Resource Use Efficiency and Productivity In a Large Scale Farm: A Case Study Of Birma Agricultural Project Limited Biu L.G.A Borno State.

By

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1994.

DECLARATION

I hereby declare that the whole content of this work was solely the result of the author's research work, except where references were made to published literature which are duely acknowledged. This work has not been part of any presentation for any other qualification.

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CERTIFICATION.

This Thesis entitled "Resource Use Efficiency and Productivity In A Large Scale Farm: A Case Study of Birma Agricultural Project Limited, Biu L.G.A. Borno State" by JAMPADA THLAMA NDAHI, meets the regulations governing the degree of Master of Science (Agricultural Economics) of Ahmadu Bello University, Zaria, and is a approved for its contribution to Scientific knowledge and literary presentation.

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DEDICATION.

The research work has been dedicated to my Wife and Son, Alheri Thlama Ndahi and Ishaku Thlama Ndahi, for their encouragement throughout the period of this study. May God bless them abundantly.

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I wish to express my profound gratitude to my Supervisor Dr. J.O. Olukosi and Dr. Dayo O. A. Philip. for their constructive criticism. supervision and advice throughout the period of the research work. I would also like to thank Dr. A.D. Barau for his advice and supervision. I cannot forget to thank Dr. Benjamin Ahmed and Mr. Danlandi Jarma for their advice and running the programme in the Computer respectively.

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ABSTRACT

Birma Agricultural Project Limited is a private Limited Liability Company, vested with the responsibility of making profit. It is possible that the farm has not harvested the profit to the fullest. It is against this background that this study was set to determine the profitability of the farm, to provide an optimum plan for the farm, to determine the effeciencies of the resource use on the farm and to offer recommendations on how best to organise the farm.

analytical tools were used for this study, namely; Farm Budgeting analysis, Production function analysis and the Linear Programming technique. The Net Farm Income for the crop and livestock sections were found to be N 22,759.27 and Nl,436,557.50 respectively,giving a total Net Farm Income of Nl,459,316.70 . The return per hectare, man-hour and capital invested under the crop section were N71.35, N1l.34 and NO,03 respectively, and for the livestock section, return per capital invested and man-hour were N3.46 and N715.59 respectively.

The comparison between the marginal value productivities and marginal factor costs of resources were carried out. All the input used in the farm were found to be used efficiently.

These resoures were found to have contributed to variations in the yield and this was shown by high value of R^2 .

The optimum farm plan derived for the farm from the use of linear programming shows that the net farm income of the farm is N7, 399, 958.40.

The lesult of the sensivity analysis showed that there could be an increase in the net farm income if five extra units of the scarce resources are used. The growing of pastures for livestock section have been recommended for this study. The construction of storage facilites to bring about improved prices of the farm produce has been suggested

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CHAPTER ONE

1.0 INTRODUCTION.

1.1 Background of the Study.

The economic importance of agriculture to any developing Country like Nigeria cannot be over emphasized. This assertion is true when the contribution of the agricultural sector is looked into. Agriculture, in Nigeria served as the major source of food, raw materials to the infant industries, foreign exchange earner and generation of employment to the growing population. The agricultural sector is predominantly dominated by about 70% of the rural population mainly farming for subsistence requirements. The volume of production for these farmers are limited because they used poor implements, improper crop mixtures, and consequently farmers failure to adopt to the new technologies of farming. Farm planning, which is a basic necessity for high level agricultural production is not very much given desired attention, thus, this sector became the weakest spot of the chain of economic progress in Nigeria (Igben, 1987).

For sometime now, Nigerians has been faced with incessant food shortages and rising food prices. This situation was brought about by a number of factors, notable among them are:

i. rapid population growth rate relative to food production growth rate.

ii. migration of energetic work force from rural areas to the urban centres, thereby decreasing the available labour force

in the rural areas that can boost food production.

iii. Shortages of trained agricultural personnel to assist in the dissemination of new findings from the research centres to the rural population to improve skills in farming.

iv. pests and diseases incidences.

v. poor storage facilities and unorganised marketing systems that discourage increases in production. and

vi. unfavourable weather conditions.

The Central Bank of Nigeria C.B.N (1986) revealed that the agricultural sector's contribution to the gross domestic products (GDP) in 1962 was 61.2%. but this slumped down significantly to 24.7% in 1973. and then further to 10.4% in 1984. The GDP in 1992 was 37.8%. Public support to the sector had also been on the decline. Aja (1985) reflected that during the first plan period of 1962 - 68. when Nigeria's priority was in agriculture. the share of the sector in the budgetary allocation was 14%. The sectorial allocation during 1975 - 78 and 1979 - 82 plans showed that the share of the agricultural sector was reduced from 14% to 6% and 8% respectively. leaving 94% and 92% to other sectors of the economy. Indeed. inadequate funding of agriculture and loose coordination of the numerous agricultural programmes remain the bane of food production in the Country. For instance. for the 1993 fiscal year. the recurrent expenditure estimate for agriculture was put at N93.4 Million as against 27.6 Million for 1992. representing an increase of 339 percent. The allocation to the agricultural sector in 1992

was 4.83% of total expenditure, but this dropped drastically in 1993 to 1.23 percent. (Wale, 1993).

The 1986 Structural Adjustment Programme (SAP) placed much emphasis on public disengagement in favour of private participation to promote efficiency and productivity in resource use. As a result of this development, there has been a public outcry for wealthy individuals and corporations to invest in agriculture to promote increased food supply to meet the demand for food. Multinationals, in the likes of UTC, Leventis group of Companies and brewery Companies responded to the call. In the home front, retired army generals, wealthy Nigerians like M.K.O Abiola, Birma Agricultural Project Ltd etc also invested in agriculture. The Birma Agricultural Project Ltd produces both crops and livestock. This study will attempt to formulate the optimum farm plan of Birma Agricultural Project Ltd and determine the resource use efficiency and productivity.

1.2 Birma Agricultural Project Limited.

Birma Agricultural Project Ltd was established in 1985 to achieve the following objectives.

i. to promote the drive for self sufficiency in both food and protein production in the Country.
ii. to generate employment opportunity to the rural and urban dwellers.

iii. to generate foreign exchange to the Company and Nigeria at large. and

iv. to provide raw materials to our infant industries.

The farm is locate at Sabon Gari Village in Biu Local Government Area of Borno State. The farm is a limited liability Company. Birma Agricultural Project Ltd has a board of directors. headed by a Chairman. Alhaji Umar Birma Sanda. who happened to own the major shares of the Company. Birma Agricultural Project Ltd is a member of Birma General Group of Companies. Other Companies owned by the same organisation include Santana Furniture Company located in Maiduguri. Birma General Supplies Ltd etc. The farm has an average annual staff strength of about 70 people. Among these members of staff are foreign professionals and indigenous trained agriculturist. On the farm site. there is a Director. assisted by the Farm Manager. Engineer. N.Y.S.C Veterinary Doctor and other assistants.

Birma Agricultural Project is mainly a profit making venture. About 85% of the produce are sold. It engages in the production of both crops and livestock. The major crops produced since inception include maize. guinea corn. rice. cowpea and cotton (in the early life of the project). Major animals kept include cattle. sheep. goats and horse for ceremonies. For this study. only cattle. sheep. goat. maize. guinea corn. rice and cowpea will be considered mainly because they are the ones attention was given to.

1.3 The Problem Statement.

The agricultural sector had witnessed successive governments attempting to evolve a viable agricultural production strategy that can yield the desired results. Such strategies include Operation Feed the Nation. Green Revolution. Back to Land. Directorate of Food Roads and Rural Infrastructure (DFFRI). National Agricultural Development Authority (NALDA) etc. The SAP era witnessed an influx of large scale farmers coming into the farming business to ease the problem of food shortage in the Country. This therefore requires the Federal Government to give the desired incentives to these set of farmers to operate successfully. These group of farmers produce more than the small scale farmers. Since their scale of production were large the gap between the supply and demand for food will be narrowed. Statistics had shown that the average growth rate of population has been estimate at 3% per annum. while the annual growth rate of food production was 2.5% (Federal Ministry of Agriculture. 1974). Ojo (1991) revealed that food demand was increasing at a geometric rate. while food supply was moving at an arithmetic rate. In 1961 - 85. there has been an increase in the average growth rate of food demand by 1.6%.

The emergence of these large scale farmers into the agricultural sector entails modernization of farming. George. (1989) contended that large scale plantation units make possible "economies of operation by the use of labour saving machineries".

Huge investments in resources therefore calls for efficient coordination of resources if the attainment of profit must be achieved. Decisions on what to produce. how to produce. how much to produce and when to produce each of the enterprises are often carried out by the farm manager. As a result of his actions. he either reaps a profit or a loss. The management of resources becomes necessary to avoid over-utilization or under-utilization of resources on a particular enterprises. The tendency to over utilize or underutilize resources depends on the motive of the farmer. Okon (1989). Stressed that different forms of objective function will take different pattern of investment and consequently different rates of growth.

Birma Agricultural Project Ltd engages in the production of both crops and livestocks. The major objective of this farm is profit maximization. Although there has been records of success by the farm. it is still possible that the optimum farm plan has not been achieved. The efficiency of resource use and productivity can be increased to ensure maximum profit. The questions this study intends to address are:

i. to what extent has the farm been able to achieve this objective of profit maximization?

ii. have the efficiencies and productivities of resources used by the farm been achieved to the fullest:. and

iii. what is the optimum farm plan of the farm?

This study seeks to answer these questions with a view to offering solutions to the questions raised, and giving meaningful and concrete recommendations to the farm to serve as a guide for future organisation of the farm.

1.4 Justification of the Study.

In Nigeria, there are indications that existing farm resources are not efficiently utilized by farm producers in general. This has made farmers to produce either at a loss or to produce at a loss that is not sufficient to meet the Country's food requirements. The Country therefore had to resort to importing food to meet the shortfall in food requirement. Planning, which is an important ingredient in every successful business has been lacking or inadequate. Incidentally these large scale farmers are associated with huge investments that require careful planning to succeed. This study has been undertaken to give a framework of planning to Birma Agricultural Project Ltd. and to justify or otherwise the huge investment in resources. It will help the farm organise the farm resources in the manner that they can be used efficiently. Resources can therefore be directed to the right crop and livestock mixtures that can provide the highest revenue.

1.5 Objectives of the Study.

The specific objectives of this study are as follows:

i. to determine the net profit of the farm:

ii. to determine the optimum farm plan for the farm:

iii. to determine the efficiencies of the resources used on the farm: and

iv. to give recommendations on how best to organise the farm.

1.6 Organisation of the Study.

This study have been organized into five chapters. The first chapter discusses the introductory aspect of the study. while chapter two constituted some reviews of literature that are related to the scope of this work. The methodology comes in chapter three of the study. Here description of the area. sampling techniques and the analytical framework of the study were stated. The chapter four of this study comprises the presentation of the data and discussions of the results. The last chapter of this study. chapter five. consist of the summary of the study. conclusion and recommendation for further study on related field.

CHAPTER TWO.

2.0 THE LITERATURE REVIEW

2.1 Farm Resources.

Farm resources are means available for producing crops and livestock (Olukosi, 1986). Heady (1982) classified farm resources into land, labour, capital and management. Other resources that can be used on the farm include fertilizers, pesticides, herbicides, seeds, water and building. Farmers, in an economic sense, are resource managers who endeavour to manipulate their resources to achieve certain ends. These ends vary with each farmers responsibility and ambitions.

Farm management, which is a branch of agricultural economics is concerned with achieving the best from a given combination of production factors under a given technological macro-economic, social and political conditions. Natural factors and their characteristics define the physical framework in which managers choose enterprises and decides how to use farm resources (Heades, 1963).

This is particularly true of all farm firms obtaining most of their receipts directly or indirectly from crops and livestocks.

Richard (1977) defined land as the crust of the earth and the space above it. Land has space or area and the shape of the area determine the use which it can be put. About 73.3% of the Country's total land area can be bought under cultivation, 10% under forest resources and 14.7% is assumed to be made up of

permanent pastures, built up areas and uncultivable waste (Federal Ministry of Agriculture and Natural Resources, 1974).

Labour is the human effort often measured in man-hours or man-days. Human labour accounts for 90% of all farm operations in non-mechanised system of peasant cultivation and in areas where mechanization is practiced, human labour accounts for 50 - 56% of farm operations (Federal Ministry of Agriculture and Natural Resources, 1974). Olukosi (1988) gave the average work hours for male adult as 5-7 hours a day. A female worker can work 0.75 the capacity of an average male adult, while a child of 7-15 years is assumed to have about 0.5 the working capacity of a male adult.

Capital can be seen as the total investment available for use in the farm operation. It can also be seen as anything produced which is used to increase the effectiveness of current productive activity that is not immediately assumed (Olukosi, 1988).

All the factors of production on the farm cannot perform individually, but have to be combined in the ratio that will be profitable. Coordination of the factors to achieve the desired end is important and this is a function of management.

2.2 *Resource Management.*

Resource management deals with the problem of organising and of making decisions on practical and technical matters related to resource use (Makehan, 1974). The goals of management, according to Makehan (1974) include harvesting of more disposable income for the farmer and provision of high profit. It also involves the

measured. Aggregate measures of productivity will serve as a barometer of economic progress, as a guide to adjustment of resources, will provide a framework for formulating and evaluating policy and indicate areas of problem that requires further study. Productivities of labour, capital and land can be defined with respect to the individual resources or in terms of a combination of them. Thus, we can define labour, capital and land productivity as the ratio of total output to labour input, capital input and land input respectively (Heady, 1982). In this context therefore, optimal productivity of resources implies efficient utilization of resources in the production process. Productivity and efficiency can be considered to be the same when physical concepts are considered, but when economic considerations comes in, they are different because the costs and returns of inputs come into play (Victor, 1975). Victor (1975) further stressed that extra costs of each unit of input and the value of extra output must be considered.

Farrel (1957) defined economic efficiency in three ways. Technical efficiency has been defined as the measure of the firms' success in producing maximum output from a given set of inputs. It indicates all those undisputed gains that can be obtained by planning management. Secondly, price efficiency is considered as a measure of a firms' success in choosing an optimal set of inputs. This is an indication of the gains that can be obtained by varying the input ratio on certain assumptions about the future price structure. Thirdly, he defined overall efficiency as the simple

product of the technical and price efficiency. These measures assume a standard production function which could be set up as a yardstick for measuring individual firms' performance.

2.2.2 *Resource Allocation.*

Resource allocation involves the rationing of farm resources among the different enterprises grown on the farm with a view to achieve the maximum yield and consequently, the profit envisaged. Organization of production involves how resources should be allocated among different products and production methods at different periods of time. Optimum allocation of resources is a major problem in farm production.

Efficient resource allocation in an individual production unit tends to co-exists with inefficient resource allocation for the agricultural sector as a whole (Readdy, 1979). Readdy (1979) further emphasized that resources can be allocated efficiently when the following conditions hold. Resources are allocated within each farm in a manner that equates the marginal value productivities of resource services, that is a unit labour or capital should not be used to grow sugar if it can produce a greater value product in livestock. Resources are distributed between farms and farming areas so that their marginal value productivities are equal. Resources are distributed between farming and other producing areas to equalize their marginal value productivities and finally resources are allocated over time such that their discounted value products are equal. Resource allocation generally starts with

assumption regarding the motive of producers. The classical assumption is the motive for profit maximization which is an ideal framework against which various forms of efficiency of production can be adequately be measured and tested as described in 2.2.1 (Adeniyi, 1988). Afolabi (1983) contended that resources are said to be efficiently, effectively and productively utilised if it is possible to redistribute or re-allocatethem and make at least one person better off without simultaneously making another worse (a condition of pareto-optimal).

2.3 Large Scale Farming.

Drucker (1946) defined large scale farming or corporate farming as an organization that exists as a "legal person" apart from the individuals who own and control it. It carries on business in its own name, enter into contracts, sue and be sued, own property, borrows, and lend money. Corporate farming in general can be defined as the business or commercial organization of the agricultural industry (Manson, 1960). Large scale farming avoid some of the disadvantages of partnership or group farms and sole proprietory family farms. The sources of fund of the corporate farms rest on the sale of bonds or through mortgage banks or any contribution of these methods (Riley and John, 1963). Some of the advantages of large scale farming includes economies of scale, evolving of research on the farms, disease control, efficient processing with high quality produce and efficient sales organization (Courteney, 1968). Large scale farming, being

characterized by the use of heavy machineries have the advantage of increasing productivity of land, provide increased economic returns to the farmer, timeliness and precession of operations, reduced losses and improved quality of food products, improvement of the working environment, improved dignity of the farmer and increased agro-business activities on the farm (Anazobo, 1984). Okuneye (1986) stated that the major obstacle to establishing large size and viable farm project is the land tenure system. The use of machines on large scale farm increase foreign dependency of agricultural production in the Country. There is the whole question of the appropriateness of high capital intensive use in production in a labour abundance, capital scarce Country like Nigeria. Inadequate urban absorption of labour inequalities engendered by the above process, could in addition create a large segment of allienated individuals who can easily be a source of recruitment into various kinds of revolutions with disastrous social consequences (Willie, 1985). Regarding the weakness of large scale farm projects, Abalu and D'Silva (1980) felt that even if the Country could afford the heavy investment that would be involved, the tendency would be to create a landless class displacing the original owners of land and replacing them with fewer but more powerful and wealthy individuals.

2.4 Mixed Farming.

Mixed Farming system combines crop production with animal production (Anyanwu, 1982). The animal component of the farm plays

a crucial role in the maintenance of soil fertility through the production of manure. Other importance include the demand for animal products in the diet. the requirement of livestock for meat and as a means for accumulating wealth through herds expansion (Ibrahim. 1989 and Heady. 1977). Crop and animal production on the same farm are complementary to each other. While the animal section provides manure to the crops. the crop section supplies crop straws and residues to serve as animal feeds.

Okon (1989) stated that keeping of large animal enterprises do not differ much from those in developed Countries. They are both characterized by large capital investment and high degree of specialization. Many of the commercial farms do not even grow their own feed. The potential efficiency and productivity of animal/crop combination that result from their interaction becomes relevant when resources are scarce. Most of the livestocks in tropical Africa subsist on rangeland grasses and browse. sometimes supplemented by seasonal crop residues. Both the quality and quantity of intake vary markably from region to region. but inadequate nutrition is probably the most widespread and important disease of livestock in Africa (ILCA. 1980). The problem that is inherent between pastoralist and rural farmers are reduced and such problems include communal clashes. constant movement of the herdsmen. isolation of animal from endemic disease outbreak areas as a result of movement is reduced when semi-intensive animal production is practiced. Animals kept under semi-intensive system are given supplementary feeding in addition to the crop straws on

the farm. Animals tend to be more comfortable when they are restricted from roaming about.

The most popular breeds of cattle kept in Nigeria are the Zebu. Bunaji or the white fulani cattle, Sokoto gudali and Wadaro (shuwa), rahaji (red bororo) and the long Lyrehorned cattle.

The major limitations of livestock production as given by Thurasingham (1988) has been the general belief that wet tropics is not a good place for livestock production, lack of infrastructures like Laboratories, lack of training and research facilities in sufficient qualities, and most importantly, the lack of finance, organized marketing and inadequate trained staff. The FAO (1966) gave two primary shortcomings of livestock raising in Africa in which immediate action would seem to be most effective are:

(a) the high mortality of young animals, which accounts for half of the animals between birth and the age of 18 months, and

(b) the marketing of animals which are too old.

The expenditures involved in bringing the young animals to maturity more rapidly will only be worthwhile if they are actually slaughtered at young age.

2.5 Cases of Linear Programming and Productivity Studies.

Linear programming (LP) techniques can be applied to problems aimed at optimising a linear objective function given production activities and available resources levels (Mijindadi, 1980). The

technique may be used to generate optimal enterprise and resource combinations for a given production situation. Heady (1982) stated that LP as a planning tool can be applied at individual farm and industry levels as well as the national level. Mijindadi (1980) stated that the application of Lp to traditional agriculture do present some problems. The first problem is related to the basic assumption of the model. The objective function usually implies that profit maximization is the sole goal of farmers. This may not be true for small traditional farmers who would produce to meet subsistence food requirements. The second problem is the reliability of generalizing from an Lp solution based on activities and resources of "representative" "average" or synthetic farms to the behaviour of individual farmers. The arguement Mijindadi (1980) emphasized is that farmers do not possess equal amount of resources nor do they responds alike to changes in economic stimuli so that the estimate of an optimum plan may not be applicable to all farmers. This problem of representative farms can be solved by stratifying the samples by a factor or factors or on the basis of importance or quality. Activities and constraints are stratified by each strata. and different LP model developed for each class. Variations in the optimal plan may be due to management. The problem of stratification and stating the objective function can be solved when large scale farms are studied. The objective function under a large scale farm is purely profit maximization. Production technologies under a large scale farm for each activity in the project are the same. thus the elasticities of production may also

be the same.

Okon (1989) pointed in his study the difficulty of determining the coefficient for the Lp model when farmers engage in mix cropping and rearing different types of animals. The use of farm budgeting and production function can be used to construct and production function have similar resource requirement for each crop. The production function were devised to reflect the crucial interdependence between crops in mixcropping system prevailing in the areas.

The LP techniques has many applications beside its use in farm planning (Heady and Chandler. 1967). It may be used to find the optimum or best solution to any problem provided the objective function can clearly be defined and measured. A typical example is the use of LP analysis to determine a minimum cost of ration for livestock which will provide certain dietary requirements.

Adesini (1982) reflected in his study that resource productivity can fluctuate from year to year. exhibiting lack of consistent increase over the study period. which has presumed to be due to the vagaries surrounding farm production environment. This according to Adesini (1982). productivity can be improved when government provide improved seeds that are high yielding. pests and disease resistant varieties of seeds and those that are responsive to fertilizer application. In addition. crop protection chemicals and fertilizers should be made available to farmers at reasonable prices. Adesini and Ladipo (1983) reported that the most effective approach to agricultural land use and planning lies in intimate

understanding of the natural eco-system existing in different areas and a careful simulation of these for resource utilization. This will ensure that productivity can be maximized resources conserved and a long term usage made possible.

On the whole, to achieve high level of efficiency and productivity of resource use, one has to embark on proper planning and management tactics. Planning in areas of the best crop combination to be grown to economise the use of scarce resources. Okon (1989) emphasized this point when he said, the potential efficiency and productivity of animal/crop combinations that result from their interactions becomes relevant when resources are scarce.

CHAPTER THREE.

3.0 METHODOLOGY.

3.1 The Study Area.

This study is of Birma Agricultural Project Ltd. situated at Sabon Gari of Biu Local Government Area of Borno State. The State has an estimated area of 69,436 square kilo meters (Statistic year Book, 1993). Rainfall starts in the month of April and last for about 160 days (about 5 months) with a mean annual rainfall of about 1000mm. Temperature in this part of the state tends to be lower than in other parts of the state.

The vegetation of the area falls partly within the Northern Guinea Savanna and some part represent a transition from the Sudan woodland. The soil that is more predominant in this part ranges from deeper clay on the plains to shallow stoney soils particularly on the hills and inselbergs. The major crops grown on this type of soils include maize, guinea corn, cotton, rice, groundnuts, cowpea, pepper and millet. Animals reared in the area include cattle, goats, sheep, poultry and pigeons. Farmers found in this part of the state are predominantly subsistence farmers, growing crops and livestock mainly for subsistence requirements.

3.2 Sampling Procedure.

The Birma Agricultural Project Ltd was selected for this study. It is about the largest farm business set up in Biu Local Government Area and this was most appropriate for the focus of this study.

3.3 Data Collection.

Primary and Secondary sources of data was used for this study. The Secondary data was obtained from the record books of the farm. while the primary data was collected by means of a structured questionnaires and oral interview with the project manager and other categories of the farm staff. The data collected cover a period between 1989-1992. A mean data was determined to serve as a representative data for the farm. Data was collected on production and marketing activities of the farm. Specifically, the parameters collected include the following;

i. Farm Labour- Data was collected on the number and types of operations undertake on the farm. The number of hours or man-days taken for each operation by each category of workers (children, female and male) was recorded. For the purpose of this study, the year was divided into three (January - April, May - August and September - December) to correspond with the major types of operations undertaken.

ii. Machine Hours- The type of machine operation undertaken on the farm and the duration or number

of hours spent on the farm will be recorded where tractor services were hired. This will be relevant only if machines and tractors are hired, but in the case where the farm owns tractors, machines hours will not be used.

iii. Output- The yield of crops in kilograms and the number of livestock kept were recorded.

iv. Inputs (fertilizer, herbicides, pesticides, seeds, fuel etc) - The type and quantity of these inputs will be recorded. The book values of these inputs will be recorded in naira.

v. Land- The available and actual land in hectares under cultivation was recorded.

vi. Merchandising Cost- The costs of storage and transportation of products from the farm to market was recorded in naira.

vii. Costs of Land Preparations- The amount charged for land preparations weeding, spraying of herbicides, and other major operations on the farm was recorded in naira. These costs will be relevant if labour and tractors were hired by the farm, but if the operations were performed by tractors owned by the farm, cost of fueling will be used.

viii. Crop and Livestock Sales- Information on sales per unit of crop and animal was collected to

determine the revenue accruing to the farm.

ix. Maintenance Costs, depreciation costs of assets, interest charges and salaries were recorded in naira. Assets were assumed to have been depreciating at the rate of 10%. Salvage value of the assets were also assume to be 50% of the total cost of assets. The inflationary tendencies experienced during the period of the study implies that the salvage value of asset is likely to be high. These costs were subtracted from the total gross margin to arrive at the net profit accruing to the farm. Depreciation will be calculated using the straight line method of depreciation.

3.4 Analytical Techniques.

There are several analytical techniques or tools that can be employed in productivity studies, and the choice of a particular one depends essentially on the available data, the analytical facilities available and the use to which the results are intended. Three analytical tools will be used for this study namely:

i. Farm budgeting.

ii. Regression analysis, and

iii. Linear programming.

3.4.1 Farm Budgeting.

This is mainly an operation leading to the estimation of the total costs and revenue for the same period (Oluwole. 1970). Farm budgeting shows whether or not a proposed change can improve the earnings of a farm business. This or investment planning tool can also be used to select the most profitable plan for a number of alternatives. Farm budgeting can be either partial budgeting or complete budgeting. A partial budgeting is used to determine whether a small change can alter the whole farm plan. A complete budgeting on the other hand is considered when overhauling a farm or when a new farm is envisaged. Data required for the computation of the two types of budgeting are similar involving the cost of production and the revenue accruing to the farm. The model can be stated in the following manner.

$$NFI = TR - (TVC + TFC) \quad ---- \quad 3.1$$

where.

NFI = Net Farm Income of the farm in naira.

TR = Total returns to all enterprises on the Farm.

TVC = Total variable costs in naira.

TFC = Total fixed costs in naira.

Net farm income signifies the difference between total returns in naira for the farm and total expenses of production of the enterprises. One prominent failure of this model

is that, it does not define how optimum returns can be attained from the limited resources.

3.4.2 The Multiple Regression Model.

The estimation of the input-output relationship involves the specification of a production function. The production function relates one or more variable inputs holding other inputs constant to total products. The classical production function has three stages. Stage one shows that there are increasing returns to resource inputs. That is, each additional unit of input adds more to output than the previous unit of input. In stage two, returns are increasing but in stage three, returns are decreasing. Stage two is cusidered the most economic stage to produce.

The production function will be used in this study to determine the extent to which these factors are able to explain variations in output. The greater the extent to which these factors are able to explain the variability in output, the larger is the influence these inputs have on production of crops on the farm. The general linear relationship can be stated as follows;

$$Y = b_0 + b_1 x_1 + b_2 x_2 + \text{--------} + b_i x_i + e \quad \text{-------} \quad 3.2$$

Where;

Y = Output from the farm

x_1 = is the i^{th} input

b_i = is the i^{th} regression coefficients

b_0 = constant term

e = error term

Several other production function forms are used in productivity studies and the choice of any form depends on its desirable characteristics Researchers usually use the cobb-Douglas and linear forms because of the relative ease of computation and the fact that multiplicative model have seemed appropriate (Heady and Dillon, 1972). The functional forms, namely, the Cobb-Douglas and the linear forms will be used in this study.

3.5.2.1 The Cobb-Douglas or Power Function

$$Y = AX_1^{b1}\ X_2^{b2}\ X_3^{b3}\ X_4^{b4}\ X_5^{b5} + e \text{ - - - - - } 3.3$$

The logarthmic form can be given by;

$$\text{Log } Y = \log^{b}_{0} + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 \text{ -- } 3.4$$

Where,

Y = weight of all the crops in kg/ha

X_1 = Farm size in hectares

X_2 = Labour in man-days (hied)/ha

X_3 = weight of fertilizer in kg/ha

X_4 = quantity of seeds in kg/ha

X_5 = quantity of herbicides in litre/ha

$b_1 - b_5$ = regression coefficients or elasticity of production of the factors X_1 - - - - X_5

The values of the coefficients b_1 --- b_5 are direct measures of elasticities of response to inputs X_1 --- X_5 respectively in the production process. When the sum of the coefficients are taken, it will give a value of either one, greater than one or less than one. A diminishing return is reflected by a value less than one, a constant return to factors of production is indicated where the sum of the coefficients is unity. An increasing returns shows the sum of the coefficients greater than one. This implies therefore that the sum of elasticities of production is used as a measure of returns to scale in the production process. The advantage of using the Cobb-Douglas producton function are the ease of estimation, its ability to show elasticities of response to factos and the nature of returns to scale. This function allows constant, increasing or decreasing marginal productivity. The disadvantage of using this function emanated from the fact that the function cannot show both diminishing and increasing returns to factors of production in a single response curve. The assumption of constant elasticities of production of all levels of inputs and finally the assumption of zero output at zero level of inputs.

3.4.2.2 The Linear Production Function

The general linear production function for this farm can be

given as:

$$Y = b_0 + b_1 X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e \text{ --- } 3.5$$

where.

Y = output of crops in kilogram/ha.

X_1 = farm size in hectares

X_2 = labour in man-days/ha

X_3 = quantity of fertilizer in kg/ha

X_4 = weight of seeds in kg/ha

X_5 = quantity of herbicide in litre/ha.

b_1 ..- b_5 = regression coefficients.

b_0 = constant term, and

e = error term.

The equation assumes a linear relationship between the output and the factors. It is also assumed to give a constant marginal productivities of the resources used. The advantage of the linear production function is the cheapness with which it can be fitted with the least square regression technique. The major disadvantages resulted from the fact that it cannot show the diminishing returns to factors and is therefore difficult to determine.

3.4.3.3 Variable Selected for the Production Function.

The variables selected for this function include land, quantity of fertilizer, quantity of seeds, labour and herbicide used on the farm. The main reason for including the variables into the production function are as follows:

i. to determine the extend to which the selected variables explain the variability in yield of crops.
ii. to determine the nature of relationship between crop output and the variables.
iii. to determine the contribution of each unit of resources to the output, and
iv. the inclusion of the error term is due to the fact that independent variables in the model may not completely explain the variations that will be observed in the values of the output due to error of measurement or non-inclusion of some variables that may be relevant.

3.5.1.4 Expected Information From Production Function analysis.

i. The coefficient Bi's are known parameters and their estimators bi's obtained from the production function will give an insight into the direction and magnitude of change when one of the units are changed by one unit. The b_0 is the level of output which can be obtained without the use of the

other specified inputs. The summation of the coefficients in the Cobb-Douglas funtion may not add to one given rise to the following situations;

a) When the sum of the coefficients is equal to one, it implies there is constant return to scale.

b) an increasing returns to scale occurs when the sum of the coefficients is greater than one, and

c) decreasing returns to scale is the case when the sum of the coefficients is less than one

ii The marginal value productivities of each resource can be calculated from the production function. The efficiency of resource use can be determined when the marginal value productivities are compared with their respective factors prices. Marginal value productivity of an input X_1 is the addition to the total value of production resulting from the utilization of the last unit of resource X_1. If MVP_{X1} = price of X_1, then X_1 is efficiently used. MVP is given by the equation;

$$MVP_{x_i}=\beta_i \frac{\overline{Y}}{\overline{X}} P_y \text{---3.6}$$

Where,

MVP_{x1} = marginal value productivity of x_1

β_1 = the elasticity of production of x_1,

P_Y = the price per unit of output Y

$\bar{Y}$ and $\bar{X}$ = are geometric means of the dependent and independent variables respectively.

A positive MVP may imply that output could be increased by using more of a given resource. However, the size of the MVP must be compared with the factor cost in order to determine its usefulness. The difference between the MVP and the factor cost indicates the magnitude of resource adjustment necessary to attain economic optimum.

iii. The coefficient of multiple determination (R^2) obtained from the production function analysis can be used as a measure of goodness of fit. The R^2 epresent the percentage of total variation in the output (Y) that can be explained by the variation in the independent variable X_i. A higher R^2 value is assumed to be better than a lower R^2 value.

iv. Regression coefficients for the various inputs used will be tested using the t - test to determine the inputs to which output is highly responsive. Only those variable whose b - coefficient values are significant at 1%, 5% and 10% level of significance will be taken to significantly influence variation in output.

3.5 Linear Programming Model.

The linear programming model maximizes or minimizes a linear function of variables subject to linear inequality and must assume

non-negativity levels (Agbo, 1989). It is a tool used mostly in operation research, a branch of science which deals with the analysis of data on which the correctness of future actions depend. There are a number of assumptions which must be taken into consideration before LP can be applied. They are as follows:

i. there must be a linear relationship between the resources and the activities. That is as we double the production of the activities, then all the resources must be doubled as well.

ii. divisibility or continuity - this suggests that there must be a possibility of producing a fraction of output and also using a fraction of resources.

iii. additivity or independence - two or more methods of converting (processes) resources into products can exist within the limitations of available resources and that the quantities of outputs and inputs will be the sum of the quantities which would result if several processes were used *individually*.

iv. finiteness - the opportunities open to the farmer as well as his resources are not unlimited.

v. single valued expectations - only exact data and probable data are used, and

vi. short-term static model - the solutions provided

by the LP may change continously because it is a short-term solutions.

A linear programming solution provides the following informations;

(a) the crop and livestock mixture that can be produced

(b) the levels of resources used and the amount unused,

(c) the total gross margin realizable from the optimum farm plan, and

(d) the marginal value prodctivities of scarce resources

The model can be formulated as follows;

$$Z=\sum_{j=1}^{n} C_j X_j (j=1,2.---,n) \text{ --3.7}$$

Z = the returns to be maximized.

X_j's = the decision variables such as the number of hectares produced or labour hired, and

C_j's = measure the marginal contributions of each decision variables such as the returns over variables cost (gross mrgin of one hectare of crop or one head of livestock produced)

The fixed conditions present on the farm are usually stated in the form of a linear restrictions as can be seen below.

$$\sum_{j=1}^{m} Aij < b_i$$

where,

X_j's = are decision variables such as the number of hectares to be produced,

C_{ij}'s = represent how much of a resource is required for each activity, such as the amount of labour required to produce one hectare of crop or one head of livestock, and

b_i = represent the total amount of resources available for the farm project.

The linear inequality equations can be made to equality equations by adding disposal activities to allow for non-use of resources. This can be represented as;

$$\sum_{j=1}^{m} C_{ij}X_j + Li = b_i \ldots\ldots 3.9$$

where,

Ii = represent unused resources.

The next condition possing restriction on the decision variables takes the form of:

$$X_j \geq 0 \quad (j = 1,2,- - - n) - - - - 3.10$$

The condition states that for all j's, only non-negativity levels of each decision may be examined. In general, the objective of any business unit is to maximize profit or net revenue.

In order to accomplish this objective, the business unit must

assume a production function which can be expressed in mathematically as a relationship between quantities of output produced and inputs used in the process of production. The production function for enterprises on Birma Agricultural Project Limited can be expressed by;

$$Y_j = f\ (T_j,\ C_j,\ L_j) \text{ - - - - - - - - - - - } 3.11$$

Where,

Yj = the amount of output realized from the use of resource,

T_j = land in hectares used to produce product j,

C_j = capital in naira used to produce j, and

L_j = labour in man-hours used to produce j.

The profit function for each of the activities can be given by;

$$\pi_j = P_y Y_j - (kT + rC_j + wL_j) \text{ ----} 3.12$$

P_y is the price of the output and k,r and w are prices of inputs land, capital and labour. The first order condition for maximization of the profit function is that its partial derivatives be equal to zero. The partial derivatives are taken with respect to T_j, C_j and L_j.

$$\frac{\partial \pi_j}{\partial T_j} = P_y \frac{\partial y_j}{\partial T_j} - K \ldots\ldots 3.13$$

$$\frac{\partial \pi_j}{\partial C_j} - P_y \frac{\partial y_j}{\partial C_j} - r$$

$$\frac{\partial \pi_j}{\partial L_j} = P_y \frac{\partial y_j}{\partial L_j} - W$$

If equations 3.13 to 3.15 are equated to zero, and the values of the input prices are moved to the right hand side of the respective equations, equations 3.13 to 3.15 imply that the marginal value products with respect to each input must be equal to the value of the input prices.

$$\frac{P_y \frac{\partial Y_j}{\partial T_j}}{P_y \frac{\partial Y_j}{\partial C_j}} = \frac{MVP_{Tj}}{MVP_{Cj}} = \frac{k}{r} \text{ - - - - } 3.16$$

Sensitivity analysis can be carried out using the results from the LP model. This will allow us to see the response of the value of output when extra resources that are scarce are brought into production or when excluded activities are forced into the optimum farm plan. The use of extra units of scarce resources are likely to increase the gross margin while including excluded activities into the plan may attract some penalties that will bring down the total gross margin.

3.5.1 Types of Errors that Influence a LP Result.

The quality of results obtained as a result of applying LP model

depends heavily on the researcher not committing the following errors:

i. data errors - The quality of LP results depend on the quality of data used in the programme. Data errors can be committed in estimating costs. labour requirements and prices of produce.

ii. nature of LP - An overestimated prices and yields are likely to bias net revenue upward and an underestimated prices and yields can bias net revenue downwards.

iii. fixed costs - Fixed costs are not included in the calculations of LP. instead. only variable costs are required for the calculations. To arrive at the profit. fixed costs must be subtracted from the total gross margin.

iv. generalization error - The use of averages in LP are not proper because farmers may alter their strategies or technical inputs under different environmental conditions and there is no evidence to show that averages can give average products (Low, 1976).

v. Classification problem - Unless there is complete homogeneity among firms in each category. there will be some kind of classification problem. and

vi. assumption of linear production function.

The true production function is not linear and this implies the result that will be obtained from the programme differ from the true production function. It must be stressed that linearity

problem can be overcomed by the use of non-linear objective function (Olayide, 1972).

3.6 Uses of the Models.

The farm budget will be used to satisfy objective one. The main purpose of this model is to identify the costs, returns and profitability or loss of engaging in the crop and livestock production.

The regression model will be used to satisfy objective three. This will be achieved by calculating the marginal value productivities of the resources. The MVP of the resources are obtained by multiplying the regression coefficients by the ratio of the geometric mean of the output and respective resources times the price of the output. The MVP calculated for each resource will serve as a measure of efficiencies of each of the resources. The model will assist in determing the relative influence of all the variables believed to have contributed in determining the yield of crops.

Linear Programming model will be used to achieve objective two. It will also be used to determine the penalties the farmer will face if he forces the production of excluded activities. The prices of the excluded activities must attain before they come into the plan can also be obtained. The total gross margin to be obtained when the optimum farm plans are reached can be achieved. Both quantities of used and unused resources can also be determined using this model.

CHAPTER FOUR.

4.0 DATA ANALYSIS AND INTERPRETATION OF RESULTS.

In this chapter, the presentation and interpretation of the results were carried out. Three analytical techniques have been employed for this study, namely, the farm budgeting analysis, the production function analysis and the linear programming techniques. The farm budgeting analysis has been used to determine the net farm income (profitability) of the whole farm, while the production function analysis has been used to derive the efficiencies of resources used on the farm. Two forms of the production function equations has been used for this study, namely, the linear and Cobb-Douglas production equations. The form that suite best was used for the analysis. The linear programming technique on the other hand was used to determine the optimum farm plan of Birma Agricultural Project Limited. Attempts were made to introduce extra units of the scarce resources to determine their effects on the final solutions.

4.1 Resource Situation in Birma Farm.

4.1.1 Land resources.

Land is an important input for farming under both the subsistence and the large scale farmers. This study has been carried out onlarge scale farm. Land for this farm was acquired

with the aid of the State Government as well as with the help of the communities in the area. This idea of setting up the farm was welcomed by the people considering the gains they would derive from the farm. It was welcomed because the peoples desire for the area to develop was high. Table 4.1 shows the sizes of land devoted for each crop and their outputs. Also the number of cattle, goats and sheep are reflected on the table.

Table 4.1 Sizes of Land and Production of Crop/Livestock.

Crop/Live-stock.	Hectares	Livestock No.	Output(kg).
Crop			
Maize	224	-	170.733.33
G/corn	10.67	-	18.500.00
Rice	80.33	-	23.333.33
Cowpea	4.00	-	89.900.00
Livestock	-	-	-
Cattle	-	314	-
Sheep	-	77	-
Goat	-	22	-

Source: Birma Agricultural Project Limited, 1993.

From the table, it can be observed that maize occupies the greatest allocation of land. This action can be explained by the fact that the duration of rainfall in the area is short.

4.1.2 Labour Requirement.

The type of labour used on the farm was hired labour. Hired labour was obtained from the people living in the surrounding villages. The average number of hours spent by children, female and male in the period were 4.67, 4.67 and 6 hours on work days respectively. The effective working hours when these figure were converted by using the ratios 0.5, 0.75 and 1 for the children.

female and male were 2.33, 3.5 and 6 man hours respectively. Hired labour accounted for about 40% of the work done on the farm, leaving about 60% to machine operations. For the purpose of this work labour use was divided into three periods to coincide with the types of operations carried out on the farm. The three periods were January - April, May - August and September - December. The average wage rate on the farm was N2.00 per man-hour. The major operations carried out in the periods are described below:

1. January - April - This period coincide with the time when farm sanitation operations were carried out. The operations include land clearing, removal of stumps, assembling and burning of the crop residues. These operations were carried out to prepare the land for the season's operations.
2. May - August - This period fall at a time when land preparation, planting/sowing, fertilization, weeding and scaring of birds were carried out. This period witnessed scarce labour supply, when the people in the area were also busy working on their farms. The problem of labour scarcity was eased by the use of herbicides and machineries on the farm.
3. September - December - This was the time when harvesting, threshing and bagging operations were carried out. Harvesting of some crops were carried

out with a combined harvester excepts cowpea which was harvested manually. Bagging and weighing of produce were also carried out manually. Almost all the crops were allowed to dry completely before they were harvested.

Women constituted the majority of the hired labour force during these periods. This could be explained by the fact that females are not restricted from coming out in the open as in other areas. The available man-hours that can be hired in the three periods were 50.133.33. 48.785 and 59.024.44 for January - April. May - August and September - December. These figures were obtained by multiplying the available number of working days by the number of people that worked on the farm and the normal working hours of 8 man-hours per day on the farm. Their respective man-days equivalents are 12.724.2. 12.382 and 14.980.82 man-days when the average values of 2.33. 3.5 and 6 effective working hours was used to be equivalent to one man-day. Labour used for grazing in the three periods were 124.76. 35.65 and 508.76. Table 4.2 and 4.3 show the labour actually used and the available labour within the three periods in man-hours.

Table 4.2 Actual Labour Used On the Farm in man-hours.

Periods/ Activities	Jan-April	May-Aug.	Sept-December
Maize	16.986.64	29.138.57	32.659.32
G/corn	969.73	1.119.70	2.306.44
Rice	9,793.00	10.113.00	19.845.3
Cowpea	669.73	669.73	1.406.43
Sheep	124.76	124.76	124.76
Goat	35.67	35.67	35.67
Cattle	508.76	508.76	508.76

Source: Birma Agricultural Project. Ltd. 1993.

Table 4.3 below shows that labour was abundant during Jan-April, and September-December than in May-August. This could be explained by the fact that most farmers in this area were less engaged on their farms, thus, they engaged in doing some off-farm duties. Data from the five tables were used in the LP calculations.

Table 4.3 Available Man-hours In the three Periods.

Periods	Available man-hours
Jan - April	50.133.33
May - August	48.785
Sept - December	59,024.44

Source: Birma Agricultural Project Ltd. 1993.

4.1.3 Seeds.

SAMSORG 31 and TZB (FAZ - 34) were the most common varieties of sorghum and maize planted on the farm. Improved variety of upland rice, 055 variety was planted during the beginning of the rainy season. Ife brown variety of cowpea was also planted on the farm. These seeds were bought from some seed sellers and Borno State Agricultural Development Program. Sometimes, the farm engages in the selection of seeds from the farm's produce for planting. Planting of seeds were done with the aid of machines and also manually. About 12,000 kg of seeds were planted on the farm. The breakdown of the seed are given on Table 4.4.

Table 4.4 Seeds Planted per crop.

Crop	Price/kg	Quantity (kg)	Total Costs(N)
Maize	26.00	2,788.46	72,500
G/corn	8.00	575	4,600
Rice	6.00	7,900	47,400
Cowpea	18.00	648.15	11,666.67
Total costs			136,166.67

Source: Birma Agricultural Project Limited, 1993.

4.1.4 Fertilizer.

To improve the soil fertility, both organic manure and mineral fertilizer were used. Compound fertilizer (N.P.K) was utilized on the farm. A total of 132.000 kg (2.640 bags) of mineral fertilizer was used on the farm yearly. The cost of a bag of fertilizer was N26.5 per bag. In all, the mineral fertilizer was used more extensively than the organic manure. This could have been made possible because mineral fertilizers were easy to handle than manure. Mineral fertilizers are more readily useable to the crops. Application of fertilizer was done manually and with the aid of broadcasting machines. N.P.K fertilizer was used on cowpea field as a starter dose only. Table 4.5 shows the quantity and total cost of fertilizer.

Table 4.5 Quantity and total cost of Fertilizer.

Crop	Quantity of fert. (kg)	Price/kg	Total Cost N
Maize	114.528.8	0.53	60.700.26
G/corn	4.025.15	"	2.133.33
Rice	11.194.96	"	5,933.33
Cowpea	62.89	"	33.33
Total cost			68,799.99

Source: Birma Agricultural Project Limited. 1993.

4.1.5 Herbicides.

Herbicides were applied at pre-emergence stage. The total quantity of herbicides used on the farm was 11.712 litres. Table 4.6 gives the breakdown of herbicides used by each crop. The major herbicides used on the farm were gramozone. Atrazine. Apron plus and Gardoprim A. 500 FW. Application of herbicides were carried out with the aid of boom sprayers mounted on a tractor. The use of herbicides on the farm has assisted in no small way in curbing the problem of labour shortage on the farm.

Table 4.6 Quantity and total cost of herbicides under each crop in - litres and naira.

Herbi-cides	Price/ litre	Maize	G/corn	Rice	Cowpea	T. cost
Gramazone	70.00	-	519.00	-	600.93	78.395
Atrazine	82.00	510.16	-	-	-	41.833.33
Apron plus	108.00	-	-	586.39	-	63.330
Gardoprim A 500 FW	50	-	820.00	-	-	41.000

Source: Birma Agricultural Project Ltd. 1993.

4.1.6 Fuel Input.

The fuel input comprising of petrol, diesel oil, engine oil and grease were used for operating the farm machineries. The farm got its supply from the oil dealers at the controlled prices. Hence, the farm did not suffer any form of fuel shortage. Diesel fuel was the most used on the farm since most of the machineries have diesel engines. The fueling of the machines did not give the much anticipated high cost of operation because fuel was cheap during the period of the study. Table 4.7 gives the breakdown of fuel consumption and costs in the period.

Table 4.7 Fuel Consumption and Total Cost in Litres and Naira

Fuel	Price/ litre	Maize	G/corn	Rice	Cowpea	N Total Cost.
Petrol	-	11109.69	575	3818.5	163.47	-
Cost of petrol (N)	0.70	7.776.78	402.5	2.672.95	114.43	10.966.56
Diesel-oil	-	33929.9	1807.36	11.772.38	490.50	-
Cost of diesel-oil (N)	0.55	18.661.45	994.05	6474.81	269.78	26.400.09
Engine-oil	-	1760.78	42.50	582.05	42.50	-
Costs of Eng. oil (N)	3.40	5.986.65	144.5	1978.97	144.5	8.254.62
Grease	-	138.75	4.22	58.09	4.22	-
Cost of Grease-(N)	5.00	693.25	21.1	290.45	21.1	1.026.4
Total Cost						46.613.67

Source: Birma Agricultural Project Ltd. 1993.

4.1.7 Management.

Upton (1973) stated that peasant farmers are good managers given their circumstances. The Birma Agricultural Project Ltd has a mean staff strength of 78. The top members of staff are trained staff. The Director, farm manager, the engineer and the Veterinary Doctor are holders of Ordinary National Diploma in agriculture. Bachelor of Science Farm Mechanization and National Youth Service Corps. Veterinary Doctor, to handle the livestock section. In the early life of the farm, expatriates were employed to handle the farm.

4.1.8 Summary of Inputs Used On the Farm.

Table 4.8 below highlights the summary of the inputs used on the farm.

Table 4.8 Inputs Used On the Farm.

Crops/inputs	Units	Maize	G/Corn	Rice	Cowpea	Land
	Ha	224	10.67	80.33	4	
Jan-April	Labour MHRS	16.986.64	969.73	9.793	669.73	
May-Aug.	" "	29.138.57	1.119.7	10.113	669.73	
Sept-Dec.	" "	32.659.32	2.306.44	19.845.3	1.406.76	
Seeds	kg	2.788.16	575	7.900	648.15	
Fertilizer	"	114.528.8	4025.15	11.194.96	62.89	
Herbicides	Litres	1.119.93	510.16	586.39	820.00	
Petrol	"	11.109.69	575	3818.5	163.47	
Diesel Oil	"	33.929.9	1807.36	11.772.38	490.50	
Engine Oil	"	1760.78	42.50	582.05	42.50	
Grease	"	138.75	4.22	58.09	4.22	

Source: Birma Agricultural Project Limited Ltd. 1993.

4.2 Cost - Return Analysis.

The profitability or net returns of a farm is considered as the total revenue less total costs. In view of the fact that the analysis was carried out on a single farm producing both crops and livestocks. Net farm income was determined for the two separately.

4.2.1 Variable Costs.

These are costs incurred on variable resources, and the costs increases as the scale of operation increases. Variable inputs utilized on the farm are fertilizer, labour, seeds, fuel and herbicides.

Fertilizer utilized on the farm was compound fertilizer, N.P.K. The average price per kilogram was N0.53. The fertilizer was used on the cowpea field as a starter dose only, while it was used extensively on maize guinea corn, and rice fields.

Labour was used for all the activities on the farm. Labour used on this farm was hired labour from the nearby communities and the wage rate charged was N2.00 per hour.

Seeds used were costed at N26.00, N8.00, N6.00 and N18.00 per kilogram respectively for maize, guinea corn, rice and cowpea. The average price for all the seeds was found to be N14.5, and this was used for comparison with the marginal value productivities since their average weight was used in the production function analysis. The total amount of money spent on drugs amounted to N15,000.00.

Herbicides were measured in litres. The average price for all the herbicides was N77.5 per litres. Herbicides were used during the pre-emergence stage.

Petrol as a source of energy and engine oil, diesel oil and grease as sources of lubricants were used by the machineries on the farm. The price of petrol, engine oil, diesel oil and grease were N0.70, N3.40, N0.55 and N5.00 respectively.

4.2.2 Fixed Costs.

The fixed costs are expenses incurred on the farm irrespective of whether the farm is in production or not. These costs do not vary with the level of production. The different types of fixed cost items include maintenance and repairs costs, salaries of permanent staffs, depreciation costs, death of animals and interest charged on capital borrowed. The depreciating assets include tractors, ploughs, cars, combined harvester, boom sprayers, water drinkers, houses, land and planters. The year of purchase, expected life of the assets, purchase price per unit and number of items can be seen on Table 4.9. Straight line method of depreciation was used for the calculations of depreciation costs.

Table 4.9 List of Fixed Assets and their depreciation costs

Equip-ments	Year of purchase	Life of assets	No. Ha.	Unit price(N)	Total costs(N)	Depreciation costs(N)
Cars	1986	10	4	70.000	280.000	14.000.000
Tractors	1985	15	5	50.000	250.000	8.333.33
Ploughs	1985	10	4	10.000	40.000	8000.00
Houses	1984	50	4	35.000	140.000	1400.00
Harves-ters	1985	15	1	100.000	100.000	3333.33
Boom Sprayers	1985	8	2	3000	6000	375.00
Water Drinkers	1987	3	5	150	750	125.00
Planters	1985	8	4	5000	20.000	1250.00
Broad-casters	1985	7	1	5000	5000	375.00
Land	1981	100	2000	150	300.000	1500.00
Total depreciation						38691.66

Source: Birma Agricultural Project. Ltd. 1993.

Table 4.9 shows that total depreciation was N38.691.66. A summary of both variable and fixed costs are in Table 4.10.

Table 4.10 Total Cost of Production.

Resources	Cost of Production N
Variable costs	
Fertilizer	68.799.99
Seeds	136.166.67
Fuel	46.613.65
Hired Labour	251.340.04
Feeds	45.009.99
Drugs	15.000.00
Herbicides	224.558.33
Total Variable Costs	787.488.67
Fixed Costs.	
Salary	216.000.00
Diosh	12.598.58
Maintenance & repairs	30.000.00
Livestock purchased	56.000.00
Interest	20.000.00
Depreciation	38.691.66
Total Fixed Costs	373.285.24
Total cost of Production	1.160.773.90

Source: Birma Agricultural Project Ltd. 1993.

4.2.3 Gross Revenue Accruing to the Farm.

The gross revenue accruing to the farm comprises of all proceeds realized from the sale of both crop and livestock produced by the farm. The gross revenue of the farm is shown in Table 4.11. A total of N1,007,399.98 was realized from the sale of crop produce and N1,506,3000.00 was obtained from the livestock sales. The livestock contributed about 59.92% of the total revenue accruing to the farm. leaving 40.08% to the crop section. The total revenue realized was N2,513,699.98.

Table 4.11 Gross revenue from Sales of Crops and livestock.

Crops/livestock	Sales N
Maize	612,199.99
G/corn	55,500.00
Rice	269,700.00
Cowpea	69,999.99
Cattle	1,570,000.00
Sheep	30,800.00
Goat	5,500.00
Total Revenue	2,613,699.80

Source: Birma Agricultural Project Ltd. 1993.

4.2.4 Net Farm Income of Birma Agricultural Project Ltd.

This section attempts to give a summary of the cost and returns for the crop and livestock sections separately for the farm. and consequently. their net farm incomes. The Net Farm

Table 4.12 Net Farm Income of the Crop Section.

Details	Total Cost N	Total Sales N
Revenue from crops		
Maize		612,199.99
G\Corn		55,500.00
Rice		269,700.00
Cowpea		69,999.99
Total Sales		1,007,399.98
Cost of Production		
Fertilizer	68,999.99	
Fuel	45,009.00	
Herbicides	224,558.33	
Seeds	136,166.67	
Hired labour	251,340.06	
Interest	20,000.00	
Depreciation	38,566.00	
Salary	200,000.00	
Total Cost/Revenue	984,640.71	1,007,399.98
Net Farm Income (crops)		N22,759.27
Return per hectare		N71.35
Return per man-hour		N11.34
Return per capital		N 0.03

Source: Birma Agricultural Project Ltd, 1993

The return per hectare, man-hour and capital are reflected on Table 4.12 above.

Incomes were obtained by subtracting both the total variable costs and the total fixed costs from the total revenue. The Net Farm Income realized here represent the Net Profit obtained for the crop and livestock sections. Table 4.12 and 4.13 show the Net Farm Incomes for the crops and livestock section.

Table 4.13 Net Farm Income of Livestock Section.

Details	Total Cost of Production(N)	Sales of Animal(N)
Revenue from Livestock		
Cattle		1.570.000.00
Sheep		30.800.00
Goat		5.500.00
Total Revenue		1.606.300.00
Cost of Purchases		
Feeds	45.009.00	
Death	12.593.58	
Labour (Wages)	4.014.95	
Depreciation	125.00	
Drugs	15.000.00	
Starting livestock stock	56.000.00	
Total Cost	169.742.53	
Net Farm Income (Livestock)	N1.486.557.50	
Return to Naira Costs	N8.46	
Return to one man-hour	N715.59	

Source: Birma Agricultural Project Ltd. 1993.

The Net Farm Income obtained from the livestock section is N1.436.557.50. This value when compared with the Net Farm Income from the crop section which was found to be N22.759.27 was larger.

This suggests that livestock production contributed more to the farm income than the crop section. The contribution of one man-hour in the livestock production is larger than that obtained from crop section. The return per capital in the crop section also is more than the return per capital value in livestock section. The net farm income of the farm is N1.461.316.70. These values can be seen in Tables 4.12 and 4.13.

4.3 Activities in the Linear Programming Models.

Six activities have been specified in the linear programming model. They are:

i. production activities of both crops and animal.
ii. consumption activities.
iii. selling activities.
iv. labour hiring activities.
v. borrowing activities. and
vi. buying activities.

4.3.1 Crop and Livestock Production Activities

The optimum farm plan shows that all the seven activities of both crop and livestock entered in the basic programme appeared in the plan. Maize, Guineacorn, cowpea and rice be produced at 223.996, 10.67, 0 and 87.75 hectares respectively, and also 1524, 30 and 17 heads of cattle, sheep and goats be provided. All these figures composed of both the enterprise combination and minimum levels for consumption. Maize being a major crop on the farm has

the highest number of hectares and this confirms its supriority over the other arabe crops. The Net Farm Income (NFI) realised from the planned farm is N7.399.958.4 and when compared with the NFI on the unplanned farm of N1.461.316.70, shows a remarkable improvement. Appendix I shows the basic linear programming matrix while Table 4.13 shows the optimum farm plan.

4.3.2 Consumption Activities

Consumption levels was provided for in the optimum farm plan. The farm can produce 16.833.33, 5.500 and 10.687.5 kilograms of maize, guineacorn and rice, and 26, 29 and 16 heads of cattle, sheep and goats respectively. Appendix I shows the minimum consumption levels entred in the basic programme.

4.3.3 Selling Activities

Some levels of selling activities came out in the optimum plan. The proprietor can produce 170.752.1, 18.500 and 98.372 kilograms of maize, guineacorn and rice respectively for sale. He can equally raise 470.372, 77 and 22 heads of cattle, sheep and goats for sale. The available capacities, sheep and goats for been stated in Appendix I.

4.3.4 Labour Hiring Activities

Since labour was hired during the farming period, the optimum farm plan used hired labour of 19.195.13, 5.024 and all the labour from January-April, May-August and September - December

respetively. The September-December labour was scarce for the farm operation thus the farm can hire more in this period. Appendix 1 shows the available labour constraints in the periods for hiring. while Table 4.15 shows the amount of labour that was hired in the periods specified.

4.3.5 Borrowing Activities

The farm can borrow as much as N300.000 for the farming period. The amount represents the credit that can be used to supplement his own equity capital. The amount borrowed is to be repaid in one period.

4.3.6 Buying Activities

To achieve the desired goal. the farm can engage in the purchase of the following quantities of inputs as shown on Table 4.14. The row in the basic programme shows the cost per unit of inputs purchased in Appendix 1.

Table 4.14: Buying Activities on the Farm

Inputs	Quantities in the plan
Petrol	15.66.7 litres
Diesel oil	48.000 litres
Engine oil	2.426.8 lires
Grease	205..33 litres
Fertilizer	132.000 kg
Herbicides	3.026 litres
Maize seeds	2.788.46 kg
G/corn seeds	575 litres
Rice seeds	648.15 litres
Cowpea seeds	7.900 litres

Source: Birma Agricultural Project Limited. 1993.

4.4 Formation of the Basic tableau for LP.

The data utilized to form the basic tableau for LP represent the mean data obtained from 1989-1992. The mean data for the periods 1989-1992 therefore represent the representative data for the farm. It is hoped that the representative data may not differ much from the yearly data. Thus, the specifications may not reflect exactly what was obtained on yearly basis. The most cumbersome and hectic task encountered during the calculation of the elements in the basic tableau was the determination of the

resource and product coefficients. The use of the representative data was justified to avoid planning for the farm every year, since the process is tedious. The average for some years was used to form a basis for planning for the farm. In the process of measuring the variables, omissions and commissions of important parameters were likely to have been committed. The bias can be a major problem in altering the results. OKon (1989) pointed out that aggregation bias can be a major problem when a representative farm (in this case a representative data) was used in formulating the problem. The fact that similar technology was utilized in production of the activities, variations in output and input demand may not differ much. Mijindadi (1980) outlined some possible areas where specifications biases can be committed:

i. exclusion of variables.

ii. using approximations in representing variables.

iii. inappropriate aggregation of output and inputs, and

iv. committing various other signs of omission or commissions.

These errors could lead to a biased result to the farm. This would mean that under specified variables could lead to a lower objective function (profit) and an over specified variables could lead to an over exaggretion of the objective function.

4.5 The Optimum Farm Plans for Birma Agricultural Project Limited.

The optimum plans for Birma Agricultural Project Limited were shown on Table 4.15. The total gross margins for farms is N7.746.660. The gross margin is for all the activities produced on the farm. whether for consumption or to be sold. The gross margins did not consider the values of the fixed cost. The value of the fixed cost items on the farm was N361.691.66. The Net Farm Income of the farm after the fixed costs were subtracted for the farm is N7.399.958.40. The Net Farm Income represents the total profit that could be realized when the farm is properly planned. The cattle activity contributed about 94% of the total profit leaving only 6% for the programming activities. The cattle activity was dominant considering the importance attached to cattle as a sign of wealth. These values strengthens the need to include livestock activity in farm production.

Table 4.15 Optimum Farm Plans for Birma Agricultural Project Limited.

Items	Units	Activity Levels
Maize	Ha	223.996
G\corn	"	10.67
Rice	"	87.75
Cowpea	"	0
Cattle	No	1527.000
Sheep	"	30.00
Goat	"	17.00
Total Gross Margin	N	7,761,650.00
Land	Ha	322.42
Livestock	No	1545.00
Capital	N	1.110.825.00
Lab 1	MHRS	19.195.12
Lab 2	"	5.024.00
Lab 3	"	59.024.00
Total labour	"	83.248.12

Source: Birma Agricultural Project Limited. 1993.

Enterprise Combination.

The optimum farm plans has all the seven activities in the original program. These activities have been represented in Table 4.15. The amount of hectares to be devoted to production is 322.42. The farm should produce 26.29 and 16 heads of cattle, sheep and goats.

Labour Use.

The amount of labour required for use to achieve the gross margins in the plan can be seen in Table 4.15. From the table, the total labour required was83.243.12 man-hours for all the periods. The breakdown of the man-hours for January-April, May-August and

September-December can be seen on Table 4.15. The amount of man-hours not used in the plan were 80.938 and 43.759 man-hours for January-April and May-August periods respectively.

Shadow Prices.

The shadow price of a binding constraints provides valuable guidance to the farm management on "the extra contribution the management would gain from increasing by one unit the amount of the resources (Lucey, 1989). It is important to note that only binding or scarce resources have shadow prices. This accords with common sense, for there would be little point in paying more to increase the supply of a resource of which one has surplus. These shadow prices are the marginal value products that would arise if one more or less unit of the scarce resources was available. Lucey (1989) contends that these contributions made by a unit of scarce resources if made available are the marginal value products gained as a result of increasing one unit of the scarce resources. Table 4.16 shows the marginal value products of the scarce resources on Birma Agricultural Project Limited.

Table 4.17 Marginal Value Products of Resources.

Resources	Unit	Marginal Value Products(N)
Land	Ha	0
Cattle	No	4841.04
Lab 1	MHRS	0
Lab 2	"	0
Lab 3	"	9.85
Capital	N	0.00

Source: Birma Agricultural Project Limited. 1993.

OKon (1989) quoted Beneke and Winterboer (1971) that the interpretation of the shadow prices on the disposal activities as marginal value products is not consistant with the exact meaning of the marginal value products. The arguement was that while the marginal value products is the value added to total value products as a result of using extra unit of resources. this condition was not fulfilled because the production coefficients for the activities are defined in fixed ratio one to another.

The marginal value productivity of resources changes as one resource becomes limiting in the process of production. The moment a particular resource becomes limiting, the farm resources must be organised as a whole.

4.6 Sensitivity Analysis.

Sensitivity analysis is the process of changing the values and

relationships within a problem, and observing the effect on the solution (Lucey 1989). In practice, virtually all linear programming problems are solved by a computer package which incorporates numerous facilities to test the sensitivity of the solution to changes in the problems. Lucey (1989) enumerated three ways changes can occur:

i. changes in the amount of resources.
ii. changes in the coefficients of all the objective function and constraints, and
iii. changes due to the variations in the total amount of resources and or constraints.

The shadow prices of scarce resources or the marginal value products of the scarce resources can be used from the final tableau. In the computer print outs, they were shown as negative and positive values. The marginal value products of cattle, and Lab 3 are N4,841.04, and N9.85. It implies therefore that the total gross margin can increase by these values if a unit of them is added to production. The reverse of this statement could be true if a unit of the scarce resources is reduced.

Let us assume that we are to employ five units of these scarce resources into production. The total gross margin of the plan will increase or decrease by N24,205.20 and N49.25. It should be noted that the most scarce resource has the highest marginal value products. In this study the livestock constraint is the most scarce of all the resources. The marginal value products of all

the scarce resources put together when five units of each resources were used is N24.254.45.

Table 4.18 Effects of Increasing five units ofScarce Resources on the Total Gross Margin.

Item	Units	Activity Levels
Maize	Ha	223.996
G/corn	"	10.67
Rice	"	87.75
Cowpea	"	0
Cattle	No	1524
Sheep	"	30
Goats	"	17
Total Gross Margin	N	85.7904.04
Land	Ha	322.416
Livestock	No	1550
Capital	N	1.110.830
Lab 1	MHRS	19.195.12
Lab 3	"	5024
Lab 4	"	59.029
Total Labour	"	83.243.1

Source: Birma Agricultural Project Limited. 1993.

Tables 4.17 show the effect of increasing five units of scarce resources and it shows that there was increase in total gross margin in the plan.

4.7 Inputs - Output Relationships.

The results of the algebraic forms of production function for the farm show the Cobb-Douglas equation to fit very well for the farm. The coefficients reflected include regression coefficients. and coefficients of multiple determination (R^2) and the adjusted R^2 for the linear equation. semi-log and the Cobb-Douglas production

functions.

Cobb-Douglas Equation

$$\text{Log } Y = -\text{Log}20.37 + 1.16\log X_1^{***} \text{ Log} + 7.76\log X_2^{***} + 1.6\log X_3^{***}$$
$$(-0.64) \qquad (-0.10) \qquad (1.04) \qquad (-1.890)$$
$$+ 0.46\text{Log}X_4^{***} + 0.23\text{Log } X_5^{***}$$
$$(0.47) \qquad (0.68)$$
$$R^2 = 76.41\%, \quad eb_i = 8.01$$

Figures in parenthesis are t calculated values

*** significant at 1%,5%, and 10% levels of significance.

Regression analysis was carried out for the farm and the Cobb-Douglas equation was significant at 1%,5%,10% level. This implies that the variables included in the model were significant in explaining the variations in yield. The coefficients of multiple determination indicates that the variables in the equation explained 76.41% of the variations in yield. The sum of the bi's in Cobb-Douglas equation is 8.00 implying that there is an increasing returns to scale. There is need therefore, to increase the use of the resources, since they are still significant in production. When all the inputs are increased by one percent, the output will increase by 8.00 percent, indicating that there is an increasing returns to scale.

4.8 Marginal Value Productivities of Inputs.

The marginal value productivities (MVP) are obtained by using equation 3.6. The MVP of the resources are products of the

regression coefficients, ratio of the geometric means of output and resources and the price of the output. The average price of the enterprises have been used in the determination of the MVPs. The marginal factor costs of the inputs have been used for comparison with the MVP of the respective resources. Table 4.21 gives the MVPs and the MFCs of the selected resources.

Table 4.21 MVPs and Marginal Factors Costs of Resources in Naira.

Resources	MFC (N)	MVPs (N)
Land	150.00	65.621.00
Labour	2.00	4455.00
Fertilizer	0.40	937.05
Seeds	14.40	86.84
Herbicides	77.00	262.43

Source: Birma Agricultural Project Ltd. 1993.

The MVPs and the MFCs of resources under the Cobb-Douglas equation were found to be N55.621, N4.455 N437.09 N86.84 and 262.43 and N150.00, N2.00, N0.40, N14.40 and N77 respectively. The MVPs of all the inputs are more than the MFCs and thus they are efficiently used.

CHAPTER FIVE.

5.0 SUMMARY OF FINDINGS, LIMITATIONS, RECOMMENDATIONS IMPLICATIONS OF RESULTS AND SUGGESTIONS FOR FURTHER STUDY

5.1 Summary of Findings.

For a business enterprise to thrive successfully, there must be a well conceived and articulated plan to serve as a guide for future actions. It was against this background that this study was formulated to provide an optimum plan for Birma Agricultural Project Limited to assist the management execute the farm activities. The major questions this study was set to provide answers to are:

i. to what extent was Birma Agricultural Project Limited able to achieve this motive of profit maximization?

ii. what is the optimum farm plan of the farm? and

iii. what were the efficiencies of each of the resources utilized on the farm?

Three analytical techniques were used to achieved the set objectives of the study. They are the farm budgeting technique, the production function analysis and the linear programming technique. The farm budgeting was employed to achieve objective

one of the study by finding the difference between the total farm revenue and the total cost of production of the enterprises. The production function coefficients were used in the calculation of the marginal value productivities, which in this case serves as the efficiencies of the resources used on the farm. The production function was used to also find out the percentage contributions of the farm resources to the variations in yield. Three forms of the production function were used, the linear production function, the semi-log and the Cobb-Douglas production functions. The Cobb-Douglas production function was found to be more suitable than the other two forms. This was dictated by the good signs of the coefficients and the high values of the R^2. The linear programming model was used to determine the optimum plan of the farm. It is expected that the summary of the findings below will justify the use of these three analytical tools

5.1.1 The Net Farm Incomes.

The use of the Farm Budgeting technique was essentially to determine the net farm income that result from the investment made. The total returns resulting from the production of both crop and livestock sections were N1,007,399.98 and N1,606,300,000 respectively. This gives a total revenue of N2,613, 699.80. The contribution of the crop and livestock to the overall performance of the farm were 38.54% and 61.46% respectively. The result portrays the importance of the livestock section in the overall performance of the farm. The total cost of production of both crop

and livestock were N984.640.71 and N169.742.53 respectively. The Net Farm Income of the crop and livestock were N24.859.13 and N1.436.557.50. The return per capital, labour and hectare for the crop section were N0.03, N11.34 and N71.35 and for the livestock section, they are N8.46 and N715.37 for capital and man-hour respectively.

5.1.2 Efficiencies of Resources Used.

Equation 3.6 was used to determine the efficiencies of resources used on the farm. The marginal value productivities according to Olufemi (1982) was used to serve as a measure of resource use efficiency. The marginal value productivities of land, labour, fertilizer, seed and herbicides were found to be N58.621, N4.455, N937.05, N86.04 and N262.43 respectively. The marginal factor costs of land, labour, fertilizer, seeds, and herbicides were N150, N2.00, N0.4, N14.4 per kg and N77 per litre. A comparison of the marginal factor costs and MVPs showed that all the inputs were used efficiently. It will also be economical to increase the use of all the inputs since they were efficiently used. The difference between the marginal factor cost and the marginal value productivities indicate the scope of resource adjustment necessary if economic optimum needed to be achieved.

5.1.3 Optimum Farm Plans of Birma Agricultural Project Limited.

The aspiration of any business organization is to evolve a combination of activities with the available resources that will yield the highest revenue. This could be realized when a carefully well drawn plan was made for the business enterprise.

The combination of activities achieved from the plan by the Linear Programming Model were maize, guineacorn rice cowpea, cattle sheep and goat at 223.996, 10.67, 87.75 hectares for the crop section and raise 1524, 30 and 17 heads of cattle respectively. The total gross margin for plans A, B, and C were N7,923,563, N806,664.5 and N7,923,563 respectively. The Net Farm Income resulting from Plan A,B and C were found to be N7,562,871.34, N445,972.84 and N7,562,871.34 respectively.

The marginal value productivities of any extra unit of scarce resources was also provided in the plan. The MVPs entails the extra gain that can occur to the farm from using one unit of each of the scarce resources. These values were provided on Table 4.16. These marginal value productivities of the scarce resources are their shadow prices. There is no shadow price for abundant resources, in this case land, Lab_1 and Lab_2.

Sensitivity analysis was carried out and the results can be seen on tables 4.17. We tried to find out what the total gross margin will be if more units of the scarce resources and excluded

activities were included in the plan. It was discovered that there was an increase in the total gross margin and a decrease in the total gross margin by N24.252.45 The total gross margin from the plans were the most achievable under the present resource endowment.

5.2 Implication of the Results.

This study has provided some insight into resource use and productivity of factors of production and the optimum farm plan of Birma Agricultural Project Ltd. The grazing of the animals can be done on the unused land and extra hours can be employed in the production of some other crops. The optimum farm plan determined can change from time to time depicting the resource

endowment the farm will acquire. However, the manager can use this plan to serve as a guide for future actions on the farm.

5.3 Recommendations of the Study.

The findings, of this study showed that there was an increase in profit generally as a result of the new optimum farm plan over the net farm income realized from the farm budgeting. That suggests that the farm production can be expanded to harvest such profit. A few recommendations have been advanced for the farm to enhance their performance.

1. The scarce labour in the third period, September-December, for harvesting, bagging and weighing should be provided. This could be

achieved by going to agreement with some people that may be willing to come during the time to auguement the labour requirement. The hiring or acquisition of more combined harvesters from the Lake Chad Basin Development Authority be undertaken.

2. There is need to discard some of the old machineries on the farm and then use the money realized from their sales to repair some of the workable ones on the farm. This idea will help in reducing the cost of production as a result of depreciation and repair costs of fixed items. It would be better to have few machineries that are workable and efficient than to have many machines that are working.

3. The farm should embark on the production of some nutritious pastures on the unused land using the remaining labour to increase the performance of the livestock section. This will alleviate the lost in weight encountered by the animals in searching for grasses when they are scarce. The pastures when baled and then supplied to the animals when there are scarcity of grasses caused by incessant bush burning can boost animal production.

4. There is need for the farm to own some storage facilities on the farm. The low prices of the produce may be due to lack of storage facilities. thus produce were sold at the farm gate. The prices of the farm produce could have been higher should there be storage facilities. so that farm produce can be stored and sold

when prices are high. This will assist the farm to reap more profit than what they are getting now.

5.4 Limitations and Suggestions for further Study.

In the traditional farming systems, modern techniques of planning were not used extensively as in the commercial agricultural systems. This was confirmed by the poor performance of the small scale farmers under the peasant farming systems. In recent years, however, modern tools of planning have been provided to ameliorate the performance of farming business. In this study, the advantages of modern planning instruments have shown that profit can be increased. This point was drawn from the higher profit obtained in the optimum plans. Although the result of the study looks fantastic, it is only for an individual farm. Policy statements can not be made on these findings. It is therefore suggested that more large scale mixed farming enterprises be studied. It is only when this is done, generalization about large scale mixed farming systems can not be made. A study should be performed on large scale mixed farm and large scale farming without livestock to compare their profitability under their optimum farm plans.

The accuracy of the findings will depend on the quality of the data used. The use of average values of the data for this study may distort the real solution in the real world, but one should have a guide than to have nothing at all.

It is possible that during the course of this study some important variables were omitted or there might be some variables included which were not supposed to be there. The researcher, during the course of the study had tried as much as possible to minimise these omissions and commission of variables.

Another serious limitations of this study possed a problem were the short duration available for the study and the financial problem faced by the researcher.

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APPENDIX I: THE BASIC PROGRAMMING MATRIX FOR THE LINEAR PROGRAMMING WITH ALL MIXIMUM LEVELS

ROW No.	OBJECTIVE FUNCTION	CROP PRODUCTION ACTIVITIES IN OPTIMUM FARM PLAN MODEL							BUYING ACTIVITIES									
	(CJ)		MZ	GC	RC	CP	CF	SH	GT	Petrol	Diesel	Eng. oil	Grease	Fert	Herb.	MZ seed	GC seed	RC seed	CP seed	
	Resources	UNITS	1194	503	2423	4195	4857	291	141	-0.70	-0.55	-3.40	-5	-0.53	-70	-26	-8	-6	-18	RHS
1	Land	Ha	1	1	1	1														<200
2	Livestock	No.					1	1	1											<1500
3	Capital	N	1093	4898	885	13305	143	109	109											<1700000
4	Lab1	MHRS	75	94	122	167	1.62	1.62	1.62											<50133
5	Lab2	"	130	108	126	167	1.62	1.62	1.62											<48783
6	Lab3	"	146	216	246	352	1.62	1.62	1.62											<59024
7	MZTR	Kg	-762.28																	<0
8	GCTR	"		-1733.83																<0
9	RCTR				-1119.13															<0
10	CPTR	"				-6333.33														<0

APPENDIX I: Cont'd

11	CTTR				-314					<0
12	SHTR	"				-77				<0
13	GTTR	"					-22			<0
14	MIC	"	75.15							>16833.33
15	BCC	"		515.44						>5500.00
16	RCC	"			133.05					>10688.00
17	CPC	"				-				>0.00
18	CTC	No			26					>26.00
19	SHC	"				29				>29.00
20	GTC	"					16			>16.00
21	Petrol	Lt						-1		<15666.66
22	Diesel	"							-1	<48000.00
23	Eng. Oil	"							-1	<2426.80
24	Grease	"							-1	<205.33

APPENDIX I: Cont'd

25	Fertilogel	Kg			-1				(132000.00
26	Herbicide	Lt				-1			(3036.48
27	MZ Seed	Kg					-1		(2788.46
28	GC	"						-1	(575.00
29	RC	"							-1 (648.15
30	CP	"							-1 (7900.00

APPENDIX I: Cont'd

ROW No.	OBJECTIVE FUNCTION		BORROWING ACTIVITIES	L A B O U R H I R I N G ACTIVITIES			S E L L I N G ACTIVITIES						C O N S U M P T I O N A C T I V I T I E S							
	(C1)	Units	CAPS	LAB1	LAB2	LAB3	KI	GC	RC	CP	CTS	SSHS	SGTS	SMIC	SGCC	SRCC	SCPC	SCTC	SSHC	SGTC
	Resources		-0.10	-2	-2	-3	3	3	3	3	5000	400	250	0	0	0	0	0	0	0
31	Credit Row	N	-1																	<300000.00
32	Lab1	MHRS		-1																<50133.33
33	Lab2	"			-1															<48785.00
34	lab3	"				-1														<59024.44
35	MZTR	Kg					1													<0.00
36	GCTR	"						1												<0.00
37	RCTR	"							1											<0.00
38	CPTR	"								1										<0.00
39	CTTR	No									1									<0.00
40	SHTR	"										1								<0.00

APPENDIX I: Cont'd

41	GTTR	"	1								<0.00
42	MZC	Kg		1							>16833.33
43	GCC	"			1						>5500.00
44	RCC	"				1					>10687.50
45	CPC	"					-				-
46	CTC	No						1			>26.00
47	SHC	"							1		>29.00
48	GTC	"								1	>16.00

Appendix II - Abbreviations.

1. Lab_1 - Labour in period one in man-hours
2. Lab_2 - " " " two " "
3. Lab_3 - " " " three " "
4. MZ - Maize
5. GC - Guineacorn
6. RC - Rice
7. CP - Cowpea
8. CT - Cattle
9. SH - Sheep
10. GT - Goat
11. MZTR - Maize transfer
12. GCTR - Guineacorn "
13. RCTR - Rice "
14. CPTR - Cowpea "
15. CTTR - Goat "
16. SHTR - Sheep "
17. GTTR - Goat "
18. MZC - Maize consumption
19. GCC - Guineacorn "
20. RCC - Rice "
21. CPC - Cowpea "
22. CTC - Cattle "
23. SHC - Sheep "
24. GTC - Goat "
25. MZS - Maize selling

26. GCS - G/corn "
27. RCS - Rice "
28. CPS - Cowpea "
29. CTS - Cattle "
30. SHS - Sheep "
31. GTS - Goat "
32. CAPB - Capital Borrowing
33. MHRS - Man-hours
34. BAP - Birma Agricultural Project
35. GDP = Gross Domestic Product
36. LP = Linear Programming.

APPENDIX III: QUESTIONNAIRE

Resource Use Efficiency and Productivity Under a Large Scale Farm: A Case of Birma Agricultural Project Ltd. Biu L.G.A, Borno State.

SECTION A: GENERAL INFORMATION

1. Name of the Farm Project: .....

2. Date of Establishing the Farm Project: .....

3. Ownership of the Farm Project (ticks)
   (a) Private ownership ( )
   (b) Partnership ( )

4. What are the major problems of the Farm Project?
   (a) Lack of Finance ( )
   (b) Lack of spare parts ( )
   (c) Lack of Sufficient trained Staffs ( )
   (d) Lack of hired labour at critical periods ( )
   (e) High cost of inputs ( )
   (f) Administrative problems ( )
   (g) Drought problems ( )
   (h) Lack of market for the products ( )

5. Purpose of establishing the farm project (tick)
   (a) provision of food for the family ( )
   (b) profit making venture ( )

6. Number of permanent staffs: .....

7. Crops/livestock raised on the farm (tick
   (a) G/Corn ( ) (d) Rice ( )
   (b) Maize ( ) (e) Cattle ( )
   (c) Cotton ( ) (f) Poultry ( )

8. Herbicides are applied at (tick)
   (a) Post-emergence stage ( )
   (b) Pre-emerge state ( )

9. Total production since inception of the Project.

Year	G/corn	Maize	Cotton	Rice	Poultry	Cattle

SECTION B: LAND

10. Land is acquired through the following means (tick)
    (a) Inheritance ( )
    (b) Bought from farmers ( )
    (c) Acquired through the Government ( )
    (d) Leasing ( )

11. Total land available for the Project: .....

12. Cost of Land: .....

13. Actual land available under cultivation of crops.

Crop	Hectares
Maize	
G/Corn	
Cotton	
Rice	
Others	

SECTION C: CAPITAL

14. Sources of funding the farm project (tick)
    (a) Private effort ( ) (b) Partnership ( )
    (b) Sale of Shares ( ) (d) Credit from the bank ( )

15. Available capital for the year: .....

16. Cost of field operation undertaken.

Operation	Cost In Naira				
	Maize	G/corn	Cotton	Rice	Others
Land clearing					
Harrowing					
Ploughing					
Ridging					
Planting/sowing					
Weeding					
Harvesting					

17. Cost of Transportation of enterprises.

Item	Cost of Naira
Cotton	
Maize	
G/corn	
Rice	
Others	

18. Cost of Running Tractors/cars owned by the farm.

Item	Quantity	Unit price	Total price
Petrol			
Diesel oil			
Engine oil			
Grease			
Others			

19. Cost of storage of farm produce.

Item	Cost of Naira
Cotton	
Maize	
G/corn	
Rice	
Others	

20. Amount and unit cost of inputs available on the farm.

Inputs	Cotton	Maize	Cotton	Rice
Seeds				
Fertilizer				
NPK				
SSP				
CAN				
UREA				
Perticides				
Herbicides				

21. Unit price and yield of enterprises for the year.

22. List of assets owned by the farm

Name of asset	Year of Purchase	Number of Assets	Unit Price

23. Quantity of crops/livestock given out as gifts or used for food.

SECTION D: LIVESTOCK

24. Pupose of keeping livestock (tick)
(a) animal products (milk, meat etc) ( )
(b) manure ( )
(c) profit making ( )
(d) breeding purpose ( )

25. Types of livestock kept (tick
(a) Cattle ( )
(b) Sheep ( )
(c) Goats ( )
(d) Poultry ( )

26. Number of times poultry were kept in the year

.....

27. Value of cattle kept in the year N .....

28. Value of poultry kept in the year N .....

29. Livestock are kept under (tick)
(a) intensive system ( )
(b) semi-intensive ( )
(c) free range system ( )

30. Cost of initial stock of all the livestocks ...

.....

31.

Item	Number
Cattle	
Sheepn	
Goats	
Poultry	

32. Cost of Feeds.

Enterprise	Yield	Unit price	Total Revenue
Feeds			
Salt lick			
G/nut cake			
Cotton Seed-cake			

33. Number of hours spent for rearing

livestock:.....

SECTION E: LABOUR

34. Sources of labour (tick)
(a) family labour ( )
(b) hired or contracted labour ( )

35. Cost per hour of labour

Item	Unit cost of labour per hr.	Number of hrs. spent per day	Number of work days in the period.
January-April			
May-Aug.			
Sep-Dec.			

36. Estimated number of men, women and children (10-14 years) working on the farm per day on these fields for the periods in 35.

Item	Cotton	Maize	G/corn	Rice
Children (10-14hrs				
Women				
Men				

37. Average effective working hours spent on the farm per day.

(a) children: .....

(b) women: .....

(c) men: .....

38. If labour is contracted, what is the charge per hectare .....

39. Do you use the services of tractor hiring scheme Yes/No

40. If Yes, what is the charge per day? N: .....

41. Number of hours spent by a tractor daily: .....

42. Number of hours spent to plough a hectare: .....

43. Number of tractor hired: .....

44. Cost of tractor hired per day: .....