in the case of fish enterprise were local fingerlings and poultry droppings.

Other investment expenses are depreciated value of assets, interest on loans and premium on insurance.

2.10.3 Multiple regression analysis

Regression analysis is a commonly used analytical technique in determining the relationship between the dependent variable and independent variables. The multiple regression analysis used was, according to the approach of Hughes (1966), who used it to analyse cross sectional data of some socio-economic variables. Also, Osuntogun (1978) and Olagoke (1990) methods of using it in analysing farmers relationship and selected socio-economic variables were applied.

The first step in using regression analysis to estimate relationships is to specify the algebraic (or functional) forms of the relation between output and the selected socio-economic variables. The range of functional forms considered was limited by constraints imposed by the regression procedure. Three forms which are usually used are the Linear, double log transforms and semi-log transforms (Lingard 1974). Since theory gave no firm indication as to the form of the relation, the three forms were accordingly fitted in this study.

There are various econometric techniques that could be used to derive estimates of the parameters of economic relationships from statistical observations. The ordinary least squares

(OLS) is one of the most commonly employed techinques. Moreso, as the use of more sophistricated techniques do little to improve the fit, the OLS was used to estimate the models in this study (Ayub, 1975, Gilliches, 1957).

The ordinary least squares (OLS) is based on certain assumptions, namely, the distribution of the random variable, the relationship between random variable and the explanatory variables and the relationship between the explanatory variables themselves (Koutsoyiannis, 1981).

The form finally used was the one that gave the best explanation of the observed relationship.

The variables used are described below;

Gross Output (Y)

This is the total output of all the major crops found in the cassava-based crop mixture and it was measured in tonnes while the weight of the harvested fish measured in tonnes, was used in the case of fish output.

Farm Size (C_1)

The size of each field or pond was measured in hectares. The pre SAP farm size was derived from past record through ADP listing while during SAP was measured by the enumerators stationed in each community. Moreso, most of the ADP contact farmers have measured farm size. The coefficient was expected to be positive.

Farmers Income (C_2)

The farmers income was determined from all the sources available to the farmers. It was measured in Naira. The coefficient of this variable was expected to be positive.

Farming Experience (C_3)

This variable was included because it was believed that the number of years a farmer had put into farming would influence his performance positively. As such, the correlation coefficient of this variable with total output was expected to be positive.

Age (C_4)

The age of the farmers was expected to influence their active use of SAP resources. Younger farmers would tend to adopt the use of SAP incentives more than the older often conservative farmers. Therefore, the correlation coefficient of this variable with output was expected to be negative.

Educational Attainment (C_5)

It was believed that a farmer's educational attainment was one of the significant variables that could determined the level of output. This was given as the total number of years the farmer spent in school. The coefficient of the variable was expected to have a positive sign since literate farmers would tend to move towards understanding and using the incentives provided by SAP than the illiterate ones.

Occupational Status (C_6)

This referred to either full or part time involvement of the respondent in farming activities. It is normally represented by a dummy (i.e 1 for full time , 0 for part time). The correlation coefficient was expected to be positive as full time involvement would mean more utilization of SAP incentives unlike part-time involvement which implied less utilization.

Household Size (C_7)

This was the total number of persons (wife/wives, children or grand children and extended family members) that lived and fed with the respondent. The correlation coefficient might be positive depending on the magnitude, age structure and availability for farm activities among the household.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study Area

The study area is South Eastern Nigeria. It is the area South of River Benue and East of River Niger. The area lies approximately between latitudes 5N --7 N and longitudes 7 E--8 E (Figure 1). It stretches from the humid forest to the Subhumid Guinea Savanna ecological zones (Nweke *et al* 1991).

The area comprises nine States of the federation, namely Abia, Anambra, Akwa Ibom, Bayelsa, Cross River, Enugu, Ebonyi, Imo and Rivers States. The 1991 census put the population at 18.92 million. The agricultural activities of the area are influenced by the vegetations (Udo, 1981; Adapalm; 1994). The climate is characterised by uneven high temperatures and seasonal distribution of rainfall from March to November. The area is chosen because of its significance in cassava and fish productions (Agboola 1979; Ademosun, 1988).

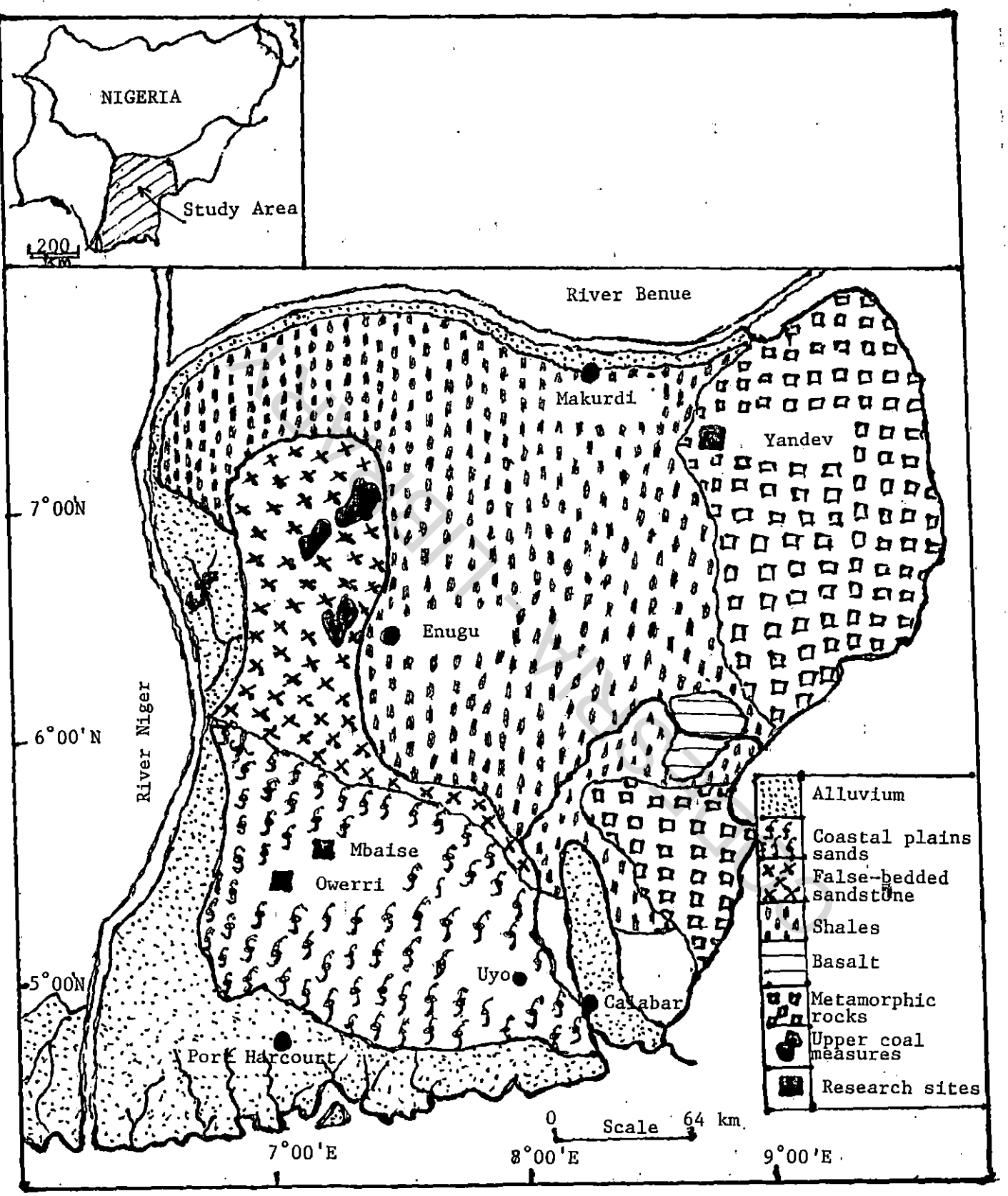


Figure 1. GEOLOGICAL MAP OF SOUTHEASTERN NIGERIA.

3.2 Farming and Fish Production Systems

Mixed farming is the dominant farming systems in the area. This may be due to the risky nature of farming. Farmers tend to spread risk by keeping a variety of crops and animals, termed mixed farming.(Okigbo, 1986).

In this study, two enterprises namely cassava based crop mixtures and fish production were investigated.

3.2.1 Cassava based crop mixture

This was found to be an important crop mixture, composed usually of cassava as the main crop in association with maize, melon and vegetables. Other crops included in the association are cowpea, pepper, tomato and amarantus (Nwajiuba, 1995; Nweke *et al* 1991).

Cassava is the major staple crop in the study area. Its importance is reflected in the pattern of farm resources use as well as its contribution to the household food and cash incomes. Cassava has the potential for use as livestock feed, industrial production of starch, pellets, alcohol, adhesives and pharmaceuticals (Olayide, 1981; Okorji, 1983; NRCRI, 1986).

Table 3.1 shows that cassava based crop mixtures constituted about 57% of cultivatable farm land in South Eastern Nigeria, position previously held by yam (Okorji, 1983). This may be in connection with less farm household requirement for cassava production in relation to other crops like yams and rice.

Table 3.1: Relative Importance of CBCM, in the Study Area.

Crop Based Mixtures	Number of Farmers	Percentages
Cassava based crop mixtures	68	57
Yam based crop mixtures	32	27
Rice based crop Mixtures	12	10
Cocoyam based crop mixtures	8	7
Total	120	100

Source: Field Data, 1995

The environmental requirement for cassava based crop mixtures was relatively moderate. It was found to be at best on light sandy loam soil, with good drainage. Lageman (1977) reported that the importance of cassava based crop mixtures started with the acute problems of shorter fallows. The main reasons for the increase of cassava based crop production according to Nwajiuba (1994) included:

i. increasing population density and declining soil fertility

ii. lower labour requirements than other crop based mixtures

iii. harvesting could be done according to food requirements, and

iv. when processed into garri, it could be easily stored and transported.

About 63% of the respondents described CBCM as a "SAP crop" because of its high cash return, relatively high yield and ease of management. It ranked first among other crop mixtures, with 57%, while yam, Rice and Cocoyam based crop mixtures followed in that order respectively.

It was identified that the planting date for cassava, the main crop, ranged from March to November, though the peak planting period was between April - June. Most of the respondents grew cassava based crop mixtures at the beginning of the planting period. The late planting practice was not substantial especially as most other arable crops in the mixture cannot survive the adverse weather condition. It was identified that the mixtures compete for land and labour during the peak period of agricultural production.

3.2.2 Fish Farming

Fisheries subsector contributed 3% of the Gross Domestic Production (GDP) of South Eastern Nigeria; the annual growth rate for fisheries contribution to GDP was estimated at 3.7% (Moses, 1989).

Nigeria is the largest consumer of fish and fish products in Africa. Consumption increased by about 3.4% per annum between 1971 and 1979. Per capita consumption increased from 7kg to 9kg within the same period (Dada and Snanadoss, 1983).

Fish is regarded as a close substitute to meat in relation to animal protein in Nigeria (Ademosun, 1988). The edible portion of fish contains on the average about 20% protein

(Moses, 1980). It constituted about half of the animal protein intake in Africa and is very essential as a raw material in the livestock industry (FAO, 1991).

Fish farming was described as the controlled production of fish in ponds, (Moses, 1980). Of all the fish producing sectors, fish farming was seen as the best positioned in contributing significantly towards increased fish production in Nigeria especially in this era of SAP, where other modes of fish production have been played down (Eluagu, 1995).

Pond fishing is the main type of fish farming in the study area. Most of the farmers were on part-time, and combined fish farming with other types of job. It is regarded as a supplementary source of aquatic food in the area.

The farm size was generally found to be less than 0.5 hectare and it was owned by individuals, co-operative organisations and government establishments. Three systems of operations were feasible in the area. They included extensive, semi-intensive and intensive systems. The extensive cultivation, unlike the other systems was found to involve large areas of land, low levels of capital investment, minimal maintenance cost, and a very low total outlay. The most cultivable species included *Tilapia*, *Clarias*, *Heterotis* and *Heterobranchus*. These species were found to have fully acclamatised in the area. In the rearing ponds, under monoculture most of the farmers use about 20 fingerlings of between one to three grams each per meter square, but under polyculture, the stocking rate was about six fingerlings per meter square. Prior to stocking, the farmers did eliminate pests and later dressed the ponds with about

2.5 tons/ha of chicken manure, and subsequently use about 60kg/ha of 15-15-15 NPK fertilizer biweekly. The depth of the ponds were found to be between 60 - 100cm.

The fingerlings were fed, with pellets that contain between 30 - 40% crude protein and 3,000 - 4,000 Kcal digestible energy/kg food for good growth (Ita, 1980). The pellets were distributed with one "Cast" over a surface of about two meter square in order to minimise competition.

Occasional samples of fish are usually taken to estimate the growth rate, and subsequent adjustment in the feeding rate. It was observed that under intensive management, the fingerlings attained over one kilogram of weight within a year.

3.3 Sampling Procedure

Random sampling technique was adopted in the selection of States and respondents used in this study. In the attempt to provide a fairly representative sample for the survey, four States of Abia, Enugu, Imo and Rivers States were randomly selected. The States were divided into three agricultural zones using ADP delineation. All the three agricultural zones were covered, due to dearth of pre-SAP data.

The farmers were selected based on the three agricultrual zones in each State; for the cassava based crop farmers, 10 respondents were randomly selected from each agricultural zone while seven fish farmers were randomly selected, using ADP listing as the main frame.

In all, a total of 120 cassava based crop farmers and 84 fish farmers were interviewed but only 80 fish farmers were used in the analyses. As per cassava - based crop farmers, 30 farmers were selected per State while that of fish was 21 farmers. The households were selected from a list compiled with the assistance of ADP staff in each of the agricultural zones. Sample size was limited by available resources, as the cost route method employed in data collection of SAP data was expensive.

3.3.1 Cost - Route Approach Adopted

This entailed making repeated visits to the farmer for at least one cropping season. By this approach much reliance was not placed on memory recall as the events were recorded soon after they have occured or while they were occuring (Nwosu, 1975)

In this method during SAP, data were collected repeatedly using questionnaire, direct observations and actual measurement. This approach has been used by several authors in Nigeria. (Nwosu 1975; Norman, 1973; Spencer, 1973).

3.4 Data collection Techniques

Data for the study were collected both from primary and secondary sources. The cost-route technique was used for generating information for the three years used as SAP period (1993 - 1995). However, Pre-SAP data were derived from ADP, ADP contact farmers, Federal Office of Statistics and Local Government Areas, within the periods used as pre-SAP (1983 - 1985). Given the wide spectrum of secondary data, considerable problems were encountered

in this area. There were variations in the average official sources, hence the use of average from the official sources.

The data were generated with the assistance of three enumerators recruited and trained in each agricultural zone.

3.5 Methods of Data Analysis

Data for the first study objective was analysed using descriptive statistics, such as, means and percentages. The pre-SAP period was defined as between 1983 - 1985 and that of SAP period was defined as between 1993 - 1995. The annual growth rates were calculated according to Browers (1982) thus,

$$\gamma = \sqrt[n]{\frac{P_n}{P_o} - 1}$$

where,

γ = required rate of growth

n = time periods

P_o = first period of the data

P_n = last period of the data

The student t - statistic was used to determine the impact of the programme on the levels of output of crops in the mixture and fish farming. The formular below was applied.

$$t = \frac{\bar{y}_1 - \bar{y}_2}{PSE}$$

Where

$$PSE = \sqrt{SE_1^2 + SE_2^2}$$

PSE = Pooled Standard Error

Y_1 = Mean for Pre-SAP output

Y_2 = mean for SAP output

SE^2_1 = Standard errors for Pre-SAP output

SE^2_2 = Standard errors for SAP output

Furthermore, data for the socio-economic part of this objective were included because several studies have shown that variables other than inputs affect output (Okorji, 1993; Chidebelu, 1983; Nwosu, 1975, and Mbanasor, 1991).

Wilson and Gallup (1955) and Osuji (1980) identified eduction, farm size, income, experience and occupation as being significant in determining output. It therefore, means that the socio-economic status of the farmers influences output, hence the inclusion of the socio-economic variables in the study:

This part of the objective one was achieved by the use of regression analysis. The correlation matrix from the model was used to show the relationship between gross output (Y) in tonnes and the included variables.

The regression model was fitted thus:

$$Y = F(C_1, C_2, C_3, C_4, C_5, C_6, C_7, U)$$

where,

Y = Gross output (tonnes)

C_1 = Farm size (ha)

C_2 = Income (N)

C_3 = Farming experience (years)

C_4 = Age (years)

C_5 = Educational attainment (years)

C_6 = Occupational Status (dummy)

C_7 = Household size (number)

U = error Term

Since theory gave no firm indication as to the form to be adopted, the three functional forms indicated in Lingard (1974) were fitted. The form finally used were semin-log and double log respectively for cassava based crop farmers and fish enterprise.

In evaluating the production efficiency of the two categories of farmers in objective (ii), the production function model used in examining the differentials in production efficiency of Pre-SAP and SAP farmers was specified according to Chennareddy (1967), Nwosu (1975), and modified by Olomola, (1988).The implicit form is specified as :

$$Y = F(P_1, P_2, P_3, P_4, P_5, e)$$

where

Y = Gross value of total output (Naira)

P_1 = Farm Size (ha.)

P_2 = Labour Used in Mandays

P_3 = Modern Material Inputs (N)

P_4 = Local Material Inputs (N)

P_5 = Other investment expenses

e = Stochastic variable or error term which takes account of unexplained factors.

This model was applied to Pre-SAP and during - SAP data for the two enterprises used in the study.The inclusion of farm size was controlled by the smallness of the area

cultivated which showed no harmful collinearity ,this has also been substantiated by several authors.(Olomola ,1988, Singh, 1975, Nwosu, 1975)

Using the empirical data, the model was estimated in three functional forms thus:

a. **Linear function,**

$$Y = b_o + b_1P_1 + b_2P_2 + b_3P_3 + b_4P_4 + b_5P_5 + e$$

Where;

Y = dependent variable,

b_0 = constant term

b_1 - b_5 = Parameters that were estimated, and

e = error term.

b. **Semi - log function;**

$$Y = \ln b_o + b1 \ln P_1 + b_2 \ln P_2 + b_3 \ln P_3 + b_4 \ln P_4 + b_5 \ln P_5 + e$$

c. **Cobb - Douglas function (double log function)**

$$\ln Y = \ln b_o + b_1 \ln P_1 + b_2 \ln P_2 + b_3 \ln P_3 + b_4 \ln P_4 + b_5 \ln P_5 + e$$

Where b_1 to b_5 are parameters which were interpreted directly as elasticities.

Both the allocative and technical efficiencies were derived from the above model thus;

(i) **Allocative Efficiency**

Mathematically a farmer is allocatively efficient if

$$MVP_{x_i} = P_{x_i}$$

or

$$\frac{MVP_{x_i}}{P_{x_i}} = 1$$

where,

MVP_{xi} $(i = 1,2 \ldots, 5)$ = the marginal value product of the ith factor

P_{xi} $(i = 1,2 \ldots, 5)$ = the unit price or marginal factor cost (MFC) of the ith factor.

The marginal physical product MPP_{xi} (xi of each resource was calculated, using the formular

$$MPP_{x_i} = \frac{b_i}{\overline{x_i}}$$

where

MPP_{xi} = Marginal Physical Product of the given resource

bi = the regression coefficient of the given resource.

xi = the geometric mean of the give resource.

The $MPPxi$ was then multiplied by the geometric mean price of the output to obtain the marginal value product of the respective resource (MVP_{xi}).

Furthermore, the relative allocative efficiency was calculated according to mijindadi (1980).

$$CP_t = \frac{(aP_t - bP_t)}{aP_t} = (1 - \frac{1}{\gamma})100$$

where

Cpi = absolute value of the required percentage change in the MVP of the resource Pi

$api = MVP\ of\ Pi$

bpi = cost of one unit of pi or $MFC\ of\ pi$

$r = api/bPi$

As a decision rule, the closer Cpi is to zero, the higher the efficiency of use of that resource within the periods. Thus, the various percentages obtained, were used to compare level of efficiency of use of each of the resources in both periods, for the two enterprises.

ii Technical Efficiency

In order to determine the more technically efficient period among the respondents, the covariance analysis technique was used following Onyenweaku and Fabiyi (1991) and Chow (1960).

In this, the two unexplained variations from the estimated functions for the two periods were added to give a total unexplained variation.

$$\sum e_1^2 + \sum e_2^2 = (\sum e_1^2 + \sum e_2^2)$$

with $(n_1 - k) + (n_2 - k) = n_1 + n2 - 2k$ degrees of freedom (df)

where

$\sum e_1^2$ = unexplained variation for Pre-SAP

$\sum e_2^2$ = unexplained variation for SAP period

ni = number of observations for Pre-SAP

$n2$ = number of observations for SAP period

K = number of parameters estimated

$(\Sigma e_1^2 + \Sigma e_2^2)$ = total unexplained variation

The total unexplained variation $(\Sigma e_1^2 + \Sigma e_2^2)$ was subtracted from "pooled" unexplained variation (Σe_p^2) that is

$$\Sigma ep^2 — (\Sigma e_1^2 + \Sigma e_2^2)$$

with (n1+n2 - K) - (n1+n2 - 2k) = k(df)

From the above, the ratio used in determining the more technically efficient period was determined as

$$F^* = \frac{[\Sigma eP^2 - (\Sigma e_1^2 + \Sigma e_2^2)]/K}{(\Sigma e_1^2 + \Sigma e_2^2)/(n_1 + n_2 - 2K)}$$

In this, comparison, was made between the observed F - ratio and the theoretical value of F at the appropriate significant levels. If F - calculated was greater than F - table the hypothesis of equal technical efficiency was rejected, implying that the two periods differred significantly.

This tool was applied separately for both cassava - based crop enterprise and the rural fish farming enterprise.

iii. **Economic Efficiency**

In assessing the economic efficiency, the profit function approach adopted from Onyenweaku *et al* (1995), developed by Lau and Yotopolous (1 971) was followed.

The model involved the estimation of a profit function and employing a dummy variable to differentiate between the two periods, inorder to test the more economic efficient period.

The underlying assumptions employed in the formulation of the profit function were that the farmers were profit maximizing, price takers in both output and variable input markets, and that the production function was concave in the variable inputs. According to Mcfadden (1971), there exists a one to one correspondence between the set of concave production functions and the set of convex cost functions. Hence, without loss of generality only profit function were considered in the empirical analysis of the behaviour of profit-maximizing price-taking farms.

The unit output price (UOP) profit function model used is specified thus:

$$\mathbf{Ln\Pi = lnb_0 + b_1 lnD + b_2\, lnWR + b_3 lnFS + b_4 lncI + U}$$

Where

LnΠ = Log form of profit per farmer in Naira defined as total value of output less total variable cost.

LnD = dummy variable (Log) distinguishing between the two periods (1 = Pre-SAP, 2 = SAP)

LnWR = Money Wage rate in Naira per man day (log form)

LnC1 = depreciated capital input per farmer

U = random error term.

This model was applied separetely for each of the enterprises studied.

Objective (iii) was realised based on the work by Olayemi and Olayide (1981). In this, the estimated regression coefficients (b1) and beta coefficients or standard partial regression coefficients were calculated. This was carried out because beta coefficient (b1) is a standardised measure of the relative importance of individual explanatory resources, irrespective of the units in which the coefficients were measured. This was then used to compare the relative importance of the defined resources prior to and during SAP. It was calculated thus for both periods and enterprises:

$$bi' = bi \frac{\delta \bar{P}i}{\delta y}$$

Where

bi = beta coefficient

δ **pi** = Standard deviation of the given resource in the period

δ y = Standard deviation of the dependent variable in the periods.

As a decision rule, the higher the beta coefficient, the more important the resource in question in a given period for the enterprises.

Also the estimates of the elasticity of production of each resource was obtained using the formular

$$\Sigma pxi = \frac{bi}{y}$$

where,

Σpxi = Elasticity of production of the given resource in each of the periods for the two enterprises.

bi = regression coefficient of the given resource in each of the periods for the two enterprises.

Yi = geometric mean level of the respective value of output in each period for the two enterprises.

The returns to scale were estimated using the sum of Elasticity of production of each equation. Less than one, was regarded as decreasing return to scale while greater than one, was interpreted as increasing return to scale.

Objective (iv) was achieved using enterprise budgets. In this, itemised costs and returns of each enterprise were evaluated. In order to arrive at inference on the relative profitability of aggregate resources used, the net returns from both periods, for the two categories of farmers were compared.

In assessing part of this objective (iv), sensitivity analysis test was employed. In this the costs and returns components of SAP data were subjected to some hypothetical situations, so as to assess rigorously the extent to which the two enterprises would withstand unexpected future agricultural policy distortions ie, looking beyond SAP policy measures.

Objectives (v) and (vi) were realised using descriptive statistics.

3.6 Tests of Hypotheses

The test of significant difference in production efficiencies were achieved through the application of Chow test and student t - test.

The results were further subjected to both statistical and econometric tests. The test statistics used were R^2, for measuring the goodness of fit, F - test for measuring the overal significance of the whole equation, beta coefficients for measuring the contribution of each variable to the explanatory power of the model; and mult-collinearity test, for measuring the Linear relationships among the explanatory variables.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Socio -Economic Features of the Respondents

In this, an attempt was made to describe a number of socio-economic features of the farmers in recognition of their enhancing the interpretation of the functional analysis in subsequent discussions. The socio-economic variables considered include age, occupation, marital status, farming experience, education and household size.

4.1.1 Age distribution of the Farmers

The age distribution of the respondents is shown in Table4.1 .The data presented show that the distribution of the respondents was skewed towards middle age bracket.

Table 4.1: Percentage distribution of the respondents according to age

Age (years)	Cassava based crops farmers		Fish farmers		Total	
	No.	%	No.	%	No.	%
Less than 30	9	7.5	5	6.2	14	07
30 - 50	72	60	50	62.5	122	61
Above 50	39	32	25	31.3	64	32
Total	120	100	80	100	200	100

Source: Field Survey,1995

From table 4.1 it could be observed that less than seven percent of the two sets of farmers were under 30 years of age, while about 61% was in the middle age class (30 to 50) and about 32% was above 50 years of age, indicating a high proportion of able bodied farmers in the two enterprises. The greater percentageof middle age farmers might be as a result of high cash return associated with farming as reported by Okorji (1983), Olagoke (1990) and Eze (1991).

The age structure in rural farming is significant in at least two important respects. The first consideration is increased productivity, while the second has to do with increased rate of adoption of innovations which SAP seeks to achieve. Since rural farming systems still rely on rudimentary tools, powered by human muscle, it means that very old farmers will face severe energy constraints and will be less productive than the younger and more energetic groups. Moreso, the older farmers tend to be more conservative and less vulnerable to the wind of change than the younger farmers.

4.1.2 Farmers Occupational Status

The two sets of farmers were grouped according to their occupational status in farming since the introduction of SAP. Those who made most of their income (75%) from farm-work were classified as full-time farmers, while those who made most of their income from non-farm occupation were classified as part-time farmers.

With regard to this, about 57% of the cassava-based crop farmers were on full-time while

43% combined farming with other occupations. Unlike in the cassava- based crop farming, most of the fish farmers were part-time (63%). This may be due to the relatively low labour demand in fish farming. It can easily be combined with other means of livelihood. It is only in the riverine areas that it was found that most of the fish farmers were on full-time basis.

4.1.3 Marital Status of the Farmers

A greater percentage of both groups of farmers was married, 76% for cassava based crop mixtures and 64% for fish farming. Among the fish farmers, 24% were single while 12% were either widowed or divorced. Almost all the married respondents (85%) have only one wife.

4.1.4 Farming Experience

The number of years of farming experience by the respondents is shown in table 4.2. The result presented shows that the greater percentage of the two groups of farmers experienced fall within the period of Structural Adjustment Programme.

Table 4.2: Percentage distribution of the farmers according to farming Experience

Years of Farming	Cassava Based Crop Farmers		Fish Farmers	
	No.	(%)	No.	(%)
Less than 5	19	15.8	9	11.3
5 - 10	52	43.3	49	61.2
11 - 15	12	10.0	11	13.8
16 - 20	29	32.2	6	7.5
Above 20	120	100	80	100

Source: Field Data, 1995

As could be seen from the table the majority of the fish farmers (61.2%) had between five and 10 years of farming experience, while about 27% had experience ranging between 11 and 20 years. On the other hand, a greater percentage of the cassava-based crop farmers (CBCF) (84%) had between five and fifteen years of experience in farming.

The number of years a farmer had spent in the farming business could give an indication of the practical knowledge which has acquired. Although experience may not count in terms of risk taking, it is apt to have considerable influence on production efficiency. for instance farmers who have longer experience may have become more efficient through trial and error.

4.1.5 Educational Attainment:

As shown in Table 4.3, the level of education of fish farmers appears substantially higher than that of cassava based crop farmers (CBCF), where 37% had no formal education.

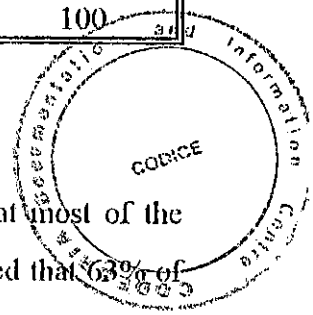
The relevance of the literacy level of farmers to farm productivity and production efficiency has been documented by several authors (Okorji and Olukonle, 1992; Olomola, 1986; Noor, 1981; Welch, 1970; Nelson and Phelps, 1966).

The farmers educational attainments were not only found to raise their productivity but also increased their ability to understand SAP and its package and technologies being disseminated through extension. The high level of literacy shown by fish farmers may not be unconnected with the complexity of its management.

Table 4.3: Percentage distribution of the farmers according to educational attainment

Level of Education Attainment	Cassava Based Crop Farmers		Fish Farmers	
	No.	(%)	No.	(%)
No formal Education	44	36.7	5	4.2
Primary Education	40	33.3	28	35.0
Secondary / TTC	20	16.7	25	31.3
Higher Education	16	13.0	22	27.5
Total	80	100	120	100

Source: Field Survey, 1995.



4.1.6 Household Size of the Farmers

The household size of the respondents shown in table 4.4 shows that most of the farmers have less than five persons per household. The result further explained that 63% of the Cassava based crop farmers belonged to this household size.

Table 4.4: Distribution of Farmers by Household Size

Household Size	Cassava Based Crop Farmers		Fish Farmers	
	No.	(%)	No.	(%)
0 - 5	76	63.3	71	88.8
6 - 10	36	30.0	9	11.2
11 - 15	8	6.7	0	0.0
Total	120	100	80	100

Source: Field Data, 1995

Also 89% of the Fish Farmers also belonged to this household size.

The availability of family labour for farm work depends in no small way on the household size. Participation in farm activities by the members of the household depends also on the opportunity cost and age structure of the household (Olomola, 1986).

The low-size of the households might be responsible for the greater use of hired labour by the rural farmers (Mbanasor,1991).

4.2 Production Activities of the Farmers

The average production and resource employment pattern by both crop and fish farmers, within the periods under-investigation, are shown in Tables 4.5 and 4.6 respectively.

Table 4.5 Average production and Resource Employment Pattern of Crop Farmers Before and During SAP

Items	Before SAP 1	During SAP 2	Percentage Change
Land Under Cultivation (Ha.)	2.04	2.86	40.2
Employment of Labour (Mandays)	442.7	536.5	21.2
Modern Inputs Used (N) Fertilizer Herbicides / Pesticides Improved Planting Materials	 {274.4} {44.1} {387.5}	 {3932.2} {147.9) {660.1}	 571.4
Value of Local Input (N)	606.7	348.4	42.5
Other Investment Expenses (N)	2082.8	5515.2	154.8
Gross Value of Output (N)	10,022.9	138,961.7	1286
Average Exchange Ratio	$1: N100	$1: N86	

Sources: 1. Derived from Secondary Data
2. Field Data.

The farm resources considered are cultivated farm size, labour, value of modern inputs used, value of Local inputs and other investment expenses as previously defined.

Since SAP, cassava based crop farmers (CBCF), on the average utilized relatively more farm resources than before SAP. When the levels of resource use of the later were expressed as percentages of those of the formers, cultivated farm size increased by 40.2%; labour use 21.2%; value of modern inputs 571.4%; while other investment expenses stood at 154.5%.

However, the only exception was in the use of local inputs which was more abundantly employed by the crop farmers before the inception of SAP (-42.5%).

Table 4.6: Average production and Resource Employment Pattern of Fish Farmers Before, and During SAP

Items	Before SAP	During SAP	Percentage Change
Farm Size (Ha.)	0.09	0.4	344
Labour Use (Manday)	138.9	177.4	28
Value of Modern Input (N) Fertilizer Feeds Fingerlings Medication	 {191} {867.4} {388} {43.9}	 {3212.1} {6387.1} {3987} {771.9}	853.4
Value of Local Inputs (N) (Poultry Manure/Cow Dung)	277.8	730.1	522
Other Investment Expenses Depreciated Fixed Assets (N) Interest on Loans (N)	 {1007.6} {252.5}	 {2119.6} {763}	 129.8
Gross Value of Output	22,268.5	71.672	221.9

Source: Field data ,1993-1995.

Fish farmers, on the average, also used relatively more resources during SAP than before SAP (Table 4.6). When the levels of resources of the later were expressed as percentage increase of the former, farm size increased by 344%, Labour use, 28%, Value of modern Inputs 853.4%, Value of local inputs 522% while, other investment expenses increased by 129.8.

The farmers realised higher value of gross output during SAP. The gross output value of the farmer was more than eight times that of before SAP.

The higher resource utilization by the two sets of farmers during SAP is in consonance with apriori expectations. Before SAP, agriculture was stagnant, constrained by low producer prices, restrictions on marketing and the drought of the early eighty. Since SAP period, the real depreciation of the Naira improved producer prices, while the elimination of marketing boards and the liberalization of trading had a very positive impact on a variety of food production including fish (Zanini, 1994).

The revival of crop based mixtures and fish farming was boosted since SAP by the adoption of improved inputs which were not possible before SAP, due to depressed demand and lower prices for their products.

This finding contradicted Nwosu (1991) and the fears of Aluko (1987), that increased costs of improved farm inputs like fertilizer, agrochemicals could lead to their under utilization. It was rather observed that SAP engendered increased use of modern farm inputs in both fish and crop enterprises. The problem resulting from price increases was identified to be that of procurement rather than that of under utilization.

However, the findings of Nwosu (1991) and Aluko (1987) might be applicable to large-scale farming, unlike in small-scale farming which this study investigated.

4.3 Average Trend in output/ha. of Cassava Based Crop Mixtures Before and During SAP

The average trend in output of crops in the cassava-based crop mixtures is indicated in Table 4.7. The result showed that, with the exception of melon, all the other crops in the mixture experienced increases in output level before SAP. For instance, cassava's output/ha rose from 3.1mt. in 1983 to 3.3mt. in 1984 while maize yield in the same mixture, increased from 0.23mt. in 1983 to 0.27mt. in 1984. Between 1984 and 1985, all the crops in the mixture experienced increases in their output levels with the exception of melon, whose output declined further from 0.14mt/ha. to 0.12mt./ha.

The result further revealed that even though most of the crops in the mixture experienced increases from 1983 to 1985, their growth rates in 1985 were far below those of 1984 levels. For example,whereas the growth rates for cassava, maize and vegetables in 1984 were 7.9%, 17.3% and 25%, respectively, their growth rates in 1985 were 7.3%, 3.7% and 5% respectively This general declining growth rates might be part of the reason for the introduction of SAP.

Table 4.7: Average Output\Ha And Growth Rates of Cassava Based Crop Mixtures In South Eastern Nigeria Before , and During SAP (Tonnes)

Period	Cassava		Maize		Vegetables		Melon	
	Qty.	Growth Rate %	Qty.	Growth Rate %	Qty.	Growth Rate %	Qty.	Growth Rate %
Before SAP1								
1983	3.06	-	0.23	-	0.16	-	0.16	
1984	3.30	7.9	0.27	17.3	0.20	25	0.14	-12.5
1985	3.54	7.3	0.28	3.7	0.21	5	0.12	-14.3
During SAP2								
1993	6.23	-	0.40	-	0.32	-	0.16	-
1994	6.52	4.7	0.47	17.5	0.39	18	0.18	12.5
1994	7.06	8.3	0.50	25.5	0.49	25.6	0.17	-5.5

Sources: 1. Derived from ADP
2. Field Data, 1993 - 1995

The situation during SAP period was a mixed one as shown in Table 4.7. The result showed that between 1993 and 1994, the average output of most crops in the cassava-based crop mixtures increased. However, in 1995, with the exception of melon that declined in the average output per hectare all the rest showed increases. Between 1993 and 1994, there were positive growth rates, for example cassava had 4.7%, maize 17.5% vegetables 18%, and melon 12.5%.

These positive rates continued between 1994 and 1995, with the exception of melon that had a negative growth rate.

4.3.1 Impact Analysis of Cassava-based crop Mixtures within the periods

Table 4.8 showed that the output per hectare of cassava-based crop mixtures (CBCM) in the SAP era were higher than their pre SAP average output per hectare. For example, average output levels of cassava, maize, vegetables and melon rose from 3.3mt, 0.26mt, 0.19mt, and 0.14mt, respectively, in the pre-SAP to 6.60mt, 0.49mt, 0.40mt and 0.17mt, respectively, during SAP.

The average growth rates indicate two patterns. For cassava, its growth rate during SAP was lower than before SAP growth rate. The second pattern was that the average growth rates of maize vegetables and melons, which were 21.5%, 21.8% and 3.5% respectively , were higher during SAP, than their corresponding growth rates prior to SAP. Nevertheless, Table 4.8, shows that the outputs of cassava-based crop mixtures in the SAP period have risen compared to the pre-SAP output levels. Cassava increased by 100%, maize by 88.5%, vegetables by 110.5% and melon by 21.4%.

The t-test analysis showed that the increase in the average output levels of cassava, maize and vegetables in the CBCM during SAP were statistically significant at the 5% level over their pre-SAP period while that of melon was not significant.

These findings showed that the measures which were introduced during the SAP period

might have contributed significantly to the increases in the average output per hectare of CBCM. Such measures, according to Eluagu (1995) and NISER (1992) included government programmes such as the Directorate of Food, Roads and Rural Infrastructure (DFRRI). The construction of rural roads by DFRRI contributed to the minimisation of transportation constraint encountered by rural farmers. Also the National Directorate of Employment (NDE) provided willing farmers with soft loans. Furthermore, the urban to rural migration of able bodied men, as a result of retirements, retrenchments and unemployments, might have also influenced positively the increases in output levels per hectare as most of them were absorbed into various agricultural programmes provided by SAP. Other factors which might have contributed included provision of improved planting materials and relatively higher prices for agricultural products.

Table 4.8: Impact of SAP on Cassava Based Crop Mixtures

Cassava Based Crop Mixtures	Pre-SAP (1983 - 1985)		SAP (1993 - 1995)		Change	Diff. in % Change	T-test
	Av. Output (Mt.)	Av. Growth Rates	Av. Output (Mt.)	Av. Growth Rates			
Cassava	3.30	7.6	6.60	6.5	3.30	100	10.58*
Maize	0.26	10.5	0.49	21.5	0.23	88.5	3.97*
Vegetables	0.19	15.0	0.40	21.8	0.21	110.5	3.98*
Melon	0.14	-13.4	0.17	3.5	0.03	21.4	2.14^{NS}

Sources: 1. Derived from ADP Records
2. Field Data, 1993 - 1995
* Significant at 5%
NS Non - Significant

4.3.2 Output Trend in Rural Fish Enterprise Prior to, and During SAP

The average output per farmer for rural Fish production and annual growth rates within the periods are shown in Table 4.9. The table showed that, between 1983 and 1985 which constituted the non-SAP years, the average output per fish farmer, was generally on the increase but with decreasing growth rates in all the years.

The pattern of output of production during the SAP years (1993 - 1995) was different from that of the non-SAP years. For instance, average output was 2.2mt, 2.52mt and 2.96mt in 1993, 1994 and 1995 respectively while non-SAP years had 1.26mt, 1.46mt, and 1.5mt. respectively in 1983, 1984 and 1985.

Though the growth rates were generally on the increase within the periods, that of the SAP were increasing at an increasing rate.

Table 4.9 Average Trend in Output of Rural Fish Farmers in South Eastern Nigeria

Periods	Qty (Mt.)	Grwoth Rates (%)
Pre-SAP		
1983	1.26	-
1984	1.46	15.9
1985	1.54	5.5
During SAP		
1993	2.20	-
1994	2.52	14.6
1995	2.96	17.5

Sources: 1. Derived from Secondary Records
2. Field surveys, 1993 - 1995

4.3.3 Impact Analysis of Rural Fish Farming Before and During SAP

The significant differences in average output per farmer between the two periods are summarised in Table 4.10

Table 4.10 Impact Assessment of Rural Fish Enterprise Before and During SAP (Mt.)

Before SAP		During SAP		Difference		T- Value
Average Output (mt.)	Average Growth Rate %	Average Output (Mt.)	Average Growth Rate %	Change	Change (%)	
1.42	10.7	2.56	16.1	1.14	80.3	4.60*

Key * Significant at the 5%
Sources: 1. Derived from Past Records
2. Field survey, 1993 - 1995

The result presented in table 4.10 showed that the average growth rate of fish output from rural farming, increased from 10.7% before SAP ,to 16.1% during SAP.

In order to establish a statistical validity between the average output of fish farming during the two periods, t-test was conducted. The result obtained (Table 4.10) indicated that the difference between the two periods was significant at the 5% level. The result of this finding is in agreement with the aproiri expectations, which is inconsonance with CBN (1993) and NISER (1992), which reported increases of 5% and 57.8%, respectively.

On the other hand, other modes of fish production such as artisanal, inland, industrial, coastal shrimp and distant water showed decreases during SAP (Eluagu, 1995, NISER 1992). The decline in these other modes of fish production may be attributed to the exchange rate deregulation of the Naira, resulting in significant increases in the prices of fish inputs for these modes of production. The inputs included boat engines, fishing nets and other inputs which are normally imported.

Furthermore, tariffs imposed on the imported inputs compounded the prices problem. For instance, tariff rate on fishing nets increased from 33.3% prior to SAP, to 90% during SAP (NISER, 1992). But in Fish farming, the implementation of SAP measures encouraged the use of improved fingerlings, efficient use of resources, and the shifting to local sources of improved inputs. This positive performance of rural fish farming might be partly because some other key reforms improved the incentive structure, and partly because regulations and distortion did not adversely affect their performance.

4.4 Relationships Between Outputs of the Two Enterprises and Selected Socio-Economic Variables

As elucidated in the methodology, this analysis is based on the belief that the selected socio-economic variables, namely farm sizes (C1), income (C2), farming experience (C3), age (C4), educational attainment (C5), occupation (C6), and household size (C7) had some relationships with the farmers output (y).

4.4.1 Cassava based crop mixture: (CBCM)

The result of the correlation matrix for CBCM is shown in Table 4.11. The result shows that all the socio-economic variables chosen were positively correlated with output. However, only four variables were significantly correlated with the farmers output. These were farm size, income, educational attainment and occupational status of the respondents. Farm size had the highest associated with the yield of CBCM, out of all the selected variable with a correlation coefficient of 0.7186, and it was significant at one percent level.

Table 4.11: Correlation Matrix Showing the Relationship Between Cassava-Based Crop Output and Socio-Economic Variables.

	y	C_1	C_2	C_3	C_4	C_5	C_6	C_7
y	1.0000							
C_1	0.7186**	1.0000						
C_2	0.1719*	0.1557*	1.0000					
C_3	0.0206	-01496*	-0.0860	1.0000				
C_4	0.0235	-0.0801	0.0204	0.5107	1.0000			
C_5	0.2135*	0.1536*	-0.0845	0.2679*	0.0406	1.0000		
C_6	0.1806*	0.0595	-0.0890	0.0345	0.0368	0.248	1.0000	
C_7	0.0096	-0.1505*	-0.425	0.3141	0.3263	0.0395	-0.1184	1.0000

Note: ** Indicates coefficients that are significant at one percent
*** Indicates coefficients that are significant at 5% level**

This was followed by educational attainment which had a correlation coefficient of 0.2135. The occupational status of the respondents had 0.1806, while income exerted the least among the significant coefficients with 0.1719. Though, the rest of the socio-economic variables exerted positive relationship with the output of CBCM, they were found to be insignificant.

The implication of these findings is that an increase in the level of all the socio-economic variables chosen would most probably increase the level of output of CBCM. The highest influene exerted by farm size suggestd that it was the most important variable for increased production level of cassava based crop mixtures. The relatively high influence exerted

by the level of educational attainment also has policy implications. It showed that education was imperative in understanding the use of technologies and strategies in the production of this enterprise.

4.4.2 Fish farming

The correlation matrix of the specified socio-economic variables and output of rural fish enterprise is presented in Table 4.12.

In the case of fish farming all the variables were not positively related to output. Pond size (C1) had the highest influence on fish output, out of all the specified variables with a correlation coefficient of 0.358, and was significant at the one percent level. This was followed by farming experience which had a correlation coefficient of 0.207 and was significant at the 5% level. Farmers age and income each had a positive correlation coefficient but was not significant at the five percent level.

Table 4.12: Correlation Matrix Showing the Relationships Between Fish Output and Selected Socio-Economic Variables.

	y	C_1	C_2	C_3	C_4	C_5	C_6	C_7
y	1.0000							
C1	0.3358**	1.0000						
C2	0.102	0.092	1.0000					
C3	0.207*	0.317**	0.105	1.0000				
C4	0.092	-0.162	-0.160+	1.0000				
C5	-0.017	-0.217*	0.203*	-0.124	-0.164+	1.0000		
C6	-0.021	-0.041	-0.143	0.104	-0.1928	0.035	1.0000	
C7	-0.044	-0.051	-0.234**	-0.033	0.325**	-0.131	-0.199	1.0000

Note: * Significant at 5% level
**** Significant at 1% level**
\+ Significant at 10%

However, educational attainments, household size and occupational status had negative relationships with output.

The implications of these findings suggest that icreases in the variable that exerted positive influence would most probably increase the level of fish output. The correlations of the specified variable on fish output were generally low. The higher influence exerted by pond size indicated that pond size is indispensable in rural fish enterprise. It is also worthy of note, that in fish farming, experience counted more than educational attainment. This has implication for institutional support. The use of educational certificates in the granting of loans to fish farmers

by the National Directorate of Employment, should be reconsidered. In its place, experience would be a better option, for increased performance.

4.5 Production Efficiency Analysis

In an attempt to examine the production behaviour of the farmers prior to and during SAP in details, two econometric models were estimated. The first one was with respect to non-SAP data, while the second one was with respect to SAP data. Two case studies were used, namely, cassava based crop enterprise and rural fish farming. Each of the models was estimated using linear,semi-log and double log functional forms.

4.5.1 Econometric Estimation of Production Efficiency of Cassava based crop farmers Before and During SAP

The R^2 and the value of the F - ratios were used to select between the s ingle equation models. However the appropriateness of signs, significance of coefficients and economic consideration were also taken into account in the choice of functional forms. There was no serious econometric problems. The result presented in Table 4.13, shows that each of the estimated equations provided a good fit. Indeed a "better" fit was obtained from the functions of SAP period than that of non-SAP era. The coefficients of multiple determination from linear, semi-log and double-log (power) function indicated that 48%, 52% and 49%, respectively, of the variations in gross value of output of SAP data were explained by the independent variables. While 41%, 32% and 33%, respectively of the variations in the gross

value of output of non-SAP data were explained by the explanatory variables included in the model. In the linear function, all the coefficients have the expected positive signs except farm size which had negative sign during SAP era. Similar pattern was also observed in the signs of the coefficients both in the semi-log and power functions, except in that of farm size within SAP period.

It could be observed that almost all the fitted equations indicated that local material input was not a significant variable in explaining the variations in the gross value of output. The functions showed that modern material input, labour and other investment expenses were the more important explainant within the periods studied.

Table 4.13: Coefficents off Estimated Production Function with Gross Value of Output as Dependent Variable for Cassava-based crop Enterprise.

Functional Forms	Constant	Farm Size	Labour	Modern Inputs	Local Inputs	Other Expenses	R2	DW	F-ratios	
Linear										
SAP Era	-858.2873	-4138.60	153.49**	.0011	3.97+	.7980+	.48	1.92	1%	
		(1218.38)	(58.91)	(.0033)	(2.14)	(.4774)				
Non SAP Era	1243.0784	869.35	3.65	2.75**	1.16	1.44**	0.41	1.70	"	
		(542.56)	(2.32)	(0.85)	(0.78)	(0.48)				
Semilog										
SAP Data	-728817.79	-57609.34	112447.57	13979.60	-1618.13	4787.11	0.52	2.09	"	
		(35366.07)	(34051.74)	(3114.59)	(2039.99)	(3304.71)				
Non-SAP Data	-16700.19	520.06	1547.85*	957.21**	818.48	686.71	0.32	1.67	"	
		(1039.32)	(939.88)	(321.71)	(621.87)	(458.89)				
Power Function										
SAP Era	0.56	-0.56	1.36**	.1977**	-.0061	.0905	0.49	2.01	"	
		(0.54)	(0.52)	(.0506)	(.0311)	(.0505)				
Non SAP Era	6.09	0.26+	.0835	.1430**	.1116	.0905	0.33	1.85	"	
		(0.15)	(.1385)	(.0474)	(.0916)	(.0676)				

Note: **Figures in brackets are standard errors.**
** **Significaut at 1%**
* **Significaut at 5%**
+ **Significant at 10%**

4.5.1.1 Technical Efficiency of Cassava Based Crop Farmers Prior To, and During SAP

A farmer in any of the two periods is technically more efficient, if he consistently produces larger output given the same quantities of resources within the periods (Onyenweaku *et al*, 1995). The result of the estimated production function is presented below, using the power function as the lead equation.

$$\ln Y_1 = \ln 6.09 + \underset{(0.1531)}{0.2568^{*}}\ln P_1 + \underset{(0.1385)}{0.0835}\ln P_2 + \underset{(0.0474)}{0.1430^{**}}\ln P_3 + \underset{(0.0916)}{0.116}\ln P_4 + \underset{(0.0676)}{0.0905}\ln P_5 \quad (1)$$

$$(1 = \text{Pre-SAP},\ R^2 = 0.33,\ n = 120,\ e^2 = 27.23)$$

$$\ln Y_2 = \ln 0.56 - \underset{(0.54)}{0.56}\ln P_1 + \underset{(0.52)}{1.3632^{**}}\ln P_2 + \underset{(0.0506)}{0.1977^{**}}\ln P_3 - \underset{(0.0311)}{0.0064}\ln P_4 + \underset{(0.0505)}{0.0905}\ln P_5 \quad (2)$$

$$(2 = \text{during SAP},\ R^2 = 0.49,\ n = 120,\ e^2 = 24.75$$

$$\ln(Y_1 + Y_2) = \ln 5.08 + 0.3557\ln P_1 + 0.1216\ln P_2 + 0.3693\ln P_3 -$$
$$(0.1586) \quad (0.1450) \quad (0.0247)$$

$$0.0657\ln P_4 + 0.1970\ln P_5 \quad (3)$$
$$(0.0321) \quad (0.0433)$$

$$(3 = \text{Combined period}, \quad R^2 = 0.82, \quad n = 240, \quad e^2 = 69.$$

Where

**	=	Significant at the 1% level
*	=	Significant at the 5% level
+	=	Significant at the 10% level
$Y_1 + Y_2$	=	Pooled sample
R^2	=	Coefficient of Multiple determination
1	=	Pre - SAP
2	=	During SAP
n	=	Number of Observations
e^2	=	Residual sum of Squares

The result presented in table 4.14 shows the test of significance between the two period. It showed that the F-ratio of 12.47 was statistically significant at both the 1% and 5% levels. The result further showed that the coefficients of the fitted equations were not equal, implying that there was significant difference in the production behaviour of the farmers within the two periods. This shows that there was a change in the technical efficiency. It could be inferred that the underlying production functions within the two periods did not belong to the same

population. It further indicated that cassava based crop farmers were technically more efficient prior to SAP than during SAP, following the size of the constant term which was found to be higher before SAP than during SAP, with 6.09 and 0.56 respectively, (Koutsoyiannis, 1979 and Olomola, 1988).

Table 4.14: Chow Test of Difference Technical Efficiency of Cassava Based Crop Farmers Before and During SAP Eras

Estimated Model	Oberved Variance	Critical Value	
$Y = f(P_1, P_2, P_3, P_4, P_5, e)$	F *	F 0.01	F 0.05
	12.47	2.80	2.10

4.5.1.1.1: Maginal value products

The marginal value products of the resources were also used in consolidating the relative technical efficiency of the farmers within the periods (Onyenweaku *et al* 1995).

The MVP could assume a positive or negative sign depending on how resources are being used. The result is presented in Table 4.15.It showed that the marginal value productivities of farm size, modern inputs, and local inputs were higher for Non-SAP period than for SAP period.

On the other hand, the marginal value productivities of labour and other investment expenses were higher for SAP era than for non-SAP era. This finding is a further indication of the basic differences in the production behaviour between the periods. The negative marginal

value productivities of farm size and local inputs of the respondents during SAP further indicated that the production methods were technically better prior to SAP, than during SAP.

Table 4.15: Marginal Value Products of Resources Before SAP and During SAP for Cassava Based Crop Farmers

Resources	SAP Period	Non-SAP Period
Farm	-17111.19	1210.0
Labour	151.40	1.86
Modern Inputs	0.79	2.96
Local Inputs	-1.03	0.95
Other Invests. Expenses	1.23	0.82

Source: Field Surveys 1993 - 1995

It could be concluded that the farmers within the periods did not belong to the same regression model and hence their overall production relationship differed significantly. In otherwords, the farmers were technically more efficient prior to SAP than during SAP.

4.5.1.2: Allocative efficiency of cassava-based crop farmers prior to, and during sap

Table 4.16 contained the result of fitting the SAP and Non-SAP equations as already defined. For the various resources included in the model, the opportunity costs used were the average market prices that prevailed during the periods. The per hectare opportunity costs of SAP and Non-SAP periods were N750 and N120, respectively. The average prevailing rate of

interest used to obtain the opportunity cost of capital and other inputs (10% for Pre-SAP and 13% for SAP era). Similarly, the opportunity costs of hired labour were N12 per manday before SAP and N85 per manday during SAP. As a test of allocative efficiency, the ratio of marginal value products to marginal factor costs was computed

Table 4.16: Ratios of Marginal Value Products to the Marginal Factor Costs of Resources Within the Two Periods.

Resources	SAP Era	Non-SAP Era (Closer 1)
Farm Land	-22.82	10.08
Labour	1.78	0.16
Modern Inputs	0.70	2.65
Local Inputs	-0.91	0.86
Other Investments (Expenses)	1.13	0.75

Source: Field Surveys 1993 - 1995

Table 4.16 shows that the farmers did not achieve any absolute allocative efficiency in the use of resources within the period studied.

The farmers were found to be allocatively more efficient in the use of farm land, and local inputs before SAP than during SAP. Similarly, they were more efficient in the use of labour, modern inputs and other investments during SAP than before SAP. The difficulties identified in increasing farm land since SAP, may have resulted in the inefficient use of this resource. Also, the relative low price of local inputs when compared to the modern inputs, may have resulted in their inefficient use during SAP.

The result further revealed that the farmers under utilized farm land and modern inputs, while being excessive in the use of labour, local inputs and other investments before SAP. On the other hand, they were excessive in the use of modern inputs during SAP while under utilizing labour and other investment expenses within the same period.

The excessive use of modern inputs may be attributed to wrong notion by farmers that the excessive use of modern inputs in isolation of other factors would improve their fortune in cassava based crop enterprise. The under utilization of labour and other investments could be attributed to SAP policy measures which realigned the exchange rate by raising the hitherto low priced inputs and wage rate beyond the reach of the rural farmers.

4.5.1.2.1: Requirements in allocative effciency of resource under SAP

Table 4.17 showed that there was no perfect or maximum allocative efficiency within the two periods, since the percentage requirement for any of the resources was not zero. In other words, the specified resources were either being over utilized or under utilized by the farmers within the two periods studied.

The result further indicated that the farmers needed to increase their farm size, labour, local inputs and other investments by 144%, 44%, 210% and 8%, respectively, and reduce their use of modern inputs by 43% inorder to achieve maximum allocative efficiency during SAP.

The implication of this finding is that there is still possibility of increasing the profitability of this enterprise under SAP measures, through the achievement of maximum allocative efficiency.

Table 4.17: Percentage Requirements in Allocative Efficiency of Resource Use by Cassava Based Crop Farmers Before and During SAP

Resources	SAP Era (%)	Non-SAP Era (%)
Farm Size	104	90
Labour	44	-545
Modern Inputs	-43	62
Local Inputs	210	-16
Other Invests. Expenses	12	-34

Source: computed from field data, 1993 - 1995

4.5.1.3 Economic efficiency of the cassava based crop mixtures within the two periods.

Here the profit function approach was adopted as elucidated in the methodology. The estimated form of the equation is presented below:

$$\ln\Pi = \underset{(0.3860)}{2.5975} + \underset{(0.1307)}{0.5746D} + 0.6184^{**}\ \ln WR + \underset{(0.1390)}{0.1173FS} + \underset{(0.0489)}{0.1403\ln IE} \quad (4)$$

where

$\ln\Pi$ = Profit per farm in Naira

D= Dummy (1 = Pre-SAP, 2 = during SAP)

lnWR = Money Wage Rate in Naire per manday

lnFS = Farm size

ln1E = Other Investment expenses

R^2 = 0.82

n = 240

Durbin Watson = 1.86

F = significant at 1%

The result showed that wage rate, farm size, and other investment expenses accounted for 82% of the variations in the farmers profit, in this enterprise. The coefficient of the dummy variable was positive but statistically non-significant at the 5% level, implying that the profit function had almost equal intercept terms for the periods. The result suggested that the SAP measures had not significantly improved the economic efficiency of the cassava based crop farmers.

4.5.2 Econometric Estimation of Production Efficiency of Rural Fish Farmers

The result presented in Table 4.18 shows that the three functional forms adequately characterized the empirical data, as indicated by the significance of F ratios and the Value of the coefficient of multiple determination (R^2).

The combined use of the simple correlation coefficient, the adjusted coefficient of multiple determination and the standard errors of the estimates indicated that there were no serious econometric problems. The Durbin-Watson statistics also showed no autocorrelation problem.

The R^2 from the linear, semi-log and power functions of SAP data showed that 52%, 37% and 39% respectively, of the variations in gross value of output of rural fish farmers were explained by the explanatory variables included in the model. The regression coefficients have the expected positive signs and those that were statistically significant were shown in Table 4.18.

However, the coefficient of local inputs was not significant in all the forms and have negative signs in semi-log and power functions.

Similarly, the R^2 from the Linear , semi-log and power functions of non-SAP data showed that 14%, 36% and 23% respectively of the variations in the gross value of output of the respondents were explained by the explanatory variable specified in the model. Though the value of R^2 was low for non-SAP era the value was found to be significant. A test of the overall significance of the model, using F-test, showed significance, implying that the regression is significant, i.e not all the regression coefficients were zero. This means that the explanatory variables actually had significant influence on the value of the output. It might be noted that R^2 value tend to be low in cross-sectional data and in whole farm analysis due to large

variability that is possible accross the individual entities and lack of a common underlying trend (Nwosu, 1991; Intriligator, 1978)

For further analytical purposes the power function provided the lead equation. The choice was based not only on the value of R^2 but on the appropriateness of signs and significance of coefficients. Economic considerations also influenced the choice. For instance, the linear function did not behave well in non-SAP era with R^2 being 0.14, even when it had the highest R^2 value during SAP. Moreso, it could not give an indication of the nature of returns to scale among the respondents. This decision is supported by Olayide and Heady (1982). The power function recommended itself as well, on the ground of computational feasibility. This analysis was carried out on per farm basis rather than per hectare since it would restrict the power function estimates to constant return to scale. (Sahota, 1963).

Table 4.18: Coefficients of Estimated Production function Models with Gross Value of Output as Dependent Variable in Fish Farming

Functional Forms	Constant	Farm Size	Labour	Modern Inputs	Local Inputs	Other invest. Expenses	R^2	DW	F-ratio	
Linear										
SAP Data	33880.88	-18815.96	48.77*	2.52**	1.45	2.46*	0.52	2.2		
		(25331.65)	(23.24)	(0.47)	(2.64)	(1.20)				1%
Non-SAP Data	10599.41	-418.41	6.96	.1960	.8901+	0.9696	0.14	1.4		"
		(14485.82)	(5.16)	(.1050)	(.5435)	(.8074)				
Semi-log										
SAP Data	-739510.43	36.77	31190.95	52855.82	-6865.52	28180.59	0.37	1.96		"
		(9033.82)	(13392.19)	(15960.13)	(11509.75)	(10893.19				
Non-SAP Data	-81392.19	562.95	3245.10+	7564.82	1500.08	1772.45	0.36	1.6		"
		(1235.09)	(1861.26)	(1441.79)	(1387.21)	(191.98)				
Power Function										
SAP Data	5.96	0.0498	.2288**	.2458*	-.0314	.2664**	0.39	1.79		"
		(.0596)	(.0884)	(.1053)	(.0760)	(.0719)				
Non-SAP Data	3.8	.0953	.1376	.3340**	.0960	.2610+	0.23	1.8		"
		(.0941)	(.1418)	(.1099)	(.1057)	(.1457)				

Note: Figures in brackets are standard errors

** Significant at 1%

* Significant at 5%

+ Significant at 10%

4.5.2.1: Test of differences in technical efficiency of rural fish farmers within the two period.

To identify whether the farmers differ significantly on technical efficiency prior to and during SAP, Chow (1960) test of equality was performed. The result is presented in Table 4.19.

Table 4.19: Chow Test of Differences in Technical Efficiency of Rural Fish Farmers Prior to and During SAP

Estimated Models	Oberserved Variance Ratio	Critical F - Value at 1% and 5% Levels of Significance	
	F *	F 0.01	F 0.05
$Y = f(P_1, P_2, P_3, P_4, P_5, e$	4.40**	2.80	2.10

** Highly Significant at 1%

The result of the test rejected the hypothesis of equal technical efficiency. In other words, the coefficients of the fitted equations were not equal, i.e there was change in technical efficiency between the two periods.

From the theory of production, it was noted that the more technically efficient period would have a larger constant term than the less efficient one (Koutsoyiannis, 1979; Onyenweaku 1986). One could, therefore, infer that the farmers were more technically efficient during SAP than prior to SAP. The constant term (5.9) in the estimated model for SAP period was higher than that of non-SAP era (3.8) (Table 4.18).

Increased technical efficiency of fish farmers under SAP might be attributed to the reduced subsidies prevalent during the period and the high cost of inputs, which might have

caused the fish farmers to be more technically efficient. It could also be stated from this study, that SAP was able to engender increase in the production efficiency of fish farmers. The finding of this report supported the government objective in withdrawing/reducing subsidies under SAP. All the same, this result might not be applicable to other modes of fish production, which decreased during the period (CBN/NISER, 1991).

4.5.2.2: Comparative allocative efficiency of rural fish farmers prior to, and during SAP

The relative allocative efficiency of the farmers in the use of resources prior to and during SAP, was based on the neo-classical requirement that each factor be paid equal to its Marginal Value product (MVP). As a test of allocative efficiency, the ratio of Marginal Value Product (MVP) to Marginal Factor Cost (MFC) was computed.

The MFC or the opportunity cost of ponds within the two periods was used (N450 before SAP, and N1500 during SAP). The average rate of interest (10% for Pre-SAP, and 13% for SAP) was used to obtain the opportunity cost of capital and other inputs, while labour was N86 and N12, during, and non-SAP eras respectively. The result is presented in Table 4.20.

Table 4.20: Ratios of Marginal Value Product (MVP) to the Marginal Factor Costs (MFC) of Resources within the Two Periods.

Resources	SAP Era	Non- SAP Era
Pond	12.41	53.99
Labour	1.09	0.91
Modern Inputs	1.00	1.82
Local Inputs	-1.66	0.56
Other Investments	6.89	2.30

Source: Field Survey, 1993 - 1995

As could be observed from table 4.20, the farmers on the average were allocatively more efficient in the use of ponds, labour and modern inputs during SAP than Pre-SAP periods. They were however inefficient in the use of local inputs during the period.

The farmers were, on the other hand, allocatively more efficient in the use of local inputs and other investments before SAP. The results also showed that, with the exception of modern inputs, the fish farmers under utilized ponds, labour and other investments during SAP. Similarly, they under-utilized ponds, modern inputs and other investments while over utilizing labour and local inpts, before the introduction of SAP.

4.5.2.3: Maximum percentage requirements for allocative efficiency

The relative allocative efficiency was calculated according to Mijindadi (1980) and was elucidated in the methodology. The result is presented in table 4.21.

The table showed that the fish farmers would need to increase their use of ponds, labour, other investments and local inputs by over 92%, 9%, 86% and 15% respectively inorder to achieve maximum allocative efficiency in the use of these resources during SAP.

Table 4.21: Percentage Requirements in Attaining Allocative Efficiency by Fish Farmers During the Periods.

Resources	SAP Era (%)	Non - SAP (%)
Ponds	92	98
Labour	9	-10
Modern Inputs	0	45
Local Inputs	156	-80
Other Investments	86	57

Source: Field survey, 1993 - 1995

The findings of this study showed an improvement over non-SAP era, which might have accounted for the profitability of this mode of fish production, unlike other modes of production (NISER, 1992).

The implication of these values suggest that there still exist the possibility of increasing production profitably, under the existing level of technology within SAP through the use of

higher levels of ponds, labour, other investments and local inputs, while maintaining costant the present level of use of modern inputs. The results showed that the introduction of SAP measures has improved the allocative efficiency of rural fish farmers.

4.5.2.4: Relative Economic Efficiency of Rural Fish Farming prior to, and During SAP

In order to determine the relative economic efficiency between the two periods, a model was fitted according to Onyenweaku and Fabiyi (1991), in which a profit function approach was adopted..The double log form provided the lead equation based on the value of R^2, F-ratio and significants of the coefficients. The estimated equation is presented below:

$$\ln\Pi = 4.7918 + \underset{(.3873)}{1.6699D^{***}} + \underset{(.0992)}{0.2433\ln WR}$$

$$+ \underset{(.0645)}{.1105^{*}\ln PS} + \underset{(.0852)}{.3610^{**}\ln OE}$$

where

lnII	=	Profit per farmer in Naira
D	=	Dummy (1 = Pre-SAP, 2 = SAP)
lnWR	=	Money Wage in Naira per Manday
lnPS	=	Pond Size (ha)
lnOE	=	Other Investments (N)
R^2	=	0.65
n	=	160
F	=	69.95
***	=	Significant at 1%
**	=	Significant at 5%
*	=	Significant at 10%
( )	=	Standard Error

The value of the coefficient of multiple determination (R^2 = 0.65) showed that 65% of the total variation in the farmers profit was accounted for by variations in wage rate, pond size and other investments. The coefficient of the dummy variable was positive and statistically significant at one percent level, implying that the profit function for non-SAP era has a higher intercept term than that of SAP era, thus suggesting a higher level of economic efficiency in SAP period.

4.5.3: Comparative analysis of the efficiencies of cassava based crop and fish enterprises During SAP

This section compared the technical, allocative and economic efficiencies between the two group of farmers.

4.5.3.1: Technical Efficiency Between the Two Enterprises Under SAP.

The main goal of the relative technical efficiency between the two group of farmers is to establish whether any distinct differences exist in the production behaviour of the two enterprises. The average product and marginal value product (MVP) of each resource were calculated at the geometric mean levels for both cassava-based crop farmers and fish frmers. The magnitudes and signs of the MVP were used to determine the differences in technical efficiency in the use of resources.

Table 4.22 shows that the marginal value productivities of pond/farm size, modern inputs and other investments were higher for fish farmers than for cassava-based crop farmers.

The foregoing is an evidence of basic difference in the production behaviour of the two sets of farmers.

The result further showed that the cassava based crop farmers were inefficient in the use of farm size and local inputs while the fish farmers were only inefficient in the use of local inputs, which indicates a better production methods over that of cassava based crop farmers.

Furthermore, the traditional theory of production stipulates that the more technically efficient enterprises will have a larger constant term than the less efficient (Koutsoyiannis, 1979), which was evident in this case. The constant term for the fish enterprise was 5.96 while that of cassava based crop enterprise was 0.56 within SAP period. This was an additional indication of better efficiency performance in the fish enterprise, apart from signs and magnitudes of marginal value products noted earlier.

The study showed that resources were more marginally productive in the fish enterprises than in the cassava based crop enterprises during SAP. It indicated that it would pay more for farmers to divert their resources to fish farming than to cassava-based crop enterprises.

Table 4.22: Marginal Value Products of Resources for Cassava Based Crop and Fish Enterprises During SAP

Enterprises	Farm / Pond Size	Labour	Modern Inputs	Local Inputs	Other Invest.	Constant Terms
Cassava - Based Crop Mixtures	-17111.19	151.40	0.79	-1.03	1.28	0.56
Fish Farming	18606.75	93.25	1.13	-2.01	7.79	5.96

Source: Derived from Field Data

4.5.3.2: Allocative Efficiency Between the Two enterprises During SAP

Table 4.23 shows the ratio of the MVP of each resource to its unit price or opportunity cost of using each resource during SAP.

Table 4.23: Ratio of Marginal Value Products to Marginal Factor Costs of Cassava Based Crop and Rural Fish Enterprises During SAP

Enterprises	Farm / Pond Size	Labour	Modern Inputs	Local Inputs	Other Invest.
Cassava - Based Crop Mixtures	-22.82	1.78**	0.70**	-0.91	1.13
Fish Farming	12.41	1.09**	1.00**	-1.45	6.89**

**** Significant at 1%**
Source: Derived from Field survey

Theoretically, the point of perfect allocative efficiency is that level where every Naira spent in acquiring an additional unit of a given resource into the production system, adds exactly one Naira to the revenue.

The result showed that the fish farmers were allocatively more efficient than the cassava-based crop farmers in the use of farms, labour and modern inputs, while the cassava based crop farmers were more efficient in the use of other investments. The two enterprises were inefficient in the use of local inputs within the period (SAP).

The result also showed that more of the resources were still under utilized by both farmers indicating possibility of profitably increasing output. However, the fish farmers had better allocative efficiency than cassava based crop farmers since the introduction of SAP.

4.5.3.3: Economic efficiency between the two enterprises during SAP

It was identified that in the cassava based crop enterprise, the coefficient of dummy variable had a higher intercept term than that of the fish enterprise. This showed that the rural fish enterprise has a higher level of economic efficiency than the cassava based crop enterprise.

4.6: Analysis of Relative Importance of Resources, Elasticities of Production and Returns to Scale Before, and During SAP For the Two Enterprises

4.6.1: Cassava based crop enterprise

This section examined the relative importance of resources, elasticity of production and returns to scale prior to , and during SAP with respect to cassava based crop enterprise.

4.6.1.1: Relative importance of resources in the value of output of the enterprise within the periods

As explained in the methodology, the beta coefficients formed the basis for ranking the specified resources in order to determine their relative importance in the value of output within the periods (SAP era and non-SAP era). The coefficients are shown in Table 4.24.

Table 4.24: Beta Coefficients and the Ranking of Explanatory Variables in Cassava-based Crop Enterprise Before and During SAP

Resources	SAP Era Beta Coefficients	Rank	Non-SAP Beta Coefficients	Rank
Farm Size	-0.3489		0.3147	2
Labour	0.8773**	1	0.1144	
Modern Inputs	0.2762**	2	0.2580**	1
Local Inputs	-0.0132		0.1047	
Other Invests:	0.1283	3	0	

** **Significant at the 1% level**
* **Significant at the 5% level**
+ **Significant at the 10% level**

Comparing the relative importance of the explanatory variables using their beta coefficients, it was observed that labour was the most important variable that affected the value of output since SAP, while modern inputs were the most important prior to SAP. Thus any improvement of this enterprise under SAP must be structured at both reduced cost and availability of labour. Next in importance within this era, were modern inputs and other investments respectively, thereby indicating their relevance in the profitability of cassava-based crop production within the study area.

The result also implies that policies aimed at increasing the use of modern inputs must ensure their availability at affordable prices. If the prices continue to be very high, then

their importance would be defeated. The mechanisation of certain stages of cassava based crop enterprise would be relevant in reducing the high cost of labour in the study area.

4.61.2: Elasticity of production of cassava based crop enterprise and returns to scale Prior to, and during SAP

The estimates of the elasticity of production of each resource and return to scale were obtained using the power function which was the lead equation. The result is presented in Table 4.25.

Table 4.25: Elasticity of Production of Cassava Based Crop Enterprise and Returns to Scale Before and During SAP

Periods	Farm (Size)	Labour	Modern Inputs	Local Inputs	Other Investments	Sum of Elasticity
SAP Era	-0.5591 (.5399)	1.3632** (0.5198)	0.1977** (.0506)	-0.0061 (.0311)	0.0905+ (.0505)	1.086
Non - SAP Era	0.2568+ (.1531)	0.0835 (.1385)	0.1430** (.o474)	0.1116 (.0916)	0.0905 (.0676)	0.685

Note: + Significant at 10%
** Significant at 1%
( ) Standard Errors

Source: Survey Data, 1993 - 1995

The result of the output elasticity in respect of each of the resources for non-SAP era was less than unity, thereby implying diminishing marginal returns to each of the resources. It could be observed that a change of one percent in farm size, labour, modern inputs, local inputs and other investments was associated with a change in the gross value of output by 0.26

percent , 0.08 percent, 0.14 perdcent, 0.11 percent and 0.09 percent respectively for pre-SAP era. With the positive and statistically significant coefficients, in the case of farm size and Modern inputs, the indication is that a one percent increase in farm size cultivated will on the average increase the gross value of output from 0.1037 to 0.4099. Similarly, the gross value of output will increase from 0.0956 percent to 0.1904 percent in response to a one percent increase in modern inputs, judging by the standard errors of the coefficients. The result indicates that the value of output was most responsive to modern inputs and farm size before the introduction of SAP.

The sum of the elasticities (0.685) is less than unity and in a power function, it is an indication of decreasing returns to scale.

For the SAP era, the result indicated that with the exception of labour, the other resources showed diminishing marginal returns to each of the resources. The elasticity coefficients indicated that a one percent change in labour modern inputs and other investments, other factors being constant in each case,was significantly associated with a change in the gross value of output of 1.3632, 0.1977 and 0.0905, respectively. From the signs and standard errors of the coefficients, it is implied that a one percent increase in labour, modern inputs and other investments would increase the gross value of output from 0.8434 to 0.883, 0.1471 to 0.7037 and 0.04 to 0.141, respectively.

On the other hand, the sum of the elasticities (1.086) being greater than unity is an indication of increasing returns to scale. This finding conforms with the assertion of Olayide and Heady (1982) that actual cases of increasing returns occur at relatively low levels of output that are prevalent in smallholder or rural farming. The significance of this finding is that higher outputs are feasible with an increase in the level of individual resources at the present level of technology.

4.6.2 Rural fish farming:

This section covers the result and discussion on relative importance of resources and output elasticiting of rural fish enterprise.

4.6.2.1 Analysis of the relative importance of resources in the value of rural fish output prior to and during SAP

The result presented in Table 4.26 shows the standardized partial regression coefficients, otherwise called beta-coefficients. These coefficients formed the basis for ranking the resources prior to SAP and during SAP, so as to determine the relative importance of each resource, within the two periods.

Table 4.26: Standardized Partial Regression Coefficients and the Ranking of Resources in Rural Fish enterprise Between SAP and Non-SAP Eras

Resources	SAP Era Beta Coefficients	Rank	Non-SAP Era Beta Coefficients	Rank
Pond Size	0.0832	4	.1103NS	3
Labour	.2673	2	.1018NS	4
Modern Inputs	.2535	3	.3323	1
Local Inputs	-.0423	5	.0964NS	5
Other Invest.	.3559	1	.1926NS	2

NS = Not Significant
Source: Computed from Field Data

Comparing the relative importance of the explanatory variables prior to, and during SAP, it was evident that modern inputs were the most important within the periods considering the magnitude and significants of the beta coefficients, though they ranked better prior to SAP than during SAP.

The relative low performance of this resource during SAP may be connected with their being more efficient since SAP. However, the significance of the variable within the two periods shows the indispensability of modern inputs in determining the value of output of rural fish enterprise in South -Eastern Nigeria. Also important in determining the value of fish output during SAP are the other investment expenses and labour. This appears plausible

in view of the components of other investments like interest rate on loan, premium on insurance and the depreciated value of the fixed assets. These variables were vital in determining rural fish farmers income. Labour was also significant because it was relevant in the management of other resources, especially modern inputs.

Local inputs like unimproved fingerlings were found irrelevant in determining the value of output of fish farmers, even their inclusion decreased the farmers income during SAP. This might be connected with their unimpressive size even under the best management techniques.

4.6.2.2 Elasticities of rural fish production and returns to scale prior to, and during SAP

Inorder to determine elasticity of rural fish production and its returns to scale, the power function was chosen as the lead equation following Olayide and Heady (1982), and Onyenweaku *et al* (1995). The result is presented in Table 4.27.

Table 4.27: Estimates of Factor-Product Elasticities in Fish Farming and Return to Scale During SAP and Non-SAP Periods.

Periods	Pond	Labour	Modern Inputs	Local Inputs	Other Invets.	Sum of Elasticities
SAP	.0498 (.0596)	.2288** (.0884)	.2458* (.1043)	.0314 (.0760)	.2664 (.0719	0.7594
Non - SAP	.1376 (.0941)	.1376 (.1418)	.3340** (.1099)	.0960 (.1057)	.2610+ (.1457)	0.9239

Note: Figures in Parenthesis are Standard Errors
** Significant at 1%
* Significant at 5%
+ Significant at 10%
Source: computed from field data

The result indicated that the output elasticity in respect of each of the resources was less than unity, thus implying diminishing marginal returns to individual resources. For instance a change of one percent in pond size, labour, modern inputs, local inputs and other investments holding in each case other factors constant, is associated with a change in the gross value of output of 0.05 percent, 0.23 percent, 0.25 percent, -0.03 percent and 0.27 percent respectively during SAP.

With the positive and statistically significant coefficients in the case of labour, modern inputs, and other investments, the indication is that a one percent increase in the use of labour will on the average increase the value of output from 0.1404 to 0.3172 percent. Similarly, the gross value of output will increase from 0.1405 to 0.3511 percent and from 0.1945 to 0.3383 in response to one percent increase in modern inputs and other investments respectively, judging by the standard errors of the elasticity coefficients.

The sum of the elasticities (0.7594) is less than unity and in a power function, it is an indication of decreasing returns to scale.

The result from the non-SAP era showed diminishing marginal returns to each of the resources. The elasticity coefficients indicated that a one percent change in modern inputs and other investments, holding in each case other factors constant, was associated with a change in the gross value of output of 0.3340 and 0.2610, respectively.

From the signs and standard errors of the coefficients, it is implied that a one percent increase in modern inputs and other investment expenses would increase gross value of output from 0.2241 to 0.4439 percent respectively. Similarly, the sum of the elasticities (0.9239) is less than unity, implying that the data set falls again within the domain of decreasing returns to scale.

The significance of these findings is that the rural fish farmers are within the rational area of production prior to, and during SAP where the ratio of the variable inputs to fixed inputs is high enough for profitable adjustments. However, SAP measures provided the appropriate incentives for profitable adjustments unlike the pre-SAP periods. As long as the MVP is greater than MFC, the farmers could still increase their production by the addition of more variable inputs to the fixed inputs. The result tends to support Chennareddy (1967) who noted that agricultural production would not only be increased simply by increasing all inputs in rural farming, but a rapid and massive development of agriculture could be achieved by breaking through the traditional state and introducing modern technology in a package. This package is provided under SAP in term of new inputs, agricultural extension programmes, soft loans, guidance in farm planning, skills and techniques, insurance scheme etc., which may have provided the better adjustments in this rational region of production.

4.7 Analysis of Costs and Returns Prior to, and During SAP and the Sensitivity of the Enterprises to Policy Distortions beyond SAP

4.7.1: Cassava-based crop enterprise

The results and discussions presented under this theme covered only cassava base crop enterprise as regards production costs and returns and the sensitivity of the enterprise beyond SAP.

4.71.1.1: Comparative analysis of production costs and returns of cassava-based crop enterprise before and during SAP

The comparative costs-returns analysis of cassava based crop mixtures (CBCM) is shown in Table 4.28. The result shows that the mixture was composed usually of cassava as the main crop in association with maize, vegetables and melons, prior to, and during SAP

Table 4.28: Comparative Average Costs and Returns data per Hectare of Cassava Based Crop Mixtures Before SAP and During SAP

Items	Pre - SAP			During SAP		
	Qty	Price Unit (N)	Value (N)	Qty	Price Unit (N)	Value (N)
Revenue						
Cassava (Mt.)	3.30	899.6	2968.68	6.1	4902.5	29905.25
Maize (Mt.)	0.26	3622	941.72	0.49	10565.18	5226.43
Vegetables (Mt.)	0.19	2521	478.99	0.39	14143.67	5516.03
Melons (Mt.)	0.14	3741	523.71	0.17	31398.35	5337.72
Total			4913.1			51211.14
Opert.(Variable)Costs						
Cassava Cuttings (bundles)	65	5.00	325.00	65	2.00	1300.0
Maize (kg.)	15	3.62	54.33	-	-	150.0
Vegetables	-	-	15.00	-	-	175.0
Melons (kg.)	5	18.7	93.50	-	-	96.0
Fertilzer (50kg bags)	2.69		134.50	6.3 bags	218.23	1374.88
Herbicides / Pesticides	-		21.60	-	-	
Labour (mandays)	217		2604.00	188	85	51.67
						15980.0
Total Variable Costs			3247.9			19127.6
Fixed Costs						
Depreciated Assets			560			758.4
Land Rents			120			750.0
Interest on Loand			-			420.0
Total Fixed Costs			680			1928.4
Total Costs			3927.9			21055.95
Net Returns / Ha.			1006.8			30155.19
Net Returns/Manday			16.5			245.40
Net Returns / Cash Input			0.31			1.58
Av. Exch. Ratio $1: N1 (Before SAP)			Av. Exch. Ratio $1: N86 (Duriong SAP)			

Source: Field Survey, 1993 - 1995

Costs of Production.

The variable costs of the average cassava-based crop enterprise in the study area have been on the increase since SAP. The average total variable costs increased from N3247.9 prior to SAP, to N19127.6 during SAP. The percentage contribution of each of the cost items to the total costs was determined. Labour was the largest contributor to the total cost. On the average, labour accounted for about 66% of the total costs prior to SAP and about 76% during SAP.Other variable inputs included planting materials, fertilizer, herbicides and pesticides.

The total fixed costs were N680 prior to SAP, while during SAP were N1928.4. The results showed that the average total costs of producing one hectare of cassava based crop enterprise prior to and during SAP were N3927.93 and N21055.6 respectively. These were made up of costs of variable inputs and fixed costs, when equated to the average exchange rate of N1: 1$ prior to SAP and $1 to N86.00 during SAP, it showed that it costs less to produce during SAP.

Returns from Production

Returns from production in cassava-based crop mixtures were based on all the crops in the association in each farm. The result presented in Table 4.28 showed that the average total revenue per hectare was N4913.1 before SAP and N51211.1 during SAP. The result indicates a tremendous increase during SAP era over pre-SAP era 942%. However, when subjected to

prevailing World Market Exchange Rate, it returned less during SAP. This is in line with aproiri expectations. Nwosu (1991) attributed the increase in the total revenue to the cost-push effect of Nigeria's inflation. It may also be attributed to the Naira devaluation which was reinforced by the rapid growth in domestic liquidity which may be blamed solely on the government's inability to adhere strictly to the set fiscal and monetary targets.

Net Returns

Net returns from the production of cassava based crop enterprise was found to vary significantly between the two periods. In the pre-SAP era, farmers had average net returns of N1006.8 per hectare compared to N30,455.2 during SAP (Table 4.28). The rise in production costs, however, did not negatively affect the profitability of the enterprise as the profit margin improved in Naira terms. The profitability position was substantially enhanced under SAP, for example, the net returns per labour per day were N16.53 and N245.40.

Also, every one Naira invested in the enterprise returned a net of N1.58 during SAP and N0.31 before SAP (Table 4.28). The results of this study suggest that the measures already adopted could change tremendously the performance of this sub-sector. The crucial issue highlighted by this analysis is that labour is the most significant cost item in the cassava-based crop enterprise, and could be useful in any future programme in enhancing the performance of the enterprise. This lends support to the conclusion that agricultural production in Nigeria could not only be increased by the provision of inputs to the farmers, but, by breaking through the arts

and technology of rural farmers, which would reduce this high labour cost.

Tractor services were found not to support the enterprise, this may be solely responsible for the continual high cost of labour since SAP

4.7.1.2: Sensitivity analysis of cassava-based crop enterprise based crop enterprise beyond SAP

As a strategy in looking beyond the Structural Adjustment Programme (SAP), the costs and returns component of SAP data in the cassava based crop enterprise were sujbected to some hypothetical situations, where the total variable costs and the total revenue were assumed to change by specified percentages. This was done to determine the extent to which the enterprise could withstand unexpected government policy as regards agriculture in the future. The results are shown in Table 4.29.

Table 4.29: Sensitivity Analysis of Cassava Based Crop Enterprise.

Variations	Effects on Net Returns (N)
No Variation	30155
100% ↑ in TVC	11027.64
150% ↑ in TVC	1463.87
200% ↑ in TVC	-8099.91
50% ↓ in TR	4549.62
25% ↓ in TR	17352.41
200% ↑ in TFC	15270.75
100% ↑ in TVC + 50% ↓ TR + 200% ↑ TFC	-1848
200% ↑ in TVC + 50% ↓ TR + 200% ↑ TFC	-35633.5
Profitability Situation	Fairly Stable

Key

↑ = **Increase**
↓ = **Decrease**
TVC = Total Variables Costs
TR = Total Revenue
TFC = Total Fixed Costs

The percentage changes adopted were based on past experiences adjudged to be very relevant to the Nigerian situation. Table 4.29 indicated that with 100% increase the total variable costs(TVC),while keeping the total revenue (TR) and total fixed costs constant, the net returns would change from N30,155 to N11,025, a fall of 36%. If this situation would arise

as a result of a government policy which increased production costs, the enterprise would still be profitable, implying stability.

A 150% increase in TVC would still have positive net returns of N1464. This situation though profitble, has a very low margin of safety. Thus, a 200% increase in TVC would bring the net returns to negative value (-N8099.9). Thus, care must be taken in increasing the costs of inputs like fertilizer, whose subsidy is gradually being removed by the federal government.

The reduction of the total revenue by 50% and 25%, and the increase of TFC by 200% would still be favourable for the enterprise. The situation would be different if the farmers experienced a combination of the changes simultaneously as indicated in Table 4.29 These combinations would present a negative net return values. Take for instance, if the TVC increased by 100%, while the total revenue dropped by 50%, the farmers would experience negative net return of -N1843. These possible changes seem appropriate, considering the challenges that relate to the weak prospects of overcoming the constraints imposed by macro-economic policy changes. These included inflations, weak base for technological improvements, institutional supports, and socio-economic degradation. Moreso, the inability of the public sector to commensurate SAP incentives could increase the total costs at the same time reducing the total revenue due to the problem of diseases and pest attacks.

These problems would need to be effectively addressed in order to put the farmers of this important enterprise on the path of sustained growth and development, especially as SAP measures were found to increase the profitability of the enterprise.

4.7.2 Rural Fish Farming

This section examined the costs and returns analysis prior to and during SAP. The section also postulated beyond SAP with regard to the enterprise.

4.7.2.1: Analysis of production costs and returns of rural fish farming before, and during SAP

The result presented in Table 4.30 shows that rural fish farmers realised higher net returns during SAP than Pre-SAP periods. The data indicated that the average net returns of the enterprise increased from N10,989.80 before SAP to N33,508.7 within SAP periods.

Table 4.30: Average Costs and Returns Data of Rural Fish Farming Before SAP and During SAP.

Items	Pre - SAP			During SAP		
	Qty	Unit (N)	Value (N)	Qty	Unit (N)	Value (N)
Receipts Output (tons)	1.42 (142kg)	157/kg	22294	2.56 (2560kg)	28/kg	71,672
Operating Variable Cost Modern Inputs						
a. Fertilizer (kg)	8 bags (50kg)	23.88/ 50kg	191	126/50kg -	182.51 -	2212.1 7387.1
b. Feeds	-	-	867.4	10,000 Sto/R	3 FN	3987.5
c. Fingerlings	12,000/ Pond	31	388.0			
d. Medication	-		43.9	-		771.9
Local Inputs a. Cow drug b. Poultry Manure c. Pig Manure	 500kg 2000kg 680kg		 100 117.8 60	 2000kg 5000kg 1000kg	 - - -	 430.1 600.0 700.0
Labour	520.9 Mds.	12/ Md.	6250.5	167	485/ Md.	14192.
Total Variable Costs			8018.5			30280.7
Fixed Costs Depreciated Assets Interest on Loans	 - -	 - -	 3007.5 252.5	 - -	 - -	 7119.6 763.0
Total Fixed Costs			3260			7882.6
Total Costs			11278.1			38162.9
Net Returns			10989.8			32508.7

Sources: 1. Field Surveys, 1993 - 1995
2. Derived from Past Records (1983 - 1985)

Labour contributed more than 50% of the total cost of production prior to SAP, but contributed about 37% of the total cost during SAP. This may be attributed to increased use and cost of modern input since SAP. However, the high cost of labour in this enterprise may also be due to the evaluation of labour in man-days. Most of the farms used attendants who received less than their actual worth in mandays.

It could be observed on the average that the gross value of production increased during SAP by 22%, from N22,268.5 (Pre-SAP) to N71,672 (SAP era). NISER (1992) supported this finding, when it reported that apart from fish farming and industrial fishing ,other modes of fish production recorded declines in output since SAP. The result showed that the average net returns in this mode of fish production increased by over 196% since the inception of SAP. This could be explained by the policy measures adopted under SAP, which led to increased use of modern inputs, reduced use of labour and sourcing of feeds locally.

The implications of increasing profitability in this mode of fish production are numerous. This result might encourage the exodus of fishermen from other modes of fish production that were found to decline since SAP, like the artisanal, inland coastal shrimp and distant water (NISER, 1992). Besides, increasing net returns could brighten the unemployment situation, which is said to be sky rocketing daily. It could be implied that this mode of fish production strategies among the rural farmers support SAP measures, as the only hope of meeting the challenge of fish development.

4.7.2.2: Sensitivity Analysis of Rural Fish Farming beyond SAP

The uncertainty inherent in many government programmes and policy made it necessary for a sensitivity test of this enterprise. This would enable us to assess the stability of this enterprise beyond SAP era, based on the costs and returns data. Several changes were built in for this purpose, each of which attempted to reflect a realistic situation in terms of the effect of macro-economic policy changes, which may affect the enterprise. The result is presented in Table 4.31.

Table 4.31: Sensitivity Analysis of Rural fish Enterprise.

Vatiations	Effects on Net Returns
No Variation	32,508.7
100% ↑ in TVC	3228.0
150% ↑ inTVC	-11,912.4
200% ↑ in TVC	-27052.7
50% ↓ in TR	327.3
25% ↓ in TR	15590.7
150% ↑ in TFC	21684.8
200% ↑ in TFC	17744.7
100% ↑ TVC + 25% ↓ in TR	-14690.0
100% ↑ TVC + 150% ↑ in TFC	-8595.9
25% ↓ TR + 200% ↑ TFC	3766.7
Profit Situation	Unstable

Key:

↑ = Increase

↓ = Decrease

TVC = Total Variable Cost

TR = Total Revenue

TFC = Total Fixed Cost

Source: Computed from Table 4.30

Table 4.31 shows that with a 100% increase in total variable costs (TVC), keeping other variables constant, the net returns would drop to N3228 as against N32,508.7. If the variable costs were increased by 150% as a result of government policy, the net returns would be negative (-N11912.4). The result further shows that a 50% decrease in TR would reduce the net returns to a negative value -N2327.3, while a drop of 25% in TR would bring down the net returns to N15590.7.

In another development, if the fish farmers experienced a combination of increases in the total variable costs and decreases in total revenues simultaneously, the fish enterprise would be unprofitable in almost all the variables that were profitable in their single hypothetical situations. These findings correspond to the prevailing economic situation in Nigeria. Combining risk analysis with biophysical situation offers potential benefits for helping farmers choose enterprises. It could also assist the farmers to properly allocate their resources. The study shows that an average fish farmers in the study area may not be able to withstand risk that will arise from a combination of uncertainty about output prices, input prices and yield as a result of policy distortions in the future. Thus, under some price combinations, it is unlikely that fish farmers would be in the optimal situation. It could be observed that the variable costs and total revenue, would be more sensitive to policy distortions and any effort at stabilising any policy programme should take these two factors into account.

4.8: Constraints of SAP to Increased Production Among the Two Categories of Rural Farmers

In order to give this study a contemporary relevance, this objective was included. It identified a number of problems that were deemed to have affected the implementation of SAP measures on agricultural production. The result is presented in Table 4.32.

Table 4.32: Percentage Distribution of Rural Farmers by Constraints Against Increased Production Efficiency

Constraints	No.	Percentage (%)
Political Environment	80	40
Foreign Exchange Effect	140	70
Preferential Treatment	160	80
Poor Input Administration/Inefficiency	190	95
Poor Farm Roads	100	50
Scarcity and High Cost of Modern Inputs	180	90
Diseases and Pests	160	80
High Cost of Labour	185	93
Inflation	180	90
Lack of social Amenities	160	80
Inadequate Extension Services	120	60

*** Multiple Responses were Recorded**
Source: Field Data.

Findings showed that the main source of problems of SAP in increasing rural production was

the government's inefficiency (95%) in providing some of the incentives stipulated in the programme. Most of the incentives embodied in SAP were either abandoned or not pursued at all. Take for instance, Nwoko (1992) identified SAP as being ineffective in achieving the following, realistic demand for foreign exchange, increased supply for foreign exchange, encouraging local production of raw materials and import substitutes, income redistribution in favour of rural dwellers' and diversification of export base through realistic pricing of exportable products. This resulted to the inability of the programme to achieve the desired impact in production necessary for stable growth and development of the rural areas.

Specifically, a number of problems meant to be addressed by the programme were exacerbated. These included scarcity and high cost of modern inputs (90%), Lack of social amenities (80%), inadequate extension service (60%), diseases and pests (60%), and high cost of labour (93%).

Another critical aspect of the constraints of the programme lie in the inability of the market forces to determine prices of agricultural output realistically. Rather, it led to the emergence of unrealistic price incentives which destabilised increased production strategy by the farmers.

The unreliability of the exchange rate of the Naira, to the major currencies, was

identified to be instrumental to the high and frequent increases in the prices of basic farm inputs vital to increased performance of rural farmers. In addition, inefficinet marketing and lack of storage facilities may have compounded the objective of increased production since SAP. Nigeria's political status with other countries of the world has been erratic since the aborted third republic. To this end, the increase in rural agricultural production did not necessarily operate as expected. It was found that most farmers were afraid of investing in such an unpredictable environment, which may have partly increased the cost of inputs.

It was also identified that the quality of life in the areas studied was lower than expected, and this may have partly influenced the adoption of innovations embodied in SAP. This may be responsible to the low adoption rate noted by Chidebelu and Mbanasor, 1996.

It was observed that inputs distribution and other incentives were skewed to big time farmers, thereby frustrating the rural farmers who produce about 80% of our total food supply (Ijere, 1986).

Similarly, it was identified that in an attempt to achieve meaniful interest rates, through market forces, low saving rate (10%) and abnormal high lending rate (100%) were evident in the study area. This may have partly raised the cost of financing rural agricultural production, thereby constituting problems to increase agricultural production.

Finally, the high and persistant inflation rate in the area was found to reduce the rural farmers real income. The respondents were found to be spending a greater proprtion of their incomes on basic household needs such as food, education, drugs, transportation and clothing which have tremendously reduced their saving potentials needed for increased agricultural investments.

CHAPTER FIVE

SUMMARY, RECOMMENDATION S AND CONCLUSION

5.1: Summary:

This study examined the impact of SAP and production efficiency of rural farmers in South Eastern Nigeria prior to and during SAP, using two enterprises namely cassava based crop mixtures and rural fish farming.

The orientation of the study was guided by the following hypotheses:

a. SAP had no significant impact on the production levels of cassava based crop mixtures, and rural fish farming.

b. There was no significant difference between the production efficiency of the farmers prior to and during SAP

c. Cassava based crop farmers were more efficient in the use of resources than the rural fish farmers during SAP; and

d. Socio - economic factors had no significant relationship with the farmers output.

A total of 200 farmers were used in the study 120 were cassava based crop farmers while 80 were rural fish farmers. The Pre-SAP period was defined as 1983 - 1985 and during SAP era was defined as 1993-1995. Primary data were generated by the use of structured questionnaires for the SAP period while Pre-SAP data were derived from secondary sources.

The study covered four randomly selected States of south eastern Nigeria, namely Abia, Imo, Enugu and Rivers.

Data generated were analysed using production functions, multiple regression, chow test, profit functions, costs-returns techniques, sensitivity tests, marginal value products/marginal factor costs ratio, t-tests, and descriptive statistics, such as, tables, percentages and means.

The study noted that since SAP the farmers, on the average, used relatively more farm resources than before SAP. The only exception was in the use of local inputs which they used less.

In the cassava based crop enterprises, the crops in the mixtures experienced increases in their output levels before SAP except melon. Though most of the crops in the mixture experienced increases in their output levels before SAP, they grew at a decreasing rates. The situation during SAP, was similar to that of before SAP, in the output levels. However, while other crops in the mixture showed increases in their growth rates melon had a negative growth rate. This may be connected to its decreasing importance in the enterprise combinations. For example growth rates for cassava, maize, vegetables and melons were 8.3%, 25.5%, 25.6% and -5.5%, respectively. These growth rates were significantly different at the 5% level in all the crops except melon within the two periods.

With regard to the fish farmers, their growth rates were generally on the increase within the periods. However, during the SAP period, growth increases were at an increasing rate.

SAP had significant impact on the production level of rural fish enterprise.

The correlation matrix analysis showed that farm size, income, farming experience, Age, education, occupation and household size were positively associated with the output of the cassava based crop enterprise. However, only four of the socio-economic variables, namely, farm size, income, education, and occupations were significantly associated with the farmers output. Thus, an increase in the levels of all the significant variables would most probably increase the level of output of cassava based crop enterprise.

With regard to rural fish enterprise, all the socio-economic variables were not positively related to output. Variables that related positively to ouput, included pond size, farming experience, age and income of the respondents. However, education, household size and occupational status of the farmers were negatively related to the farmers output. The result suggested that an increase in the factors that exerted positive impact would most probably increase the level of output of fish farmers, unlike the variables that had negative relationship, which would most probably reduce the level of output of the rural fish farmers.

Econometric estimation of the cassava based crop enterprise showed that the farmers were significantly different in their production behaviour within the two periods, indicating a change in their technical efficiency. The farmers were technically more efficient before SAP than during SAP. It was observed that the measures adopted during SAP reduced the technical efficiency of the cassava based crop farmers. This was further confirmed by the higher

marginal value productivities of farm size, modern inputs, and local inputs before SAP than during SAP. Also, they did not achieve any maximum allocative efficiency in the use of resources within the two periods. The farmers were inefficient in the use of farm size and local input during SAP unlike beforeSAP. Similarly modern inputs, labour, and other investment expenses were allocatively better utilized within SAP than before SAP. The farmers were, however, excessive in the use of modern inputs while at the same time under-utilizing labour and other investment expenses during SAP. The study revealed that the farmers needed to increase their farm size, labour, local inputs and other investments by over 104%, 44%, 210% and 12%, respectively, and reduce the use of modern inputs by 43%, inorder to achieve maximum allocative efficiency of the resources.

It was noted that the relative economic efficiency of the cassava based crop farmers did not vary significantly between the two periods. The profit structure of the enterprise within the two periods were determined by the variations in wage rate, farm size and other investments.

The econometric estimation of the rural fish farmers, on the other hand, showed that the three functional forms adequately characterized the empirical data, as indicated by the significance of the F-ratios and the value of coefficient of multiple determination (R^2).

The R^2 from the chosen function (i.e the power function) of SAP data showed that 39% of the variations in gross value of output of fish farmers were explained by the variables included in the model, while 23% was explained by the non-SAP data.

The fish farmers were technically more efficient during SAP than before SAP. In terms of allocative efficiency, the fish farmers were, on the average, allocatively more efficient in the use of pond size, labour and modern inputs during SAP than before SAP. They were, however, inefficient in the use of local inputs during SAP. On the other hand, they were allocatively more efficient in the use of local inputs and other investments before the introduction of SAP. It was further identified that the fish farmers under utilized pond size, labour and other investments during SAP. Similarly, they also under utilized pond size, modern inputs and other investments, while being excessive in the use of labour and local inputs before the introduction of SAP. The fish farmers would need to increase their pond size, labour, other inveestments and local inputs by over 92%, 9%, 86% and 156% respectively inorder to achieve optimum allocative efficiency in the use of the resources during SAP. This suggested that profitability of fish farming could still be increased under the existing technology under SAP. They were economically more efficient during SAP.

The cassava based crop enterprise differed significantly in its net returns between the two periods. The net returns were N1006.8 and N30155.2 for Pre-SAP and during SAP respectively. The return per labour per day were N16.53 and N245.4, for Pre-SAP and SAP periods respectively. Every Naira spent on the enterprise prior to and during SAP returned N0.31 and N1.58, respectively. The result also showed that cassava based crop enterprise would be fairly stable beyond the SAP period.

another development, the average fish farmer realised higher net-returns during SAP ore SAP, with N33,508.7 and N10.989.8, respectively. The net returns of this mode of roduction was found to be unstable beyond SAP. In otherwords, an average fish farmer ald not be able to withstand the risk that might arise due to uncertainty about output prices, put prices and yield as a result of future policy changes.

When the elasticities of production and returns to scale were examined with respect to cassava based crop enterprise, it was identified that the output elasticity in respect of each of the resources for non-SAP data was less than unity indicating diminishing marginal returns to each of the resources. The sum of the elasticities (0.685), being less than unity, showed decreasing returns to scale.

The pattern for this enterprise was different with regard to during SAP era. With the exception of labour, all the other resources indicated diminishing marginal returns. The sum of the elasticities (1.086) was found to be greater than unity, an evidence of increasing returns to scale. The significance of this was that higher outputs were feasible with increase in the levels of individual resources.

It was identified that labour was the most important factor that affected the value of output during SAP while modern inputs were the most relevant before SAP. Thus, policy reform must be structured at achieving both reduced costs and availability.

As per fish farming, the output elasticity prior to SAP and during SAP in respect of each

of the resources was less than unity indicating marginal returns to individual resources. The sum of elasticities within the two periods were less than unity, implying that the data sets were within the domain of decreasing returns to scale, thereby implying that the ratio of the variable input to fixed inputs was high enough for profitable adjustment.

It was identified that modern inputs were the most important variables within the two periods in this enterprise. The study showed that the main source of constraints of SAP in increasing rural production was government's inefficiency in providing some of the incentives embodied in the programme. This had militated against the programme in achieving the desired impact in production, necessary for stable growth and development, needed in the rural areas.

5.2: Recommendations:

The findings that emerged from this study have vital policy implications for enhancing, revitalizing and improving the production efficiency of the rural farmers under the Structural Adjustment Programme and even beyond.

i. The study showed that SAP measures had enhanced the resource use and gross value of output of the two enterprises. Shortage of supply or inavailability was the most important factor that affected the efficient use of resources. It is therefore most important that alternative strategy be sort; especially such strategy that would practically provide these inputs to the real farmers and on time. The use of autonomous

communities and Ezes cabinet would be a right policy decision as per inputs distribution.

ii. The study has shown that it has become imperative to raise rural productivity among the two categories of farmers. This would, however, require an improvement in the technological base of the farmers, which would offer them the scope for output expansion under SAP. This therefore requires a new incentive on research for appropriate technology that would improve the technological base of the farmers beyond the present level.

iii. SAP has some positive impacts in inducing more efficient use of resources, which could be better utilized if the constraint against production for export is further removed. In the spirit of market liberalization, government should establish without further delay, the commodity exchange and futures market (Comex), to give farmers free access to the international market, and provide the required price incentive for efficient use of resources, and accelerated agricultural production. Without attractive and competitive marketing arrangements evident in comex, the full benefits of all other incentives (infrastructural, modern inputs supply, and funding facilities) embodied in SAP, cannot be fully exploited because the farmers major concerns are the marketing and pricing variables.

iv. Government should formulate appropriate inputs and output stabilisation policy to

reduce the high cost of modern inputs and increased output price. These would enhance the stability of the two enterprises.

v. With the low sizes of average farms in the two enterprises, it has become imperative for the farmers to increase their use of modern inputs and reduce the use of local inputs. This is so as the use of local inputs were found to reduce the average value of output in the two enterprises. Any policy measure that would ensure the use of modern production package would improve the rural farmers productivity level. Moreso, the use of modern production package has been identified to be vital to the production efficiency of farmers. Any policy measure that would discourage the use package in part should be formulated, as this attitude has been found to be inefficient in the use of improved technologies.

vi. The poor condition of rural feeder roads is a major constraint on the production efficiency of the rural farmers. It is recommended that the government should intensify its rural roads rehabilitation programme. Any policy that would involve the private sector should be encouraged, even if it entails collection of approved government toll fees.

vii. Another critical area that requires urgent policy direction is the issue of input subsidy, if the farmers are to be productively more efficient. There is the need for government to completely discontinue its policy of reduced subsidy on key inputs, as this has been

abused by various agents and individuals. In order to achieve efficient use of inputs, the actual prices should be used as this would make them easily available especially as most farmers were found to be willing to pay the actual price of these inputs especially fertilizer, if it would be available. It is therefore suggested that any policy decision that would involve the use of direct private participation in the procurement and distribution of inputs would improve both efficiency and availability.

viii. There is also the need for government to address the issue of inflation adequately through exchange rate stability which would reduce the high cost of production prevalent since SAP, as well as increasing the real income of the farmers which will invariably increase rural farmers intensifications. The present (N86 to a dollar) exchange rate is still unrealistic and is tantamount to the high cost of productions.

ix. Finally, scarcity of funds was found to be a common phenomenon that influenced the production efficiency of rural farmers since SAP. Many of the farmers were found to be handicapped in this area, hence the call for a realistic policy on credit facilities for rural farmers. The government may have to re-visit this issue. The present policy on credit as contained in SAP document which included loan of upto N10,000 without stringent measure seems not to be working.

5.3: Conclusion:

In conclusion, it is evident that the policy reform called SAP is significant in addressing the production efficiency of rural farmers in the study area. With the adoption of SAP, progress was made in redressing the problem of efficiency of resource use in the enterprises studies.

However, these benefits have been accompanied by certain basic constraints. The most critical being sharp rise in the cost of production, which could be attributed to the drastic depreciation of the Naira exchange rate, high lending rate, unavailability of modern inputs and constraint in the acquisition of land.

It is also evident that the implemenation of SAP measures has led to the decline in the real income of the farmers, hence their investing power. This problem was found to be closely linked with the inefficient use of resources, as the farmers were found to have either under utilized or over utilized almost all the resources examined. This calls for adherence to the specific policy intervention measures suggested.

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APPENDIX I

UNIVERSITY OF NIGERIA, NSUKKA
DEPARTMENT OF AGRICULTURAL ECONOMICS

Dear Sir / Madam,

Topic: **An Econometric Study of the Production Efficiency of Rural Farmers in South-Eastern Nigeria.**

I am a postgraduate student, researching the above topic and would like to solicit your assistance in completing this questionnaire. All responses shall be treated in strict confidence. Moreso, no names shall be mentioned in the report and the data generated will be aggregated for overall analysis. I rely on your responses, thanking you for the anticipated co-operation.

Sincerely yours,

Mbanasor, J. A.

QUESTIONNAIRES FOR CASSAVA BASED CROP MIXTURES

SECTION A: Socio-Economic Characteristics

Tick or fill the spaces provided where appropriate

1. Sex: (a) Male ( ) (b) Female ( )
2. What is your age in years ? ( )
3. Marital Status (a) Single ( ) (b) Married ( )
4. Number of Wives ( )
5. Number of other dependents ( )
6. Number of children (a) Male ( ) (b) Female ( )
7. What is the total number of years you have spent in School ? ( )
8. How many years have you been farming? ( )
9. What is your total annual income ? ( )
10. What is your major occupation? ( )
11. How much do you realise annually from your major occupation ? ( )
12. List other types of jobs you do
13. How much do you realise from each of your other jobs ?

SECTION B: Farm Data

14. What is your total farm size in hectare? ( )

15. Which of the following based crops did you allocate greater portion of your farm land in the following years

Item	1993	1994	1995
a. Cassava based crops			
b. Yam based crops			
c. Rice based crops			
d. Any other crop			

16. What are your reasons for your allocation ?

a. High yields and great Financial Returns

b. Because of our culture

c. Ease of cultivation

d. Personal Interest

e. Any other reason

17. What crops constitute your cassava based crops ?

a. ---------- d. ----------

b. ---------- e. ----------

c. ---------- f. ----------

18. What proportion of your farm did you allocate to cassava based crops in the following years ?

Proportion	1993	1994	1995
1/4			
1/2			
3/4			
all			

19. What is your total labour requirement for cassava based crops ?

20. What proportion of labour did you source from the following in each year for cassava based ?

Labour	1993	1994	1995
hired			
family			
Exchange			
others (specify)			

21. In which periods of the farming season do you have the greatest problems in acquiring labour for cassava based crop ? ( )

22. If you use tractors for the following operations, complete the spaces provided.

Cassava Based	Charge/ha. or hrs.	Size
Ploughing		
Harrowing		
Ridging		

23 What types of Labour (men, women, children) did you employ in the performance of the following operations and how much did you pay (cash) per day for each operation per person?

Farm Operation	Men (No.)	Rate	Women (No.)	Rate	Children (No.)	Rate
Land Clearing						
Seed bed-Preparation						
Planting of Cassava of based crops						
Weeding						
Chemical Applications						
Fertilizer Application						
Harvesting						
Transportation						

FERTILIZER

24. How Many bags of 50kg of fertilizer did you use for your cassava based crops per hectare ?

	1993	1994	1995
Fertilizer			

25. What Fertilizer mixture did you use and the market price per bag for your cassava based crops ?

Fertilizer	1993	1994	1995
a. NPK 15:15:15			
b. Phosphate only			
c. Ammonia only			
d. Any other specify			

WEEDING

26. What was your method of weed control?

Method	1993	1994	1995
a. Hand weeding			
b. Mechanical			

27. How many times do you weed your cassava based crops ?

28. How much and what quantity of agrochemicals do you buy in a season from the following sources for your cassava based crops ?

Source	Fertilizer		Herbicides		Pesticides	
	Qty	Cost	Qty	Cost	Qty	Cost
a. ADP/Ministry of Agriculture						
b. Open Market						
c. Dealers						
d. Co-operatives						
e. Others (Specify)						

29. What were the chemicals you used in controlling pests in season ? Name them inorder of importance to you.

Chemicals	1993	1994	1995
(a)			
(b)			
(c)			
(d)			
(e)			

CAPITAL

30. What were your sources of farming funds and the amount realisable in each year?

Source	N 1993	N 1994	N 1995
a. Bank			
b. Co-operatives Society			
c. Personal Savings			
d. Relatives/Friends			
e. ESUSU			
f. Others (Specify)			

31. Please provide the following information on your farm

Item	Total Number	Price/Unit Per one	Expected Life Span
Shovel			
Hoe			
Cutlass/Matchet			
Sprayers			
Haskets			
Wheel barrows			
Diggers			
Farm buildings			
Others (Specify)			

INSURANCE

32. Do you know that your farms can be insured ? (a) Yes ( ) (b) No ( )

33. Is your cassava based crops insured ? (a) Yes ( ) (b) No ( )

34. If yes, what was the total cost of insuring your cassava based crops in the following years?

	A M O U N T		
	1993	1994	1995
Insurance			

PACKAGE

35. does the exchange rate influence your farming operations? (a) Yes ( ) (b) No ( )

36. If yes, how does it influence your farming operations ?

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37. Are you free to sell your farm products in any part of the world?
(a) Yes ( ) (b) No ( )

38. How do you market your products?

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39. At what rate of interest do you obtain loan?

40a. What were you buying a bag of 50kg of Fertilizer before June 1993 ?

b. Is there any road constructed to your farm since July 1993 ?

41. What was the price of a 50kg bag of the same fertilizer in ?

Year	Qty (Kg)
1993	
1994	
1995	

42. What quantity of the crops that constitute your cassava based crops did you produce per hectare in the following years ?

Yield and Output Records in Kgs or Tonnes per Hectare			
Cassava Based Crops	1993	1994	1995
Cassava			
Maize			
Melon			
Vegetables			
Others (Specify)			

43. What quantity did you put to the following uses?

Cassava Based	Sold	Consumed	Gift	Stored	Others (Specify)
Cassava					
Maize					
Melon					
Vegetables					
Others					

44. What quantity of your cassava based crops did you market in the following areas?

Item Sold	Qty Sold (kg or tonne)	Unit Price (kg or tonne)	Home/ Farmsted	Markets
Cassava				
Maize				
Melon				
Vegetables				
Others				

PR[illegible]BLEMS

45. Which of the following problems affect your cassava based crops production?

a. diseases
b. Low yield
c. Scarcity/high cost of Agro chem[illegible]als
d. Scarcity/high cost of Fertiliz[illegible]
e. Scarcity/high cost of hired L[illegible]r
f. Hired Labourers cannot be f[illegible]d
g. Lack of credit/loan
h. Inexperienced workers
i. Inadequate extension services
j. Lack of good roads to the farm
k. Lack of social amenities
l. Others (S[illegible]y)

APPENDIX II

QUESTIONNAIRE FOR FISH FARMERS

Tick or fill the spaces provided where appropriate.

1. Sex (a) Male ( ) (b) Female ( )
2. What is your age in years ? ( )
3. Marital status (a) Single ( ) (b) Married ( )
4. Number of Wives ( )
5. Number of other dependents ( )
6. Number of children (a) Male ( ) (b) Female ( )
7. What is the total number of years you have spent in School ? ( )
8. How many years have you been in Fish farming?
9. What is your total annual income ? ( )
10. What is your major occupation ? ( )
11. How much do you realise annually from your major occupation?
12. List other types of jobs you do.
13. How much do you realise from each of your other jobs?

SECTION B: FARM DATA

14. What is your total farm size in hectares ? ( )
15. What type of pond do you have?
    a. Concrete fish pond
    b. Earthen fish pond
    c. Cage
    d. Others (specify)
16. What is the size of your fish pond? ( )

17. What proportion of your income did you allocate to Fish Farming?

	1993	1994	1995
1/4			
1/2			
3/4			
4/4			

18. What are your reasons for doing so?

a. High yields and financial Returns

b. Because of our culture

c. Ease to cultivation

d. Personal Interest

e. Any other (specify).

19. From your experience in fish farming what type of fish do you grow, name them in order of importance?

(a)

(b)

(c)

(d)

(e)

20. What proportion of labour did you source from the following in each year for your fish farm?

Labour	1993	1994	1995
Hired			
Family			
Exchange			
Others (specify)			

21. In which periods of the year do you have the greatest problems in acquiring labour for your fish farm?

22. What is the total labour requirement for your fish farm in a year? ( )

23. List the various operations being carried out by you and the number of labour required as well as the amount paid per person;

Operations	Number of Labour	Amount Paid Per Person
(1)		
(2)		
(3)		
(4)		
(5)		
(6)		
(7)		

24. What is the daily requirements of labour in Man-days for the up-keep of your fish farm through maturity?

25. What is the total cost of labour in your fish farm?

26. List other expenses you incurred throughout your production period and the amount involved;

EXPENSES	A M O U N T		
	1993	1994	1995
(a)			
(b)			
(c)			
(d)			
(e)			

27. What were your sources of fish farming funds and the amount realisable in each year ?

Sources	1993	1994	1995
(a) Banks			
(b) Co-operative Society			
(c) Personal Saving			
(d) Relatives/Friends			
(e) Esuzu			
(f) Others (Specify)			

28. When did you establish your Fish Farm? ( )

29. What is the total cost of constructing your fish farm ( )

30. What did it cost you to stock your fish pond with fingerlings?

(31) List the type of feed and quantity used per day per pond as well as cost?

Feed Sources	Qty (kg or ton.)	Cost
(1) Kitchen waste		
(2) Soyabean meal		
(3) Animal faeces		
(4) Processed pellet		
(5) Fertilizers		
(6) Browing waste		
(7) Kernel cake/wheat Bron		

32. What is the average cost of veterinary atments in a month ( )

33. What is the total treatment in a prod n period ( )

34. What is the average weight of your at harvest in kg? ( )

35. List the fixed as se for your fish farm and their costs and expected life span.

Item of Fixed Cost	Qty	Year of Purchase	Cost	Expected Life Span
(a) Pond				
(b) Building				
(c) Generator				
(d) Water Pu				
(e) Basket				
(f) Nets				
(g) Buckets				
(h) Others (specif				

36. Is there any Road constructed to your farm since 1993 ? (a) Yes ( ) (b) No ( )

INSURANCE

37. Do you know that your fish farms can be insured ? (a) Yes ( ) (b) No ( )

38. Is your fish farm insured? (a) Yes ( ) (b) No ( )

39. If yes what was the total cost of insuring your fish farm?

ITEM	AMOUNT		
	1993	1994	1995
Insurance			

PACKAGE

40. Does the exchange rate influence your fish farm operations? (a) Yes ( ) (b) No ( )

41. If yes, how does it influence your fish farm operations?

42. Are you free to sell your fish products in any part of the world ? a. Yes ( ) b. No ( )

43. How do you market your fish products? ----------

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44. At what rate of interest do you obtain loan?

45. What were you buying a bag of 50kg of Fertilizer before June 1993.

46. What was the price of a 50kg bag of the same Fertilizer in

	1993	1994	1995
50kg of Fertilizer			

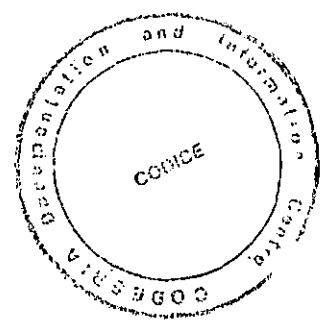
48. What is the price per kilogram fo fish ( )

49. What quantity of fish did you put to the following uses?

F I S H	QTY (KG)
(a) Consumed	
(b) Sold	
(c) Gift	
(d) Processed	
(e) Others (specify)	

50. What quantity of your fish did you sell in the following areas

Fish	Qty	Amount
(a) Farm / homestead		
(b) Urban Markets		
(c) Local Markets		
(d) Along the Road		



PROBLEMS

51: Please tick as many as possible, the following problems which affect your fish production;

a. Steepage
b. Stealing
c. Predator
d. Diseases
e. Scarcity/high cost of feeds
f. Scarcity/high cost of hired labours
g. Lack of credit/loan
h. Lack of subsidized Inputs
i. Lack of social Amenities
j. Inexperienced workers
k. Inadequate extension service
l. Other (specify)