MULTICRITERIA DECISION APPROACH TO BUDGETARY ANALYSIS: TARABA STATE BUDGET IN PERSPECTIVE

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M.TECH/OR/08/0103

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BY

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF STATISTICS AND OPERATIONS RESEARCH, SCHOOL OF PURE AND APPLIED SCIENCES, MODIBBO ADAMA UNIVERSITY OF TECHNOLOGY, YOLA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF TECHNOLOGY DEGREE IN OPERATIONS RESEARCH

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DECLARATION

I hereby declare that this project thesis was written by me and it is a record of my own research work. It has not been presented before in any previous application for a higher degree. All references cited have been duly acknowledged.

DEDICATION

This project report is dedicated to Almighty God, for enabling me pass through this huddle successfully in good health. I also dedicate it to my Late (twin) Brother Hassan Bala Habu (who died in an auto crash while we were serving our father land) - his memory will always be a source of energy/pedal for me to forge ahead.

APPROVAL PAGE

This Thesis has been read and approved by the undersigned as meeting the requirements of the Postgraduate School, Federal University of Technology, Yola

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I must acknowledge here that it's wasn't easy, but it's worth it.

ABSTRACT

One of the principal objectives of developing countries is to accelerate the pace of social and economic development. The budget is one of the (most important) tools government uses to achieve its economic and development goals. In order to introduce scientific basis for the choices government has to make, this study proposes a two-stage process of multi-criteria decision making approach in modeling Taraba State budget for efficient sectoral allocation. This process incorporates the quantitative and qualitative aspects of the decision making problem and provides a measure for determining the consistency of the decision maker. The two approaches of multi-criteria decision analysis used are Analytical Hierarchy Process (AHP) and Goal Programming (GP). The former takes care of one important aspect of budgeting known as participatory budgeting while the latter handles the optimization aspect which outlines the areas of differences (also known as deviation) when compromise between the two parties is needed. Findings based on analyzing model outcomes, showed that stake holders priorities and that of government in terms of budget allocation varies. In order to reach a compromise, Education sector needed the greatest attention, closely followed by General Administration, Health and lastly by Forestry.

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CHAPTER ONE

INTRODUCTION

1.9 BACKGROUND

One of the principal objectives of developing countries is to accelerate the pace of social and economic development. But the overall effort to achieve this development objective has remained an elusive and difficult task. This is partly due to lack of financial resources, problems of resource allocation and inefficient utilization of the resources in the public sector. The financial resources are in scarce supply to meet ever-increasing social needs and population growth. Therefore, in view of limited resources and increasing demands, there is a need to improve resource allocation through proper economic policy and expenditure planning (Getachew, 2005).

The budget reflects the choices that government has to make, and is the tool it uses to achieve its economic and development goals. The government has to balance a wide range of legitimate demands with limited resources at its disposal. In the budget government sets out what it is going to spend (expenditure) and the income it collects through taxes (revenue), which it needs to finance expenditure.

Throughout the world, the processes for determining how to raise, allocate, and spend public resources constitute the foundations of government. The way public resources are used is a major determinant of the achievement of public policy objectives (ODI 2004: 1-2). Public budgets enable governments to manage finances in accordance with political priorities and economic policy priorities. A budget constitutes a type of map that traces the fundamentals for decision making in relation to the resources generated by society and that have to return to society as supplies and services (Bloj, 2009).

Tight budgets and demanding citizens put governments under increasing pressure to show that they are providing good value for money. Providing information about public sector performance can satisfy the public's need to know, and could also be a useful tool for governments to evaluate their performance (OECD Observer, 2008).

Taraba state like other states in Nigeria and other developing countries is not isolated (or immune) from this issue of resource allocation (or budgeting). In its effort to deal with this problem the state develop a strategy known as Taraba State Economic Empowerment and Development Strategy (TSEEDS) to coordinate plan of action aimed at tackling its developmental problems.

This study attempts to analyze Taraba state budget in order to develop a methodological framework or standard for scientific modeling in the budget process. Since budgeting involves tackling multiple objectives simultaneously, this study uses tools of Multi-Criteria Decision Analysis (MCDA) .

1.2 STATEMENT OF THE PROBLEM

Getachew (2005) stressed that in developing countries, it has become increasingly complex to manage public expenditure allocation because the roles of the government have been expanded and financial resources are in scarce supply to meet this ever-increasing social needs and population growth. Due to inadequate financial resources as opposed to an increasing demand for public service, there is a need to improve resource allocation through proper economic policy and expenditure planning. He also points out that there are no criteria for determining inter-sectoral resource allocation. And that significant part of budget is not only treated as an annual budgeting exercise, but also it lacks standardized preparation to estimate recurrent and project costs. These conditions indicate that budget is decided on the basis of inadequate information, often without sufficient knowledge of programs and performances.

In Nigeria, fiscal policy is the most important instrument of macroeconomic management. Therefore, reforms at this level are critical for overall macroeconomic consistency. The problems of fiscal policy in Nigeria include inefficiency in resource use, waste and misplaced priorities in government expenditure, high fiscal deficits at all tiers of government, weak institutional structure, a fiscal federalism structure that places little or no premium on inter-temporal fiscal solvency, and poor institutional mechanisms for regulating actions of the different tiers of government and their agencies. These have led to a high debt burden, huge recurrent expenditure burdens at all tiers of government, inefficient public delivery of services and distortion in the incentive structure for both the private and public sectors (USAID, 2005).

According to USAID (2005) report, before 2002, the budgeting process in Nigeria was facing numerous challenges and had come near to collapse. The main problems have been:

i. Lack of political will and commitment to abide by stipulated rules and budget guidelines;
ii. Inability to develop a macro-economic framework for budget formulation

iii. Ambiguities in the roles of various governments of the Federal Republic of Nigeria (FRN) agencies involved in the formulation and monitoring of the budget;

iv. Periodic changes of budget line items classifications, which inhibited the formulation and monitoring of the budget;

v. Lack of coordination between the Office of the Accountant General of the Federation (OAGF) and the Central Bank of Nigeria (CBN), which inhibited the smooth disbursement of funds after budget approval;

vi. Slow budget process fraught with errors.

The above problems led to a high incidence of extra-budgetary expenditures and a breakdown of medium-to-long term plans to guide the budgeting process. Projects then were implemented haphazardly, without proper evaluation and coordination. Consequently, there are hundreds of uncompleted/abandoned projects that would cost billions to complete. Faced with so many abandoned/ongoing projects, allocation to projects had become ineffective and arbitrary, devoid of economic rationale, and spread thinly over numerous projects without significant impact on most of them (USAID, 2005).

To address the multiple problem of process fraught errors, arbitrary resource allocation not based on economic rationale, lack of criteria for determining inter-sectoral resource allocation, inefficient resource use, waste, misplaced priorities in government expenditures and ambiguities in the roles of various agencies, a model that could take care or manage this multi-conflicting and competing issues is needed.

1.3 OBJECTIVES OF THE STUDY

One of the major means of strategies to promote development is the establishment of realistic and well-prepared expenditure planning and annual budgeting. This involves the process of effective resource mobilization, proper allocation of resource among competing investments and an efficient utilization of the available scarce resources. The main objectives of these processes are to introduce aggregate fiscal discipline, establish resource allocation in accordance with government priorities and objectives, and to bring about operational efficiency

According to Vananda (2006) budget has a huge impact on service delivery and without proper budgeting there could be no good service delivery. The overall objective of this study is to assess the Taraba State budget process, analyse the budget practices and its features with the view of integrating -Multicriteria Decision Analysis (MCDA) techniques in the budget allocations as well as pinpoint the key problem areas that seek attention and

improvement. Since the budget is the primary tool available to governments to effect redistribution and delivery, it is inevitable that reform of government include changes to the budget system (Walker & Mengistu, 1999: 10).

This study has the following specific objectives.

i. Analyse Taraba State current budgeting process, highlight its loopholes in view of the current global trend in budgeting.
ii. Introduce concepts, methodologies, tools and standards using multicriteria decision analysis into Taraba State budgeting system;
iii. Incorporate citizenry participation in decision making regarding budgeting which may at the end boil back to them during implementation (to minimize finger pointing).
iv. Help government make an informed and tested decision based on formal or standard used in other countries.

1.4 JUSTIFICATION

Prominent budgeting scholars have been very explicit on the significance of budgeting to governance. Schick (1966) documented that "the capacity to govern depends on the capacity to budget." Hou (2006) reported that "if you can't budget, how can you govern?"

It is in the light of the above that Young (2003) stressed that Governments are highly aware of these intricate and mutable realities and are striving, as best as they can, to keep in step. Public budgeting is one area in particular that governments are giving attention to in order to respond to a changeable world. To do this, governments are attempting to provide reliable and complete information to budgeters and policy-makers alike so that substantive budget choices can be made.

Governments today are especially trying to ascertain how well public organizations and programs are doing in providing services and products to their citizenry. Governments are asking: "What kind and how many services are we getting from allocated dollars?" "Are these public services of good value?" "Are they making a difference in citizens' lives?"(Young, 2003).

The rationale for budget analysis are premise on the following needs:

i. To change the behaviour and composition of key government officials with a view to better promote given objectives.
ii. To achieve a shift in the pattern of allocation to particular sector of budget
iii. To reallocate public resources in a more equitable way

iv. To combat corruption and promote transparency and accountability

v. To identify government priorities from the pattern of appropriation (Salisu, 2005).

1.5 SIGNIFICANCE OF THE STUDY

Budget analysis has become a most valid tool for managing critical issues of governance and for assessing the impact of public policies in different sectors of an economy as well as on different segments of the population.

The need for budget analysis or performance budgeting is premised on four main principles: transparency, efficiency, participation and equality. Budget analysis enhances the examination of the budget process to see to what extent these tenets are observed and/or achieved, not only in the process of budget conception and formulation but in the implementation and monitoring of the budget programme. This can be viewed from two angles: one, a process of self examination by the government which indicates a commitment to necessary change. Two, it allows the civil society and development agents to engage with the policy process in a more fundamental way.

Budget analysis x-rays how government raises and spends public money with the aim of securing fairness on decision making about allocation of public resources and equity in the distribution of the impact of budgets, not only in terms of benefits but also in terms of the cost or burdens of development. An x-ray of the budget by the people through the civil society organizations therefore prompts government to be more responsive to the needs and aspiration of all.

Budget analysis by government agencies presupposes a positive attitude to change. While all governments carry out budget analysis as a precursor to subsequent budgets, that is, to influence future budget conception and formulation, a democratic government further pushes budget analysis to promote accountability. Political interests represented in government are involved in x-raying how the financial trust placed under the government by the people has been discharged. Therefore while budget analysis by the Central Bank or Ministry of Finance may be a regulatory tool, that which is advocated by the legislature for instance is a tool to promote transparency and accountability within the executive.

Because budgets are expected to trail policies and because programmes are derived from policies, analysis of budget allows attention to be focused on the link (if any) between the budget and particular policy decisions (Salisu, 2005).

This study should be viewed in the light of participatory budgeting whereby public view can be inputted in governance (or public budgeting).

1.6 SCOPE OF THE STUDY

The study shall cover Taraba State government budget as presented and passed by the state house of assembly over the period 2006 – 2010. Data to be utilized may include foreign counterpart funding, excess crude fund and other fund whose data are readily available unless otherwise termed 'highly classified'.

1.7 THE STUDY AREA

Efforts to articulate a development strategy for Taraba State must first of all start by understanding the history of the state. No one can conveniently chart the course for the future development of any political entity without understanding the elements that define the past and reconcile same with the present before attempting to forecast the future (TSEEDS, 2004).

Taraba State was created in August 27, 1991. It derive its name from one of the three major rivers in the State, River Taraba and covers a land area of 9,400 square kilometers. The dominant climatic conditions includes rainy and dry seasons typically common to tropical regions to which Taraba State belongs. According to the 2006 census figure released by the National Population Commission (NPC), Taraba State has a population figure of Two million, Two hundred and Ninety Four Thousand, Eight hundred (**2,294,800**). See appendix i. There are over 40 ethnic groups in Taraba State. The State is Agrarian; as a result the main occupation of the people is farming (TSEEDS, 2004). See appendix ii for detail background of the study area.

1.8 LIMITATION OF THE STUDY

This study is also aimed at achieving the objective of participatory budgeting i.e. involving the people (the governed) in decision making by soliciting for inputs from them – a requirement for the proposed model. Time and financial resources for this study will not be sufficient for this aspiration to be met, as such expert opinion will be sought from various sectors of the Taraba state budgeting departments or offices (as the case may be) that can be reached within the time frame the study will last.

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

Budget generally refers to a list of all planned expenses and revenues. It is a plan for saving and spending (World Bank, 1998). The word "budget" (as "budjet" in Middle English) meant King's wallet (Shah, 2007). As for today, it can be called as basic policy document of public financial management that besieges all incomes and expenditures of public (OECD, 2005). These comprehensive documents, politically, are public management tools for curbing illegality and raising democracy. In terms of administration, it means planning of legislation and administrative units' coordination; technically, improving of managerial productivity. Separately, state budgets can also be defined as keeping the registrations of income and expenditures of the government which belong to a definite time period (Hou, 2006, p.730).

Garzon (2007) defines "budget as a monetary expression of a Government's planned activities to be fulfilled based on clear policy objectives, usually in twelve months unless otherwise specified. The budget shows the cost and sources of funding to finance the identified activities…" In short budget can be defined as a quantitative economic plan made with regard to time. Therefore, for something to be characterized as a budget it must comprise the quantities of economic resources to be allocated and used, it has to be expressed in economic i.e. monetary terms, it has to be a plan – not hope or forecast but an authoritative intention, and it must be made within a certain period of time (Harper, 1995, p.318). Only a plan that has such characteristics can be called a budget (Dusan, 2005).

Key (1940: 1138) laid down a challenge for economists to resolve the 'basic budgeting problem' namely, faced with limited resources, 'On what basis shall it be decided to allocate x dollars to activity A instead of activity B?'. He went on to suggest that solutions to this problem might be found through the application of economic theory. He warned, however, that a budgeter's holy grail – an all-embracing theory of resource allocation that could be applied in practice – would probably prove to be a chimera since the problem of reconciling competing demands between different policy goals and interests was essentially one of political philosophy (Key, 1940: 1143). If that line of inquiry failed, Key proposed that solutions might be found through an improved understanding of the institutional arrangements by which resource allocation decisions are made, which would entail a 'careful and comprehensive analysis of budget process'(Key, 1940: 1144).

At the same time, the analytical framework for analysis of the basic budgeting problem has broadened. It is now recognised, following Musgrave (1959), that solutions to

resource allocation cannot be abstracted from other functions of the public expenditure management system, namely the pursuit of macro-economic stability and efficiency in the use of public funds. From the 1970s the problem of macro-economic stabilisation dominates the literature and resource allocation is, for the most part, treated as a secondary issue. Similarly, it is no longer assumed that budgetary allocation decisions are automatically transformed into budgetary outcomes. Resource allocation in the public sector is determined by both the criteria and process of decision making and the process of budget execution. Inevitably, this has widened the institutional scope of the basic budgeting problem. Whereas attention once focused exclusively on core policy institutions – the legislature, Ministries of Finance and spending agencies – it is now clear that departments within spending agencies, right down to the field level service delivery units, also have a role to play.

Public budgeting is about choices among ends and means. Although public budgeting shares many features with private sector budgeting, it does requires the application of different criteria from those used in the private sector organisations. The most prominent difference is that only a few public sector decisions can be evaluated in terms of profit and loss. Private sector decisions, on the other hand, must pay attention to the long-run profitability of the firm. Instead of evaluating government performance in terms of profit and loss as it happens in the private sector organisations, the government must be evaluated in terms of the results it promised to deliver to its citizens with resources appropriated by the legislature (Lee *et al.*, 2004).

Evaluation of government performance is difficult in the absence of accountability from elected officials and in an organisational culture characterised by too much emphasis on inputs, strict fiscal rules and historic incrementalism in budgetary decision-making process. Accountability requires government to produce two sets of information, namely, financial and non-financial information to explain not how public funds were employed, but what services were actually produced (Nkoana, 2008).

Budget analysis has become a most valid tool for managing critical issues of governance and for assessing the impact of public policies in different sectors of an economy as well as on different segments of the population. The need for Budget analysis or performance budgeting is premised on four main principles: transparency, efficiency, participation and equality. Budget analysis by the government agencies allows a process of self-examination by the government and presupposes a positive attitude to change. Analysis of budget allows attention to be focused on the link (if any) between the budget and particular policy decisions.

2.2 BUDGETARY ALLOCATION

The ways government budgets are allocated have an important impact on economic development. This is because meaningful budgetary allocations to sectors of the economy could bring government closer to the people. According to Gupta, *et al.,* (2001) budgetary allocations to some key sectors of the economy through its positive effects can enhance equity and reduce poverty. The productivity of these allocations depends on the efficiency of resource allocation within the sectors.

According to Usman and Ijaiya (2005) "In Nigeria, government places a lot of premium on agriculture, education, transport and health sectors, because of the catalytic roles these sectors play in the development of the other sectors. The overriding budgetary objective is that these prime sectors will be able to grow the other sectors giving the enabling environment. However, in some cases, these sectors return have not produced the desired result. The question that readily come to mind is that in spite of large fiscal space, why has budgetary allocations to sectors still perform abysmally poor?"

Budgetary allocations play an important role in development process of any country. Budgetary allocations according to Olaniyi and Adam (2003) are made to enhance a suitable improvement in human welfare or quality of life such as health, education, agriculture and transport services. Accordingly, budgetary allocation to sectors of the economy plays different roles in the economy. For instance, education according to Odusola (1998) sets off an intergenerational process of poverty reduction, because better educated persons are more likely to ensure the education of their children and also attend to the health requirements of their wards.

2.3 PURPOSES OF BUDGETING

Below is a brief discussion of some purposes that a budget can serve as documented by Rosenberg (1998).

i. **The Budget as a Contract:** The mayor and general assembly promise to provide funds to a department for agreed-upon purposes. In this sense, the budget is a contract between the policymakers and municipal departments. The budget also may be viewed as a contract between the citizens and the municipality. That is, the citizens have agreed to pay taxes so they can receive certain services from the municipality.

ii. **The Budget as a Management Tool:** The budget serves as a statement of the decisions and responsibilities that translate into specific programs and activities. As a management tool, a properly designed budget can help you achieve administrative efficiency, economy, and honesty through businesslike behavior. The budget increases management responsibility and accountability.

iii. **The Budget as a Motivator:** The budget motivates departments by setting forth targets and by serving as a mechanism for obtaining involvement and commitment. The budget provides a means for measuring accomplishments against goals and for comparing actual with planned outcomes. Municipal staff are more likely to be effective and satisfied if they have a clear sense of program purpose that enables them to better comprehend where they are going and how they will get there.

iv. **The Budget as a Financial Control Mechanism:** The budget can serve as a means to define and assign responsibility for financial control. A budget provides strong control over departmental expenditures and reduces the administrative discretion of department heads.

v. **The Budget as a Plan:** The budget is the investment plan for our community. It coordinates choices so as to achieve desired goals. The budget is an instrument for correlating executive and legislative action. A budget should include a detailed specification of what objectives are to be achieved by the proposed expenditures. As a planning tool, the budget can suggest alternative methods of achieving these objectives.

vi. **The Budget as a Major Policy Tool:** Whether one intend it to be or not, the budget is a major policy tool. How one decides to spend his/her community's scarce resources is perhaps the most important policy decision one will make during a fiscal year. Government resources are always less than what is needed to accomplish all the community's goals. You must make decisions that contribute the most to municipal goals. Thus, budgeting can be viewed as the process by which you make government policy. You should ask yourself how well your budget serves as a policymaking instrument.

vii. **The Budget as a Communication Mechanism:** The budget document is the mechanism by which one inform citizens, municipal officials, policymakers, potential investors, and others about community budgetary issues, trends, and choices addressed in the budget. Budget document should communicate the significant information in the budget to the reader. One can use charts and graphs, where appropriate, to highlight financial and statistical information. In addition, use narratives to describe the relationships among revenues, expenditures, and programs. In the document one also should present community demographic, infrastructure, and economic data.

viii. **The Budget as an Operations Guide:** Budget requests describe proposed activities, services, or functions that municipal institutions will carry out. In the budget requests you should identify qualitative and quantitative measures, or outputs, by which program performance and results will be evaluated. You should also identify program beneficiaries, such as the number of citizens served, and specify the number of employees required to carry out each activity. When one provides these types of information, the budget that is produced from the requests will serve as an operations guide. The budget of each institution will not only identify the cost of each activity, but also the outputs to be provided, the number of citizens who will benefit, and the staffing level required to carry out the activity.

ix. **The Budget as an Instrument of Democracy:** Historically, a major purpose of budgeting is to promote democracy. The budget should reflect the will of the citizens and should open government to public scrutiny. The budget is a means of exercising popular control over public money.

2.4 BUDGET TYPES AND REFORMS

Budget reforms started in the late of 19th and early 20th centuries to promote accountability and efficiency. The reforms have generally fallen into one of the two categories: (1) innovation designed to improve the budget type (2) innovation designed to improve the budget preparation process. This division may overlap each other, since change in the process inevitably affects the information (Bland and Rubbin, 1997).

Gianakis and McCue (1999) have classified budget types into four parts. They are line item budgeting, performance budgeting, program budgeting and zero-base budgeting. These four basic types of budgets have evolved from controlling expenditure to improving financial management.

i. **Line item budgeting** is input- oriented budget system that optimizes the control function. The system is often associated with a financial plan of estimated expenditure, expressed in terms of the kind and quantities of objects to be purchased which estimated revenue needs to finance during a specified period, usually one year. Its function is expenditure control and safeguarding of funds based on assigned budgets and the focus is on the attainment of balanced budget (Babunakis, 1976). In addition, line item budgeting usually follows a system of incremental budgeting and is effective in controlling and monitoring expenditure management.

Although line item budgets are simple and effective in controlling funds, they still have a number of drawbacks. The system does not provide information about why money was spent, and no attention is given to the efficiency and effectiveness of the program (World Bank, 1998 b). Furthermore, line item budgeting does not usually consider planning and policy option in the budget process. These deficiencies encourage governments to develop and implement the performance budgeting that is based on enhancing efficiency and output.

ii. **Performance budgeting** is based on defined programs, goals and objectives. It measures the amount of work to be accomplished, the efficiency with which the work will be completed and the effectiveness of the program (Bland and Rubin, 1997). Performance budgeting needs clear and measurable objective statement, pre-determined standards or performance measurement in comparison with similar other organization, decentralization of responsibilities and accountabilities, and institutional financial autonomy.

However, Bland and Rubin (1997) have argued that performance budgeting does not address the fundamental questions; such as whether a program is necessary at all, or how best to allocate limited resources among competing ends. In other words, it gives more attention for efficiency and effectiveness of resources rather than resource allocations among competing policies. Although, performance budgeting is difficult to design and implement, it has many advantages. It improves productivity; linking performance to budget allocation, improves accountability, allows more decentralized decision-making and more creative management.

iii. The other alternative approach to determine spending priority is **Zero- Base Budgeting**. In this approach, decision-makers conduct annual evaluation of each program and give priority against available resources. The budget is entirely remade every year; there are no commitments that are carried forward to the next fiscal year. The application of this budget system is highly limited in developing countries. This is because some of the budget items such as contractual and legal payments of loans interest payments, contractual payments for salaries are carried forward to the next fiscal year.

iv. Bland and Rubin (1997) further explained that **Program Budgeting** organizes government activities into program, identifies alternative for achieving each goal, determines the costs and benefit of each alternative, and selects the alternative that maximizes net benefit. It is a system that links long range planning with yearly budgeting and evaluation.

The main objective of performance and program budgeting is to improve linkage between policies, planning and budgeting. Currently, public sector resource allocation needs such effective synchronization of budget process with planning. This in turn requires

sustainable political commitment, sound budgetary and accounting systems, skilled and knowledgeable personnel, sufficient and flexible resource allocations (Caiden, 1996).

2.5 BUDGET ANALYSIS

Budget analysis is a thorough and detailed review of the budget. It involves the collection, study and interpretation of budget data, the correlation of budget data to other relevant information such as state policies and programs, and the establishment of findings and results. Its aim is to provide analysis and information that is credible, accessible to a wide range of audiences, and makes a timely contribution to policy debates, with the purpose of affecting the way budget issues are decided and the decisions that are made (Iris, 1999).

Budget analysis is undertaken through a number of perspectives. Some groups assess financial arrangements covering national and sub-national goals. Others look at the effects of budget decisions on programs that affect vulnerable sectors. Yet others study the relationship of spending for one function against another (for example, military spending or debt service compared with economic development). Still others analyze budget process issues, policies and institutions. Other groups undertake budget analysis through a very technical lens; this includes classifying expenditures by major and minor headings (function or nature of expense), looking at budget figures, studying new allocation items, and understanding the state's development plans as expressed by budgetary allocations (Adva, 1999).

Budget analysts often encounter problems. Access to budget data and information is a common problem. The major budget books, detailed financial studies, papers and other budget documents are often withheld from the public. On many occasions, those undertaking budget analysis have been able to secure budget information from members of the national legislature; unfortunately, this sometimes prevents groups from timely intervention in the budget process.

Clarity of budget information and data is another problem. According to Adva (1999), "the language of the budget books is obscure, divisions often are not properly identified, and functions often are not properly specified. These problems thwart the ability to assess policies."

Another problem, again found in Israel, but reflective of other countries, is that "the budget books do not enable readers to establish the relationship between functions, costs and allocations—and thus to check the rationale behind the allocations." (Maria, 1999)

There are several gaps in the budget structure that limit its effectiveness as an instrument of analysis. The budget does not show any deviations between actual expenditure

and allocations; sometimes, funds are spent for purposes other than those that are authorized; other times, expenditures are larger or less than the allocated funds and the budget does not show what happens to the unutilized portions of the allocations. The budget also does not indicate leakage, if any, in the amount expended, nor is the budget broken down by region, state, district, or municipality.

Finally, the budget process rarely provides people with the opportunity to participate in any of its stages. Sometimes, people may participate in the budget process only during the budget authorization stage, when the legislature conducts public hearings to discuss the budget. Getting started on budget analysis involves a four-step process (Adva, 1999).

2.5.1 Sectoral Budget Analysis

This is otherwise known as portfolio analysis. These focus on only a particular area of concern because of the huge amount of work involved in total budget analysis. Sectoral budget analysis may also be called for if the participants in the analysis have a special focus. A civil society organization that works in the area of reproductive health and maternal and child health may choose to focus on the health sector rather than the whole budget. This approach also allows more depth in budget analysis. More tools can be utilized and different perspectives of the advocacy issue will be exposed.

In other words, more valid entry points are created for advocacy purpose. It must be noted however that no sector can be analysed in isolation of the whole budget. Sectors are inter linked both in the demand for inputs and in the use of the outputs. Human capacity is a necessary demand for all forms of production. Thus the level of investment in one sector, say education or science and technology has implication for the supply and quality of manpower in other real sectors e.g. agriculture, works, energy and so on. In the same vein, social sector performance is highly linked with real sector productivity.

Thus, a sectoral analysis of one sector, ideally should be done, taking into cognizance the impact on related sector. Is the increased budgetary allocation in one sector matched by necessary allocation in a recipient sector? Is the allocation to science education matched by allocation to technology development programmes in S & T sector? The reality of such inter-linkages makes sectoral budget analysis of wider utility (Salisu, 2005).

2.5.2 How is Budget Analysis Done?

Budget analysis may be carried out with focus on any of the four dimensions of budgets:

i. financial inputs or appropriation

ii. activities financed

iii. outputs delivered

iv. impacts on people's lives

According to Elson (2001), analyses of inputs consist of the structure of appropriation of money and of actual spending. Usually, this follows a standard programme classification for each country. This may be by sectoral lines or ministerial line, that is the main management system of each sector. Total appropriation equals the sum of the individual allocation to each sector or live ministry plus allocation to other special agencies. The latter is often transitory in nature. Examples in Nigeria include Petroleum Tax Fund, Education Tax Fund, Poverty Alleviation Programme and so on that are not tied to one particular sector but which called for some incidental allocation at given points in time.

A budget analysis may be aimed to achieve different things. It may compare the distribution of the appropriation with the stated policy thrusts or it may simply try to deduce the implied priorities of the government from this distribution. It may derive the likely impacts of the pattern of appropriation on some development goals or simply assess equity issues with respect to different sectors or different groups of stakeholders.

Activities within a budget can also be a subject of analysis. These are the services planned and delivered which may or may not be explicitly stated in the budget. Analysis allows us to track how services/programmes related to a given objective e.g. child health, women empowerment, industrial promotion etc are funded. The disposal of funding can be monitored to see the actual amount reaching specified critical services.

Another framework for budget analysis is to monitor the output of budgets. The outputs are the planned and delivered activities or service such as number of pupils funded to go to school, number of infants immunized, number and value of business credit given. This is related to performance budgeting. On the revenue side, focus of analysis may be to assess the value of income earned, value of production levels (say in agriculture) which contributes to national revenue and so on.

Lastly, impact analysis is always a necessary aspect of budget analysis. It is one thing to plan expenditure and disburse funds, but another thing for the money spent to achieve targets of development. Often, perspective and even, annual budgets or plans come with specified quantitative targets of development. In budget analysis, we want to determine how close or how far from this target the budget implementation has carried the nation in terms of the starting index (say, demand, supply, gap) and closing index of rice self-sufficiency. If

closing gender gaps is a stated priority, then impact analysis will be carried to see in specified areas of noted gender inequality, to what extent has the gap been closed over a budget period. In the sense that these desired impacts are often not specified, budget analysis from this angle tends to be the more difficult because it would involve research from on-ground assessment of parameters in the sector which are hitherto not focused upon in the budget document which is the major information source in budget analysis.

The development of the necessary indicators to measure such impacts during budget conception and formulation will be a useful preparatory tool for budget analysis.

2.5.3 The Revenue Side of Budget Analysis

It is very easy to limit the focus of budget analysis to the expenditure side. However, there are two sides to a budget. The expenditure and the revenue side. It is as important to assess the pattern and magnitude and distribution of spending as it is important to assess the pattern, magnitude and distribution of revenue. Revenue incidence and Tax incidence analysis are useful tools for this.

These define relative contribution of income to the national purse from different sectors, different locations and different segments of the population (men, women, farmers, rural, urban and so on). This is because “to whom much is given much is expected” and vice versa. If expenditure favours a sector, relative to others, it is expected that for an efficient budget performance, commensurate income/productivity is accruing from the sector. Is the budget efficient and cost effective? Is the budget allocation equitable and just in the distribution of expenditure? Is tax incidence heavily skewed against market women or farmers or importers/exporters? If so, is the allocation or design of policies and programmes such that will further promote the performance of these groups? (Salisu, 2005).

2.5.4 Gender Budget Analysis

Gender analysis of budgets is carried out with the goal of gender equity in focus. It therefore raises questions and develops indicators to ensure that the input, output, activities and impacts of budgets are equitable for men and women.

Gender budget analysis focuses on the analysis of the effects that budgetary allocations have on men and women, to identify those who are being positively benefited and those that are not benefiting, as well as those who are being negatively affected by the pattern of budgetary allocation. An underlying objective is therefore, to effectively target expenditures and revenue policies in order to reduce any undesirable gender-specific effects.

This is for the purpose of making budgets more people friendly. It also seeks to ensure greater allocation to those spheres of life and society where the achievement of gender equity can be promoted or leveraged e.g. policy reform processes, such as land rights promotion, equitable access to production resource such as credit, technology development, educational promotion etc.

It can be summarized therefore that the core objective of gender analysis of budgets is to, in a long-term view, promote the creation of a level playing field for all willing and able economic agents (Salisu, 2005).

2.6 MULTIPLE OBJECTIVES IN DECISION MAKING

According to Kodikara (2008), many decades ago, the natural decision making process has been strongly based on the comparison of different points of view (i.e. criteria or Performance Measures), some in favour and some against a certain decision. Contrary to this, Operations Research presented its optimisation model, which is based on the maximisation or minimisation of a single objective function, subject to some constraints. Pomerol and Barba-Romero (2000) claim that these 'single objective optimisation' models quickly gained the acceptance of the scientific population due to its strong theoretical foundation. Probably due to this reason, the 'optimisation' paradigm is still considered to be very powerful and is dominant in the work of many researchers.

However, in this approach, one main practical difficulty lies in attempting to summarise all the points of view related to the desired results of the decision at hand in only one objective function. Another drawback of 'optimisation' modelling from the human point of view is its lack of realism without being able to present an effective framework to deal with the uncertainties of the world and the subjectivity of Decision Maker's values and preferences (Slovic, 1981).

Therefore, single objective optimisation has been considered as 'far from reality' by many researchers and practitioners (Brans, 2002; Galloway, 2005; Simon, 1983) and over the years, researchers and practitioners have been attempting to address the multidimensional nature of the real decision problems.

Brans (2002) explains that in a socio-economic or human framework, a well balanced decision should take into account, three poles of influence; rational, subjective and ethical poles. Most of the basic models of operational research are only considering the rational pole; no freedom is left to the Decision Maker, and no ethical aspects are considered. It is also not possible to ignore the fact that each real decision is the result of a compromise between

several solutions which all have their advantages and disadvantages, depending on one's point of view. Since many conflicting aspects occur simultaneously, the solution is no longer an optimal one but a 'satisfactory' one. While allowing for rationality and ethics, MCDA emphasizes the role of the subjective pole in the decision process, offering the DM, more freedom to consider several optimality points of view taking into account his/her emotionality and real-life experience. Multicriteria modelling gives a freedom of judgment to the DM, which is obscured by single-criterion modelling. However, according to Kodikara (2008), MCDA does not have inherent rationality. It often has the merits of realism, legibility and straightforwardness, but decision itself is, by definition, subject to political choice (Pomerol and Barba-Romero, 2000).

In practice, the applications in multi-criteria decision analysis stretch across many fields both at strategic and operational levels. These fields include public investment (e.g. Barba-Romero and Mokotoff, 1997; Rogers *et al*., 2000b), resource allocation and management (e.g. Duckstein *et al*., 1994; Flug *et al.,* 2000; Srinivasa-Raju *et al.,* 2000) and strategic decision (Rhodes *et al.,* 2005; Siskos 1986).

2.7 MULTICRITERIA ANALYSIS

Multicriteria analysis, often called Multiple Criteria Decision Making (MCDM) by the American School and Multicriteria Decision Aid (MCDA) by the European School, is a set of methods which allow the aggregation of several evaluation criteria in order to choose, rank, sort or describe a set of alternatives (i.e. investment projects, financial assets at variable revenue, financial assets at fixed revenue, dynamic firms, etc.). It also deals with the study of the activity of decision aid to a well identified decision maker (i.e. individual, firm, organization, etc.) (Zopounidis,1999).

Dodgson *et al*. (2000) defines "MCDA as an approach as well as a set of techniques aiming at providing an overall ordering of alternatives from the most preferred option to the least preferred one. The options may differ based on their several objectives and no option will be obviously best in achieving all objectives. MCDA is a technique looking at complex problems characterized by any mixture of monetary and non-monetary objectives to break the problem into more manageable pieces to allow data and judgments to be brought onto the pieces. Then, it reassembles the pieces to present a whole coherent picture to decision makers".

The development of multicriteria decision aid began 27 years ago. Its principal objective is to provide the decision maker with tools that enable him to advance in solving a

decision problem (for example, the selection of investment projects for a firm), where several, often conflicting multiple criteria must be taken into consideration (Zopounidis,1999).

The specialists in the field distinguish several categories of methods in MCDA. The boundaries between these categories are, of course, rather fuzzy. Roy (1985) proposes the following three categories of methods:

(1) unique synthesis criterion approach disregarding any incomparability,

(2) outranking synthesis approach, accepting incomparability and

(3) interactive local judgment approach with trial & error iterations.

In a classification proposed by Pardalos *et al.* (1995), four categories were distinguished:

(1) Multiobjective mathematical programming,

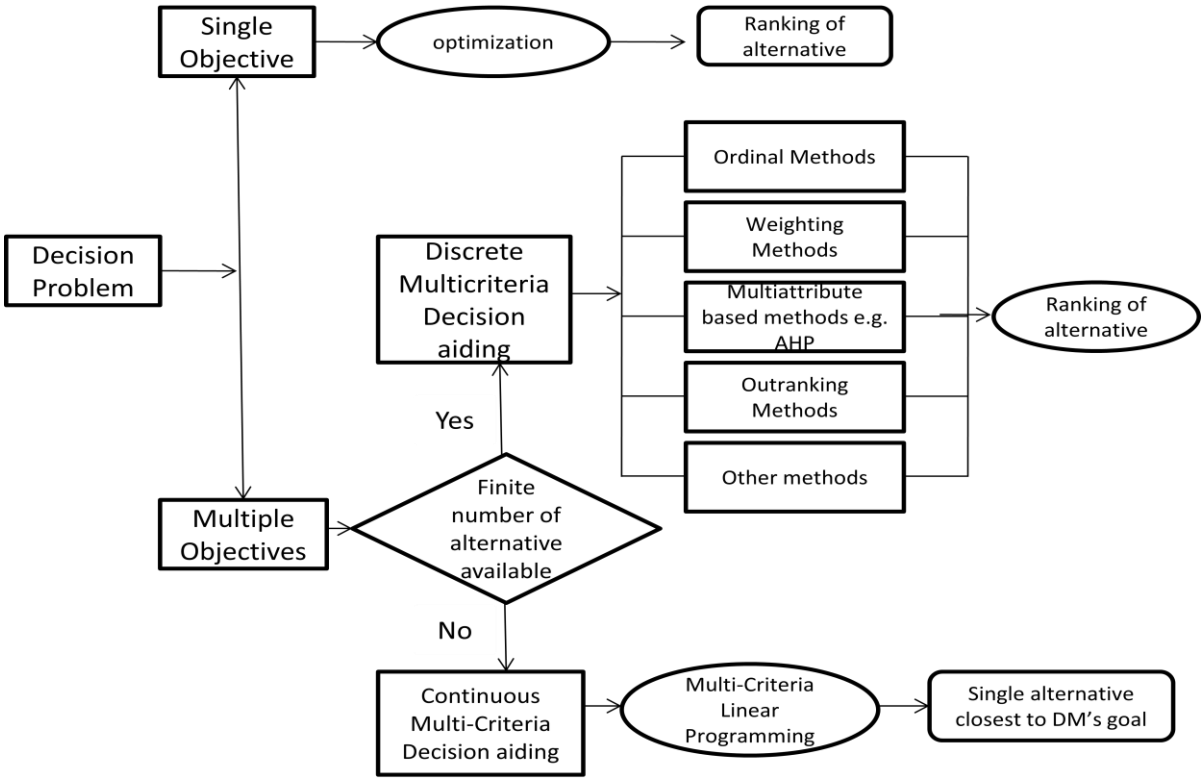
(2) Multiattribute utility theory,

(3) Outranking relations approach and

(4) Preference disaggregation approach.

The available decision making methods can either be considered as single objective or multiple objectives as illustrated in Figure 2.1 below.

Figure 2.1: Decision Aiding Model



Source: Kodikara, 2008

2.7.1 Classification of Discrete MCDA Methods

Discrete Multi-Criteria Decision Aiding (DMCDA) methods have been classified into different groups by different authors (Pomerol and Barba-Romero, 2000; Vincke, 1992; Zoints, 1990). One possible reason for this disparity is the fuzzy nature of the boundaries between these families (Vincke, 1992). In a study by Kodikara (2008) the DMCDA methods were broadly considered under the following five categories:

- Ordinal methods
- Weighting methods
- Multi-attribute utility based methods
- Outranking methods and
- Other methods

Among the basic ordinal methods are the Borda's method (Black, 1958), the Condorcet method (Condorcet and Marquis De, 1785), the method of Bowman and Colantoni (Bowman and Colantoni, 1973) and the lexicographic methods (Fishburn, 1974). All these ordinal methods derive a final pre-order (i.e. ranking) for the set of alternatives by aggregating the individual pre-orders with respect to the Performance Measures (PMs).

The weighting methods, which have been abundantly used in numerous contexts, include the weighted sum method (Kepner and Tregoe, 1965) and the weighted product methods (Pomerol and Barba-Romero, 2000). However, in weighting methods, the results are largely dependant on the weights assigned to PMs, in contrast to ordinal methods making certain assumptions on the nature of the DM's preferences (Pomerol and Barba-Romero, 2000). Though both of these methods (i.e. ordinal methods and weighting methods) do not provide adequate reliability in results for certain purposes, they are simple to apply, intuitive and very popular among Decision Makers in the real world (Janssen, 2001).

Multi-attribute utility based methods and outranking methods together record a considerable number of DMCDA applications in the literature. Multi-attribute utility based methods assess and fit utility functions and probabilities to the performance measures (Keeny and Raiffa, 1976), whereas the outranking methods are based on pairwise comparison of alternatives (Roy, 1985).

It is clear that almost all MCDA approaches use the DM preferences to make recommendations. The major difficulty facing an MCDA methodology, as many authors have highlighted (e.g. Figueira and Roy, 2002; Jacquet-Lagréze and Siskos 1982), lies in the assessment and modeling of DM preferences. Logical rules and relations as well as emotional and psychological aspects of the DM are helpful in modeling DM preferences. Clearly, this will in turn have a significant impact on the outcome of the analysis.

Brans (2002) points out that in additive utility methods, though the rationality of the solution is safe, from a practical point of view, this procedure is highly questionable due to the compensation effects among strong and weak criteria within the global value function. He also states that these methods impose an optimal solution to the DM, without leaving any freedom for taking into account the subjectivity, emotionality and the real-life experience of the DM.

The four popular additive utility-based MCDA methods include the following:

1) Multi-Attribute Utility Theory - MAUT (Keeny and Raiffa, 1976)
2) Analytic Hierarchy Process - AHP (Saaty, 1977)
3) Simple Multi-Attribute Rating Technique - SMART (Von Winterfeldt and Edwards, 1986)
4) Utility Theory Additive - UTA (Jacquet-Lagréze and Siskos, 1982)

2.7.2 THE ANALYTICAL HIERARCHY PROCESS (AHP)

The Analytical Hierarchy Process (AHP) developed and reported in Saaty (1977) was based on sets of pair wise comparison of decision maker that is represented on a human being's intrinsic ability to structure his/her perceptions hierarchically, compare pairs of similar things against a given criteria or a common property and judge the intensity of the importance of one thing over the other (Saaty, 1977).

In order to obtain an AHP ranking (i.e. overall relative weighting of the elements) the AHP synthesizes all the judgments using the framework given by the hierarchy. To do so, it is important to define a decision problem being in single decision elements between which certain relationships exist. Hence, it does need to estimate relative priority weights for the single decision elements on each hierarchy level of decision problems. There are several alternative procedures studied for estimating the relative priority weights such as eigenvetor method that is originally developed by Saaty, logarithmic least square method and linear programming (Saaty, 1980, Saaty, 1990, Korhonen and Wallenius, 1990).

The AHP is a multi-attribute evaluation method that involves three phases: decomposition, comparative judgments, and synthesis of priorities (Saaty, 1980). In the decomposition phase, the project team can explicitly develop the AHP hierarchy model from the fundamental-objective hierarchy as mentioned above. In the second phase, each decision maker utilizes paired comparisons for the attributes and alternatives to extract judgment matrices with a nine-point scale at each level. In the third phase, the paired comparison process is repeated for each attribute in the alternative prioritization problem based on the largest eigen-value method. Finally, the relative importance of attributes and the global priority of alternatives can be obtained by aggregating the weights over the hierarchy. Hence, AHP can accelerate the development of a consensus amongst multiple decision makers (Chun-Chin Wei *et al.*, 2006).

The AHP involves four steps. These are:

1. Constructing a decision hierarchy by breaking down the decision problem.
2. Performing pairwise comparisons of the decision elements.
3. Estimating the weights of the decision elements.
4. Aggregating the relative weights of the decision elements to provide a set of ratings for the decision alternatives (Ali, 2002)

Step 1: ***Constructing a decision hierarchy by breaking down the decision problem***. The crux of AHP is determination of the relative weights to rank the decision alternative. Assuming we are dealing with n criteria at a given hierarchy, the procedure establishes n x n

comparison matrix, A, that reflects decision maker's judgment of the relative importance of the different criteria (Taha, 2005).

Step 2: ***Performing pair wise comparisons of the decision elements***. The pair wise comparison is made such that the criteria in row *i* (*i* = 1, 2, …, *n*) is ranked relative to each of the criteria represented by the n columns. Letting a_{ij} define the element (*i, j*) of A, AHP uses a discrete scale from 1 to 9 in which $a_{ij} = 1$ signifies that *i* and *j* are equally important, $a_{ij} = 5$ indicates that *i* is strongly more important than *j* etc (see table 2.1). For consistency $a_{ij} = k$ automatically implies $a_{ji} = {}^{1}/_{k}$ (i.e $a_{ij} = {}^{1}/a_{ji}$ where $i \neq j$). Also diagonal element a_{ij} of A must equal 1 because a criterion is comparing against itself (i.e. $i=j$) (Taha, 2005).

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{pmatrix}$$

But $a_{ij} = {}^{1}/a_{ji}$, where i $i \neq j$ and $a_{ij} = 1$ where $i=j$

Therefore, pair-wise comparison matrix becomes

$$A = \begin{pmatrix} 1 & a_{12} & \dots & a_{1n} \\ 1/a_{12} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ 1/a_{1n} & 1/a_{2n} & \dots & 1 \end{pmatrix}$$

Table 2.1: AHP 1 to 9 scales

Scale	Meaning
1	Equal importance of the two evaluated elements.
3	Moderate importance of one element over the other.
5	Strong importance of one element over the other.
7	Very strong importance of one element over the other.
9	Extreme importance of one element over the other.
2, 4, 6, 8	Compromise.

Source: Saaty, 1983

Step 3: ***Estimating the weights of the decision elements.*** The Eigen value method is used to estimate the relative weights of the decision elements. The relative weights of columns of A can be determined by dividing each element of a column by the sum of the elements of that

same column. The desired relative weight W_i of each row are then computed as the row average of the resulting normalized matrix (Taha, 2005). The eigenvector is defined by

$$AW = W \max \lambda \qquad (2.7.2.1)$$

Where max λ is the largest Eigen value of A. It must be noted that this eigenvector solution is normalized additively, i. e.

$$\sum_{i=1}^{n} w_i = 1 . \qquad (2.7.2.2)$$

Step 4: In the last step of the AHP, ***the relative weights of various levels are aggregated.*** The results produce a vector of composite weights, which will serve as a ranking of the decision alternatives.

The widespread use of AHP may be assigned to its simplicity and flexibility. According to the literature review, it has been realized that AHP has been recently employed along with other methods like mathematical programming to consider not only quantitative and qualitative factors, but also limitations similar to real world (Nassar *et al*, 2003). Integrated AHP presents more promising and reliable results. Therefore, integrated AHP has been the focus of a significant amount of studies in recent years. The reason of integrating AHP with different tools may be assigned to the wide application and success in the decision making (Nassar *et al*, 2003).

AHP technique also allows the analyst to evaluate the correctness and the consistency of the given pair wise comparisons, by means of a consistency ratio (CR). The judgments can be considered acceptable if and only if CR≤0.1 (Saaty, 1980).

According to Pomerol and Barba-Romero (2000), some shortcomings and limitations of this method are that:

- it forces the user to adapt to a hierarchy structuring,
- the final ranking of a previously analysed set of alternatives can be perturbed by introducing new alternatives,
- it requires a lot of information from the DM, in order to construct the utility functions, and
- utility normalization problems.

However, AHP has been successfully used in a wide range of applications from corporate planning (strategy planing, choice of projects, choice of investments, choice of equipment, commercial prospecting, auditing etc.) to the resolution of international conflicts (Zelany, 1982).

2.7.3 Continuous MCDA Approach

The continuous MCDA methods use the multi-criteria linear programming to maximise or minimise a single objective function. The additional objectives are usually regarded as constraints. Pomerol and Barba-Romero (2000) note the existence of highly effective algorithms for solving this type of programs in single criterion case; these algorithms can, however be adapted to the multi-criteria case as well. Among the common methods to address the continuous MCDA problems, are the 'constraint method' by Cohon and Marks (1975) and 'goal programming' method by Charnes and Cooper (1961).

As a continuous MCDA approach, the 'constraint method' is recommended by Cohon and Marks (1975) for MCDA reservoir optimisation problems with fewer than four objectives. One objective, usually the most important one, is optimised as the primary objective. Any other objective is transformed into constraints and optimised as a secondary objective, simply by constraining the upper and lower bounds of the related Performance Measure (PM).

2.7.3.1 Goal Programming

Goal programming is a well-known modification and extension of linear programming, developed in the early 1960s owing to the study of Charnes and Cooper (1961). It solves the continuous MCDA choice problems in linear programming by a search for a solution at minimal distance from a multicriterion goal, generally non-achievable, set by the DM. It arrives at an alternative closest to the DM's ideal goal by minimising the distance from the goal. Vincke (1992) lists the steps involved in goal programming as:

i. Setting the values DM wishes to attain on each PM (these are related to the objectives)
ii. Assigning priorities (weights) to the objectives
iii. Defining (positive or negative) deviations with respect to these objectives
iv. Minimising the weighted sum of the deviations and
v. Performing sensitivity analysis

As Vincke (1992) reports, the goal programming approach, first developed in the frame of linear programming, was extended to all other types of mathematical programs and was also rendered interactive.

Linear programming deals with only one single objective to be minimized or maximized, and subject to some constraint; it, therefore, has limitations in solving a problem

with multiple objectives. Goal programming, instead, can be used as an effective approach to handle a decision concerning multiple and conflicting goals. Also, the objective function of a goal programming model may consist in non-homogeneous units of measure.

Goal programming is a branch of multiple objective programming, also known as multiple-criteria decision making (MCDM). It can be thought of as an extension of linear programming to handle multiple, normally conflicting objective measures. Each of these measures is given a goal or target value to be achieved. Unwanted deviations from this set of target values are then minimised in an achievement function. This function can be a vector or a weighted sum dependent on the goal programming variant used (Ignizio, 1976).

Goal programming (GP) can be based on different philosophies. Ignizio (1976) was first to interpret in a Simonian "satisficing" philosophy. From the analytical point of view, a satisficing philosophy within a GP context implies that decision makers (DM) are interested only in minimizing the non achievement of several goals (Nuray and Mehmet, 2007).

The minimization process can be accomplished with different methods, each one leads to different GP variant. Basically, there are only three GP variants reported in the literature. The most widely used is Lexicographic Goal Programming LGP (Non-Archimedean Goal programming), which attaches pre-emptive priorities to different goals in order to minimize the unwanted deviation variables in a lexicographic order. The second one is Weighted Goal Programming WGP (Archimedean Goal Programming), which attempts to minimize a composite objective function formed by a weighted sum of unwanted deviation variables. The third is MINMAX Chebyshev (Fuzzy) Goal programming which attempts to minimize the maximum deviation from stated goals (Tamiz *et al.*, 1998).

The initial goal programming formulations ordered the unwanted deviations into a number of priority levels, with the minimisation of a deviation in a higher priority level being of infinitely more importance than any deviations in lower priority levels. This is known as lexicographic or pre-emptive goal programming. Ignizio (1976) gives an algorithm showing how a preemptive goal program can be solved as a series of linear programmes. Pre-emptive goal programming should be used when there exist a clear priority ordering amongst the goals to be achieved.

Thus, pre-emptive goal programming is used in solving the multi objectives and assigning priority to objectives in the model. The assignment of priorities to these objectives is generally decided by the decision maker (Ignizio, 1976, Bal *et al.*, 2006).

2.7.3.2 Goal Programming Technique

The goal-programming approach is extensively applied in decision analysis in Operations Research, such as production planning, financial decisions (Kvanli, 1980), marketing decisions, corporate planning, academic planning, and decision in government (Lin, 1980, Taylor *et al.*, 1982).

The different goal programming models available to assess MCD problems include the non-linear and linear GP with Archimedean weights (i.e. weighted GP), the Interactive Weighted Tchebycheff (IWT) Procedure, the MINMAX Chebyshev GP, the Reference Point Method (RPM), the Compromise Programming (CP), and the Lexicographic Linear GP.

Taha (2005) points out that it may be impossible to find a single solution that optimizes conflicting objectives. Instead we may seek a compromise solution based on the relative importance of each objectives. Taha (2005) further asked "how can we optimize a multiobjective model with possible conflicting goals?" He then presents two methods developed for this purpose which are based on converting the multiple objectives into a single function viz: 1) the weights method and 2) the preemptive method (Lexicographic method).

Lexicographic goal programming is actually one of the most significant devices in tackling MCD problems: the different goals can be ranked according to different priority levels that reflect the target allocated to them by the decision maker.

The lexicographic approach defines different priority levels P_k for the goals of the analysis. The different priority levels reflect the hierarchical relationship between the targets in the objective function where they are arranged in order of decreasing priority ($P_1 > P_2 > \ldots > P_m$). In order to identify the solution to the problem, the highest priority goals and constraints are considered first; if more than one solution is found in the first step, another goal programming problem is formulated which takes into account the second priority level targets. The procedure is repeated until a unique solution is found, gradually considering decreasing priority levels. The lexicographic optimisation can then avoid the estimate of the different deviation weights, but the results of the analysis may be biased by the analyst's personal opinion (Romero, 1991). This study is an attempt to correct this biasedness.

2.7.3.3 The structures of GP model

The basic steps used in structuring an LP model are identical to those for GP. The major difference between the two is that the GP model does not optimize (maximize/minimize) the objective directly, as in the case of LP. Instead, it attempts to

minimize the deviations between the desired goals and the realized results. These goals are priotized in a hierarchy of importance.

To quantify this, each goal is expressed as an equation and deviational variables assigned to it. Deviational variables can be positive or negative. A positive deviational variable d^+ represents overachievement of the goal. A negative deviational variable d^- represents underachievement of the goal. If the desire is not to underachieve the goal, d^- should be driven to zero. To the contrary, if d^+ is driven to zero, the overachievement will not be realized.

It may be noted that the structure of a GP model involves two types of constraint: system and goal constraints. The system constraint are those which are more restricted in nature and have to be satisfied before the goal constraints, as they represent the existing capabilities, rather than what we would like to achieve.

From the above discussion, it can be deduced that deviational variables are mutually exclusive. This relationship is mathematically expressed as:

$$d^+ * d^- = 0 \qquad (2.7.3.3.1)$$

The steps needed to structure a GP model are threefold:

1) Goals are identified and expressed as constraints
2) Goals are analysed to determine the correct deviational variables needed for them, d^+, d^-, or both.
3) A hierarchy of importance among goals is established by assigning to each of them a pre-emptive factor, P_k. These pre-emptive priority factors reflect the hierarchy relationships in such a way that P_1 represent the highest priority, P_2 the second highest, and so on. In other words, the P's indicate a simple ordinal ordering of the goals

Once the above steps are completed, the problem can be quantified as a GP model as follows:

Minimize: $\sum_{i=1}^{m} w_{ik} P_k (d_i^+ + d_i^-)$

Subject to: $\sum_{j=1}^{n} a_{ij} x_j - d^+ + d^- = b_i$ (2.7.3.3.2)

where:

j =1,2,3, …, n.

i =1,2,3, …, m

n = no. of variables,

m = no. of constraints

k = the pre-emptive priority

w_{ik} = the differential weighting factor for the deviational variables within a single k priority level

P_k = the pre-emptive priority level k

d_i^- = the under – achievement

d_i^+ = the over – achievement

b_i = target or aspired level

a_{ij} = vector of n-decision variable

x_j = decision variables

One of the technical advantages of goal programming is that it always provides a solution, even if none of the goals are realizable, provided the feasible region is non-empty. This is due to the inclusion of deviational variables, which show whether the goals are attained or not. In the later case the measure the distance between the realized and aspired goal levels. Another advantage of goal programming is that it does not require very sophisticated solution procedures. Especially the linear goal programming problems can be solved easily by available linear programming routines.

An important drawback of goal programming is its need for fairly detailed a priori information on the decision maker's preferences. Goal programming requires definition of aspiration levels, portioning of the set of goals into pre-emptive priority classes and assessment of weight within these classes. A problem not to be overlooked is critical role of aspiration levels and the pre-emptive priorities defined by decision maker. Once a goal obtains pre-emptive priority above another, no trade-off between these goals is admitted anymore. In other words first order priority goals determine the solution space for goals of less important priority classes. This means that the definition of the goal levels must be completely reliable or that some kind of bargaining about these levels must remain possible.

Clearly, the elucidation of the decision maker's preferences in this 'direct' way is not a sinecure. Kodikara (2008) agree with scholars advocating interactive methods, which neither requires an explicit representation or specification of the decision maker's preference function nor an explicit quantitative representation of trade-offs among conflicting goals.

2.8 INTEGRATION OF AHP AND GP

The basic approach of Mathematical Programming Models is to optimize the objective function while simultaneously satisfying all the constraints equations that limit the activities of the decision-maker. The current trends of research is to formulate integrated models, as the justification of problems become more complex with the identification of seemingly unconnected factors ranging from the commitment of top management and managers' perceptions towards automation to the strategic issues and production criteria such as quality, flexibility, etc. (Chen and Everett 1991).

Schniederjans and Wilson (1991) utilized the AHP method to determine the relative weights of attributes and applied these weights to a goal programming model for Information System (IS) selection. Suresh *et al*., (1992) have developed a procedure that combines a general mixed integer goal programming formulation with AHP to utilize both optimization and evaluation capabilities. A similar attempt has been made by Myint and Tabucanon (1994) who effectively combined the GP and AHP methodologies for the machine selection problem. As a possible extension to these works on combining AHP and GP methodologies, an integrated AHP-GP model has been formulated for selection of software architecture design alternatives (Rama et al, 2007). It formally treats the priorities in the decision hierarchy of AHP as penalty weights of the goal constraints.

In addition, it is necessary to normalize the objective functions so that the deviations (d_i^+, d_i^-) from the goals are directly comparable. AHP has been employed by Gass (1986) to enable decision makers to specify numerical weightages or the objectives; besides there have been other attempts to employ the Delphi technique and Conjoint analysis for this purpose. There is a need to use AHP in conjunction with GP so as to increase the applicability of both the methodologies for problems involving syncretic (i.e., both qualitative and quantitative) criteria. The following are some of the works that have used integrated AHP-GP models: Ramanathan and Genesh (1995) for energy resource allocation to urban households, Greenberg *et al.,* (1994) for budgeting of public sector organizations, Benjamin *et al.* (1992) for planning facilities at the university of Missouri-Rolla, Khorramshahgol *et al.* (1988) for project evaluation and selection.

2.9 GOAL PROGRAMMING MODEL FOR RESOURCE PLANNING

Habeeb (1991) reported that techniques of development planning involve physical and financial aspects. Financial planning refers to the allocation of monetary resources; in Nigeria the previous development plans and budget, which had been based on the incremental approach, contained various shortcomings, resulting in deliberate inflation of estimated expenditure and consequently it has been associated with retarded growth and conflicts between ministries. He said the approach does not adequately relate national objectives to their priorities. Conventional mathematical programming models are unavailable to allocate resources effectively in conflicting environment. Habeeb (1991) then proposed a goal programming model for allocating a country's scarce resources among conflicting sectors under the conflicting conditions of national planning. The model can help to determine all priorities for the goals he said.

Habeeb (1991) also documented that in preparing a development plan, the efficient allocation of resources is an important ingredient of success and that it is necessary for resources to be allocated on objective standards. Hence, the need for a model that ensures feasible allocations. He further stressed that a goal programming model may be used because it has become acceptable for achieving conflicting multiple objectives.

Given the goals that need to be achieved within a country, available resources can be allocated to various sectors of the economy during a planned period with a goal programming (GP) model.

2.10 STRENGTHS AND WEAKNESSES OF ANALYTIC HIERARCHY PROCESS AND GOAL PROGRAMMING

Sarkis and Surrandaj (2005) claimed that, "the AHP approach offers several advantages over the other techniques, despite certain drawbacks such as rank reversal and the number of judgment elicitations that are needed".

Compared to other multicriteria decision making approaches, AHP is not relatively complex, and this helps improve management understanding and transparency of the modeling technique. AHP have the additional strength of being able to mix quantitative and qualitative factors into a decision. It can also be dovetailed with other solution approach such as optimization, DEA and goal programming (Lee et al, 2001).

AHP may use a hierarchical structuring of the factors involved. Simon (1972) writes that the hierarchical structuring is universal to the composition of virtually all complex systems, and is a natural problem-solving paradigm in the face of complexity. In AHP, judgment elicitations are completed using a decompositional approach, which has been shown in experimental studies to reduce decision-making errors (Kleinmuntz, 1990, Morera *et al* 2001).

AHP has also been validated from the decision-makers perspective as well in recent experimental investigations (Hastak, 1998). It is a technique that can prove valuable in helping multiple parties (stakeholders) arrive at an agreeable solution due to its structure, and if implemented appropriately can be used as a consensus-building tool.

Analytic Hierarchy Process (AHP), as a critical decision making tool for several disciplines, has proved controversial **(**Bosch, 2000**).** In addition, AHP requires users to take a holistic view of the design alternatives while comparing them without taking into account the analysis and intermediate results leading up the alternatives. This tends to neglect the Solution Development stage in a decision making process so the implications of intermediate decisions and analysis are lost.

A major strength of goal programming is its simplicity and ease of use. This accounts for the large number of goal programming applications in many and diverse fields. Linear Goal programmes can be solved using linear programming software as either a single linear programme, or in the case of the lexicographic variant, a series of connected linear programmes.

Goal programming can hence handle relatively large numbers of variables, constraints and objectives. A debated weakness is the ability of goal programming to produce solutions

that are not Pareto efficient. This violates a fundamental concept of decision theory, that is no rational decision maker will knowingly choose a solution that is not Pareto efficient. However, techniques are available (Hannan ,1980; Romero, 1991; Tamiz *et al.*, 1999) to detect when this occurs and project the solution onto the Pareto efficient solution in an appropriate manner.

According to Lee and Kim (2001), one shortcoming of GP is its lack of systematic approach to set priorities and tradeoff among objectives and criteria. This drawback is even more evident when both tangible and intangible factors need to be considered and when interdependent factors are involved and a number of people need to participate in the judgment process. In order to overcome this problem, Saaty (1980) applied Analytic Hierarchy process (AHP), to set priorities for objectives and determine tradeoff among them.

The setting of appropriate weights in the goal programming model according to Rama et al (2007) is another area that has caused debate, with some authors such as Gass (1987), suggesting the use of the Analytic Hierarchy Process or interactive methods (White, 1996) for this purpose.

CHAPTER THREE
MATERIALS AND METHODS

3.1 INTRODUCTION

The major objective of this study is to develop a multicriteria decision approach to budgetary analysis of Taraba State budget. The models and the method of data analysis will be presented in this section.

3.2 DATA COLLECTION

The sources of data for this study includes both primary and secondary data. Primary data used for this study was collected from a structured questionnaire which solicit stakeholders' preference on the goals or priorities government sets for itself and presents to the House of Assembly for approval (i.e. the annual budget presentation). The stakeholders in this case includes government officials (especially those in the budget departments of various ministries) and general public as the case may be.

The secondary data utilized, includes budget reports presented to Taraba State House of Assembly by the Executive arm passed into law. Specifically the budget document utlized for the purpose of this study included those for the period 2006 – 2010.

3.3 METHOD OF DATA ANALYSIS

This study adopts a Goal programming (GP) model in an attempt to achieve the earlier stated objectives. The model tried to minimize under or over achievement (deviations) of goals Taraba state sets for itself in its annual budget. The GP as originally presented by Charnes and Cooper (1980), is define by the following relationship:

Minimize: $\sum_{i=1}^{m} w_{ik} P_k (d_i^+ + d_i^-)$

Subject to: $\sum_{j=1}^{n} a_{ij} x_j - d^+ + d^- = b_i$ (3.4.1)

where i=1,2,3, …, m, j=1,2,3, …, n.

Olson (1984) also state the general goal programming formulation considering n variables, m constraints and k pre-emptive priority level as follow:

Minimize: $P_1(w_{i1}d_{i1}^{+} + w_{i1}d_{i1}^{-})$

Minimize: $P_2(w_{i2}d_{i2}^{+} + w_{i2}d_{i2}^{-})$

. .
. .
. .

Minimize: $P_k(w_{ik}d_{ik}^{+} + w_{ik}d_{ik}^{-})$

Subject to: $\sum_{j=1}^{n} a_{ij}x_j - d^{+} + d^{-} = b_i$ (3.4.2)

where i =1,2,3, …, m. j =1,2,3, …, n.

and k pre-emptive priorities

w_{ik} = the differential weighting factor for the deviational variables within a single k priority level

P_k = the pre-emptive priority level k such that $P_1 > P_2 > \ldots > P_k$,

Where $P_1, P_2 \ldots P_k$ are the preemptive priority levels such that $P_1 >, P_2 > \ldots P_k$

[*Meaning first goal is more important than the second goal that is more important than the third goal and so on. This ensures the achievement of higher-priority objectives before lower-priority ones. In other words, the P's indicate a simple ordinal ordering of the goals*].

d_i^{-} = the under – achievement

d_i^{+} = the over – achievement

[d_i^{-} d_i^{+} ,..... d_m^{-} d_m^{+} *are the deviational variables within the priority levels* $P_1, P_2, \ldots\ldots P_k$].

b_i = Target or aspired level or total amount of resource available

a_{ij} = technological coefficients associated with decision variables

x_j = decision variables

The main objective of goal programming model is to minimize the deviation from the multiple objectives identified or defined after their weights have been determined and prioritized.

For its simplicity and other advantages highlighted by Sarkis and Surrandaj (2005), the AHP will be used to determine the weights that will be incorporated into the GP Model above.

3.4 AHP ANALYSIS OF STAKEHOLDER'S PREFERENCE

This section focuses on stakeholder's preferences of goals identified from the secondary data collected using AHP analysis. Design of nominal scale in questionnaire was to undertake pair-wise comparison in each hierarchy factors. It is also to set up comparison matrix and calculate eigenvalue and eigenvector through consistency test. Thereafter, weights of each factor will be evaluated. Consequently, weighting procedure will lead to priority sequence of overall object. The proceeding steps of AHP are as follows (see figure 3.1 also for detail):

(1) Question design: set-up for individual stakeholders preferences as consulted from literature review to establish a hierarchy process.

(2) Content of questionnaire: Factor out in each layer from (1) above hierarchy that will engage in pair-wise comparison and its significance will be weighted from 1 to 9.

(3) To set up pair-wise comparison matrix: each case will have pair-wise comparison by undertaking evaluating scale. It is to form a pair-wise comparison matrix A, w_i is the weight of case i, and w_j is the weight of case j, a_{ij} is $w_i \,|w_j$, $a_{ij} = {}^1/a_{ji}$ or $a_{ji} = {}^1/a_{ij}$ (where $i \neq j$), and where $i = j$, $a_{ij} = 1$.

$i = 1,2\ldots n$ $j = 1,2\ldots n$

Table 3.1: Showing pair-wise comparison of each alternative objectives

	w_j		w_1	w_2	w_3	…	w_n
w_i	a_{ij}		a_{i1}	a_{i2}	a_{i3}	…	a_{in}
w_1	a_{1j}		a_{11}	a_{12}	a_{13}	…	a_{1n}
w_2	a_{2j}		a_{21}	a_{22}	a_{23}	…	a_{2n}
…	…		…	…	…	…	…
w_n	a_{nj}		a_{n1}	a_{n2}	a_{n3}	…	a_{nn}

Source: Chuang, 2007

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{pmatrix}$$

But $a_{ji} = {}^{1}/a_{ij}$,

Therefore, pair-wise comparison matrix becomes

$$A = \begin{pmatrix} 1 & a_{12} & \dots & a_{1n} \\ 1/a_{12} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ 1/a_{1n} & 1/a_{2n} & \dots & 1 \end{pmatrix}$$

(4) Test consistency : Consistence Ratio (CR) and its calculation method is given by the following relationships (Taha, 2005) ,

$$CR = \frac{CI}{RI}, \qquad (3.5.1)$$

Where, $CI = \frac{\lambda max - n}{n-1}$ $RI = \frac{1.98(n-2)}{n}$

Furthermore,

CI denotes Consistency Index,

RI denotes Random Consistency Index, and λmax is explained below.

We normalize matrix A above by summing each column and divide each of the column by their respective total i.e.

$$A = \begin{pmatrix} 1 & a_{12} & \dots & a_{1n} \\ 1/a_{12} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ 1/a_{1n} & 1/a_{2n} & \dots & 1 \end{pmatrix}$$

$$\sum_{i=1}^{m} a_{i1} \quad \sum_{i=1}^{m} a_{i2} \dots,\dots \sum_{i=1}^{m} a_{in} \quad \text{(Column total)}$$

Dividing each element by its column total we have

$$W = \begin{pmatrix} a_{11}/\sum a_{i1} & a_{12}/\sum a_{i2} & \dots & a_{1n}/\sum a_{in} \\ a_{21}/\sum a_{i1} & a_{22}/\sum a_{i2} & \dots & a_{2n}/\sum a_{in} \\ \dots & \dots & \dots & \dots \\ a_{n1}/\sum a_{i1} & a_{n2}/\sum a_{i2} & \dots & a_{nn}/\sum a_{in} \end{pmatrix}$$

Or

$$W = \begin{pmatrix} 1/\sum a_{i1} & a_{12}/\sum a_{i2} & \dots & a_{1n}/\sum a_{in} \\ a_{21}/\sum a_{i1} & 1/\sum a_{i2} & \dots & a_{2n}/\sum a_{in} \\ \dots & \dots & \dots & \dots \\ a_{n1}/\sum a_{i1} & a_{n2}/\sum a_{i2} & \dots & 1/\sum a_{in} \end{pmatrix}$$

Summing each row to get

$$W = \begin{pmatrix} a_{11}/\sum a_{i1} & a_{12}/\sum a_{i2} & \dots & a_{1n}/\sum a_{in} \\ a_{21}/\sum a_{i1} & a_{22}/\sum a_{i2} & \dots & a_{2n}/\sum a_{in} \\ \dots & \dots & \dots & \dots \\ a_{i1}/\sum a_{i1} & a_{i2}/\sum a_{i2} & \dots & a_{nn}/\sum a_{in} \end{pmatrix} = \begin{pmatrix} W_{1j} \\ W_{2j} \\ \dots \\ W_{nj} \end{pmatrix}$$

Where W denotes row totals,

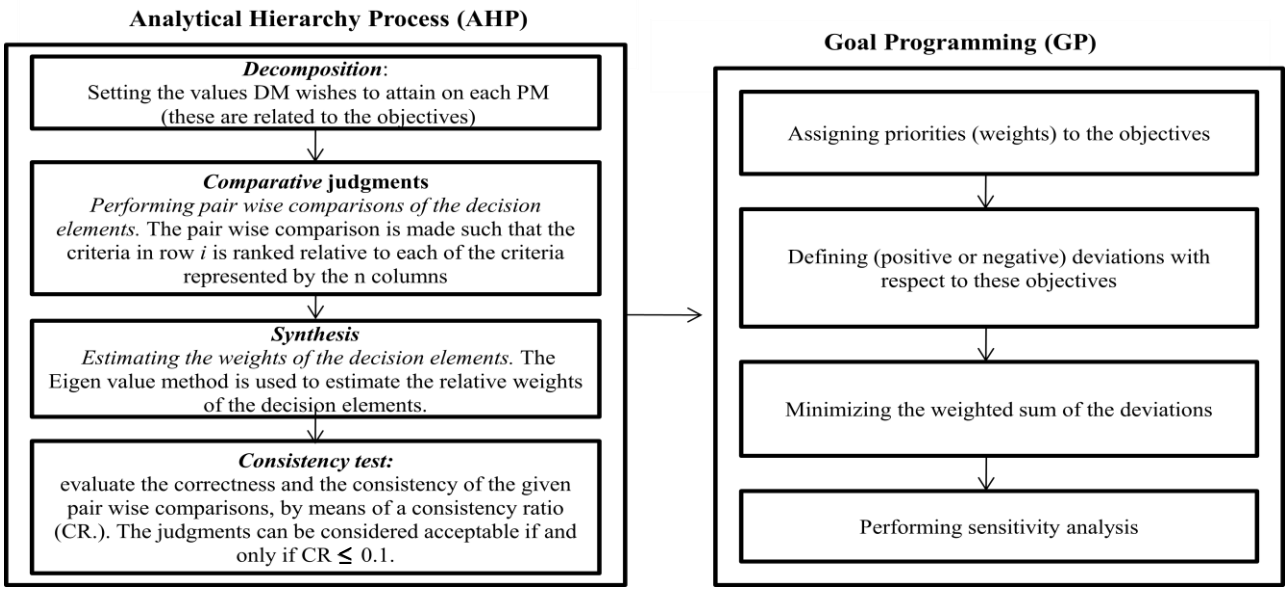
$\lambda max = W_{1j} + W_{2j} + .. + W_{nj}$

n = number of evaluating factor, and
λmax = greatest eigenvalue of the matrix.

Saaty (1980) suggested that the consistency ratio is acceptable when CR≤0.1. If CR=0, it represents consistency of respondent of questionnaire. On the contrary, we have less consistency when CR >0.1.

(5) Calculation of whole hierarchy weight: if consistency of whole hierarchy reaches acceptable level (i.e. CR≤ 0.1), last step of analytical hierarchy process is to integrate relative weights of factors in each stage to obtain the priority vector in whole hierarchy. Then the vectors and its responding case will correspond to relative priority sequence of policy object (Taha, 2005).

Figure 3.1: General steps of AHP and GP



CHAPTER FOUR

DATA ANALYSIS

4.1 INTRODUCTION

The first part of this chapter presents a brief analysis of the data collected from the budget department of Taraba State Ministry of Finance. The second part deals with the analysis of data collected through administration of questionnaire in various ministries/sectors of Taraba State Government Establishments (offices). The latter part of this section combines the results from analysis of data obtained through administration of questionnaire with the analyzed data from budget department to present a Goal Programming analysis of Taraba State Budget.

4.2 SOURCE OF DATA

The primary source of data for this research is gotten from administration of questionnaire. The questionnaire is structured in such a way that will enable it capture the data outlined in the secondary data for use in AHP analysis. The secondary data collected from Budget and Planning Department of Taraba State Ministry of Finance, basically comprises 19 sub-sectors.

Taraba State budget as approved by the State House of Assembly from 2006 -2010 (shown in table 4.1) is subdivided into four major sectors namely: Economic, Social Services, Regional Development and lastly General administration. These four sectors combine, sums up to 19 sub-sectors.

Table 4.1: Showing Taraba state Budget allocation for the year 2006 - 2010

S/no	ECONOMIC SECTOR	2006	2007	2008	2009	2010
1	Agriculture	1,306,307,140.00	1,820,000,000.00	766,000,000.00	800,000,000.00	1,255,000,000.00
2	Livestock	80,000,000.00	300,000,000.00	75,000,000.00	36,000,000.00	90,000,000.00
3	Forestry	25,000,000.00	50,000,000.00	140,000,000.00	30,000,000.00	100,000,000.00
4	Fishery	15,000,000.00	30,000,000.00	20,000,000.00	5,000,000.00	5,000,000.00
5	Industry	1,250,000,000.00	700,000,000.00	260,000,000.00	100,000,000.00	665,000,000.00
6	Energy	100,000,000.00	300,000,000.00	175,000,000.00	600,000,000.00	962,000,000.00
7	Poverty Alleviation	50,000,000.00	650,000,000.00	550,000,000.00	1,000,000,000.00	550,000,000.00
8	Transport	3,450,000,000.00	2,800,000,000.00	5,289,504,485.00	7,217,292,000.00	13,843,000,000.00
	Sub-total	**6,276,307,140.00**	**6,650,000,000.00**	**7,275,504,485.00**	**9,788,292,000.00**	**17,470,000,000.00**
	SOCIAL SERVICES					
9	Education	2,131,940,285.00	2,332,768,725.00	4,230,000,000.00	5,000,000,000.00	6,747,864,864.00
10	Health	766,000,000.00	2,050,000,000.00	1,666,196,054.00	3,000,000,000.00	2,523,900,000.00
11	Information	250,000,000.00	854,999,145.00	375,000,000.00	200,000,000.00	605,000,000.00
12	Social Development	1,740,000,000.00	690,000,000.00	1,580,000,000.00	350,000,000.00	2,527,795,066.00
	Sub-total	**4,887,940,285.00**	**5,927,767,870.00**	**7,851,196,054.00**	**8,550,000,000.00**	**12,404,559,930.00**
	REGIONAL DEVELOPMENT					
13	Town & Country plann.	560,000,000.00	770,000,000.00	1,610,000,000.00	460,000,000.00	679,000,000.00
14	Water	400,000,000.00	1,260,000,000.00	968,000,000.00	500,000,000.00	815,000,000.00
15	Sewage & Drainages	10t	100,000,000.00	100,000,000.00	90,000,000.00	320,000,000.00
16	Housing	2,160,000,000.00	700,000,000.00	3,000,000,000.00	300,000,000.00	350,000,000.00
	Sub-total	**3,120,000,000.00**	**2,830,000,000.00**	**5,678,000,000.00**	**1,350,000,000.00**	**2,164,000,000.00**
	GENERAL ADMINISTRATION					
17	General Admin	1,246,861,320.00	3,129,947,855.00	1,620,872,359.00	3,101,915,025.00	6,854,801,333.00
18	Legislature	250,000,000.00	800,000,000.00	300,000,000.00	1,000,000,000.00	500,000,000.00
19	Judiciary	150,000,000.00	500,000,000.00	460,000,000.00	297,000,000.00	200,000,000.00
	Sub-total	**1,646,861,320.00**	**4,429,947,855.00**	**2,380,872,359.00**	**4,398,915,025.00**	**7,554,801,333.00**

Source: Taraba State Ministry of Finance, 2010

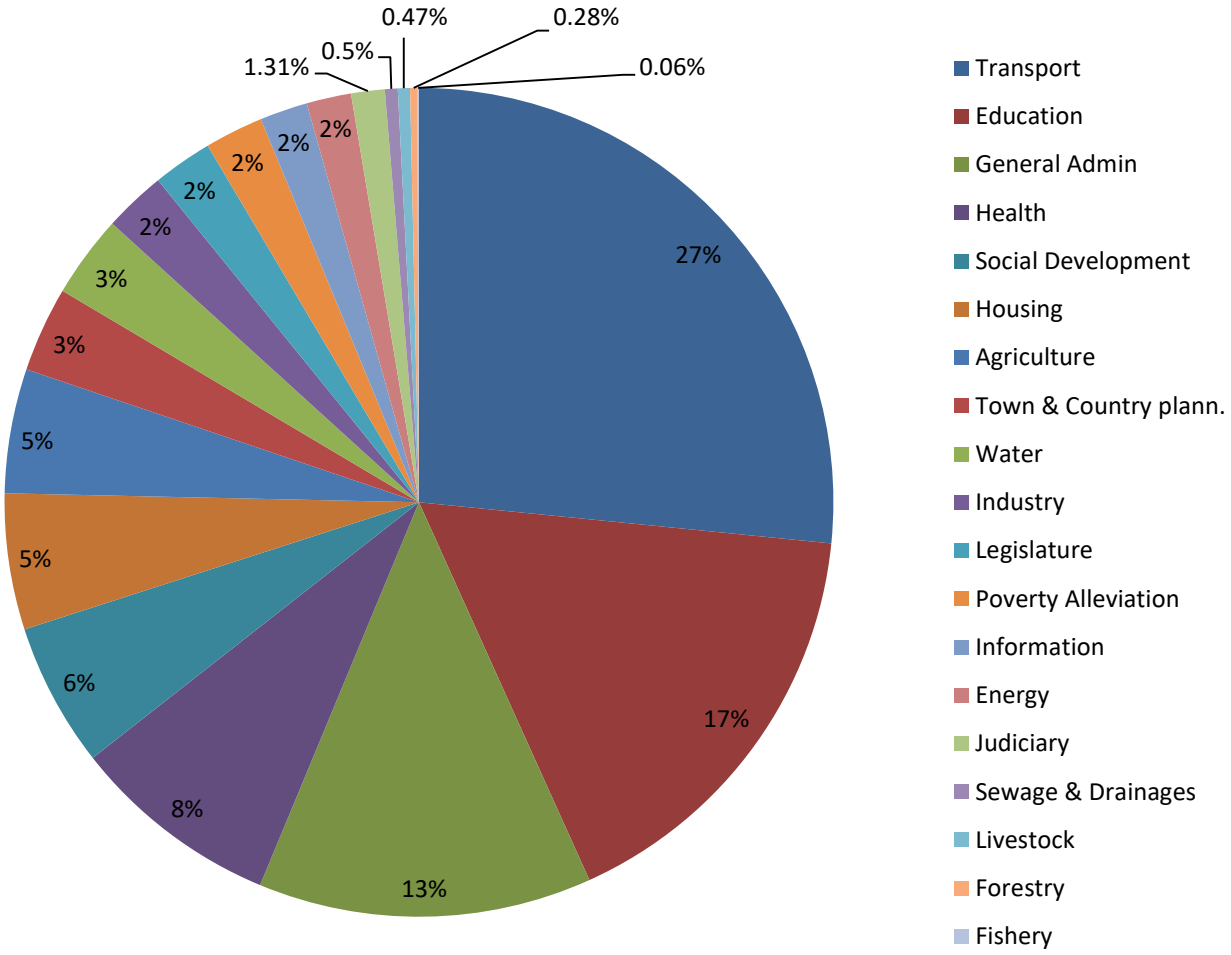
Observation:

As clearly shown in tables 4.1 and 4.2 and also demonstrated in figures 4.1, 4.2 and 4.3, Transport sub-sectors has the lion share of budget allocation from 2006 – 2010 with about 27% share, followed by Education with about 17%, General Administration 13% and so on. The least in terms of budget allocation are Livestock, forestry and Fishery with less than 1% allocation.

Table 4.2: Showing the Sum Total of Taraba State budget allocation for 2006 – 2010

S/no	SECTORS	2006-2010 Total	Percentage (%)	2006-2010 Average	Percentage(%)
1	Transport	32,599,796,485.00	26.58	6,519,959,297.00	26.55
2	Education	20,442,573,874.00	16.67	4,088,514,774.80	16.65
3	**General Admin**	**15,954,397,892.00**	13.01	**3,190,879,578.40**	12.99
4	Health	10,006,096,054.00	8.16	2,001,219,210.80	8.15
5	Social Development	6,887,795,066.00	5.62	1,377,559,013.20	5.61
6	Housing	6,510,000,000.00	5.31	1,302,000,000.00	5.30
7	Agriculture	5,947,307,140.00	4.85	1,189,461,428.00	4.84
8	Town & Country plann.	4,079,000,000.00	3.33	815,800,000.00	3.32
9	Water	3,943,000,000.00	3.22	788,600,000.00	3.21
10	Industry	2,975,000,000.00	2.43	595,000,000.00	2.42
11	Legislature	2,850,000,000.00	2.32	570,000,000.00	2.32
12	Poverty Alleviation	2,800,000,000.00	2.28	560,000,000.00	2.28
13	Information	2,284,999,145.00	1.86	456,999,829.00	1.86
14	Energy	2,137,000,000.00	1.74	427,400,000.00	1.74
15	Judiciary	1,607,000,000.00	1.31	321,400,000.00	1.31
16	Sewage & Drainages	610,000,000.00	0.50	152,500,000.00	0.62
17	Livestock	581,000,000.00	0.47	116,200,000.00	0.47
18	**Forestry**	**345,000,000.00**	0.28	**69,000,000.00**	0.28
19	Fishery	75,000,000.00	0.06	15,000,000.00	0.06
		122,634,965,656.00	100.00	**24,557,493,131.20**	100.00

Chart 4.1: Showing a Pie Chart of Total Budget Allocation for 2006-2010 (as in table 4.2 above)



4.3 THE QUESTIONNAIRE

The nineteen sectors (sub-sectors) identified in the secondary data formed the basis of our questionnaire design for this study. The questionnaire has two sections namely: personal information and comparison tables (or matrix). The questionnaire has four comparison matrix, the first with eight decision alternatives, second and third with four decision alternatives each and the last with three decision alternatives. See appendix i.

Chart 4.2 : Showing a Pie Chart of Average Budget Allocation for 2006-2010 in each Sector (as in table 4.2 above)

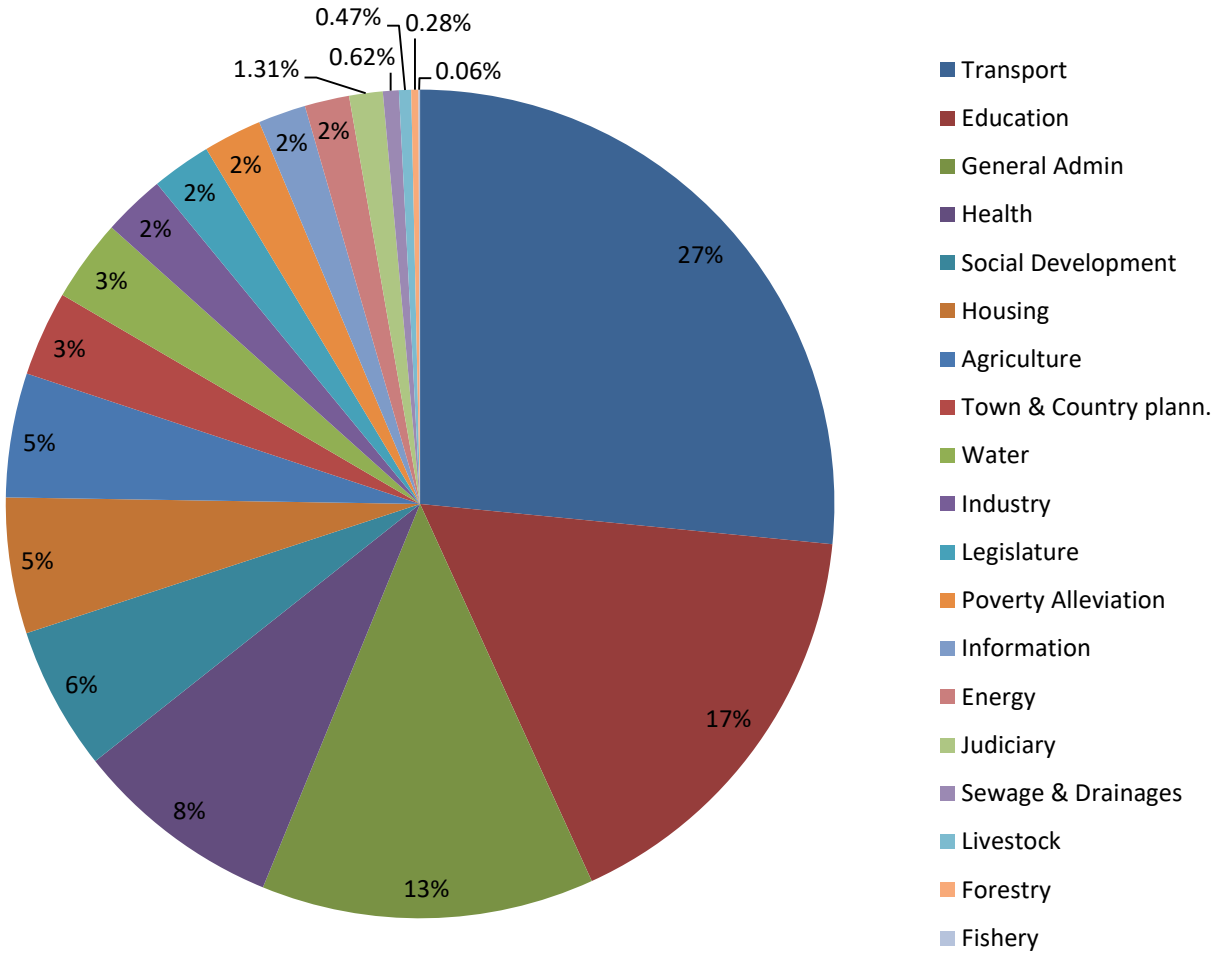
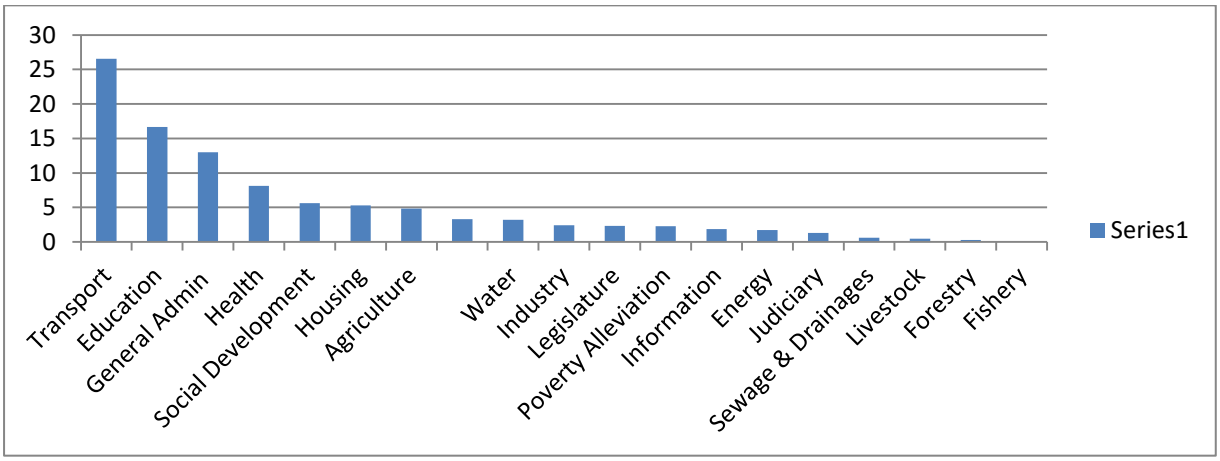


Chart 4.3: Showing a Bar Chart of Average Budget Allocation for 2006-2010 (as in table 4.2 above)



4.4 THE DESIGN

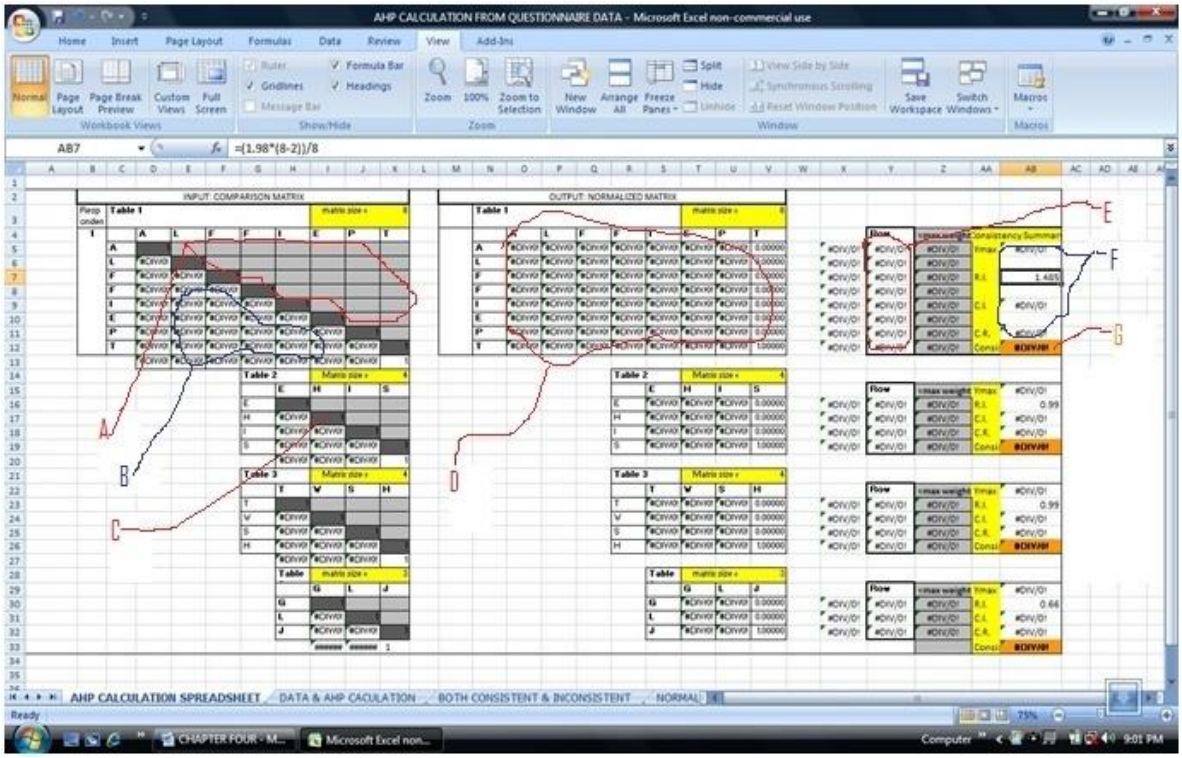
The questionnaire is design in tabular form with one decision alternative on the left hand side (LHS) comparing with the rest of the decision alternative on the right hand side (RHS). After the first LHS decision alternative has been completely compared with all the decision alternatives on the RHS it deleted from the table. The next decision alternative on the RHS (the one on top of the column) is now moved to the LHS and compared with the rest in the RHS. This is repeated until the decision alternative on the RHS is reduced to one. This procedure is applied to the four comparison matrix.

4.5 DATA ANALYSIS

This study adopts two well known Multicriteria decision tools – Analytical Hierarchy Process AHP and Goal programming GP.

To carry out the AHP analysis for this study an Excel Solver Programme (Procedure) is design to help capture the data easily and automatically calculate all the parameters needed. The designed solver helps in automatically inverting the entries gotten directly from the questionnaire, it normalizes the matrix, calculates the weights. Other parameters that are automatically obtained from these procedure are λmax value, Consistency Index (CI), Random Consistency Index (RI), Consistency Ratio and it also tells us whether the matrix is consistent or not by displaying 'CONSISTENT' or 'INCONSISTENT' depending on whether CR satisfy the condition of CR < 0.1. The solver looks like the figure 4.4 below

Figure 4.4: Showing the AHP designed and used for this study



The data from questionnaire are entered into section label ‘A” (in light-ash colour) directly in figure 4.4 above. Section label ‘B’ output directly the inverse of section label ‘A’. Section label ‘C’ (dark-ash colour) is left untouched since it contains the value one (1) – meaning a decision alternative is comparing against itself. On entering of data into section label ‘A’, the section label ‘D’ outputs the normalize matrix, section label ‘E’ gives the weights of the alternatives, ‘F” gives the output of λ_{max} , CI, RI and CR. The Last section label ‘G’ displays ‘CONSISTENT’ or ‘INCONSISTENT’ depending on the condition CR<0.1.

About 100 questionnaires were administered to various offices/ministries in Taraba state. 75 answered questionnaires were returned out of this 60 were correctly entered and 15 were invalid. The summarized result of AHP analysis carried out on these 60 questionnaires using the Excel program developed for this study is shown in table 4.5 below. Detailed result of the analysis is presented in Appendix v.

4.6 RESULTS OF AHP ANALYSIS

Table 4.5: showing the result of weights derived from AHP

(a) (b) (c) (d)

SUB-SECTORS	CONSISTENT WEIGHT	
	MEAN	MEDIAN
Agriculture	0.23042	0.23355
Livestock	0.16577	0.1723
Forestry	0.13946	0.13165
Fishery	0.10056	0.09711
Industry	$0.10	0.10501
Energy	0.07506	0.07301
Poverty A.	0.08951	0.09112
Transport.	0.09426	0.078
Education	0.30698	0.34876
Health	0.31375	0.28576
Information	0.2638	0.16115
Social devt.	0.11548	0.11814
Town plann.	0.2188	0.14235
Water	0.4244	0.37559
Sewage/drain.	0.1129	0.06339
Hounsing	0.24389	0.14806
Gen. admin.	0.36741	0.30412
Legislature	0.26631	0.10823
Judiciary	0.36629	0.30983

	NORMALIZED CONSISTENT WEIGHT	
	MEAN	MEDIAN
Agriculture	0.05761	0.06978
Livestock	0.04144	0.05148
Forestry	0.03487	0.03933
Fishery	0.02514	0.02901
Industry	0.02624	0.03137
Energy	0.01876	0.02181
Poverty A.	0.02238	0.02722
Transport.	0.02356	0.0233
Education	0.07675	0.1042
Health	0.07844	0.08537
Information	0.06595	0.04814
Social devt.	0.02887	0.03529
Town plann.	0.0547	0.04253
Water	0.1061	0.11221
Sewage/drain.	0.02823	0.01894
Hounsing	0.06097	0.04424
Gen. admin.	0.09185	0.09086
Legislature	0.06658	0.03233
Judiciary	0.09157	0.09257

RANKED MEAN WEIGHT	
	MEAN
Water	0.1061
Gen. admin.	0.09185
Judiciary	0.09157
Health	0.07844
Education	0.07675
Legislature	0.06658
Information	0.06595
Hounsing	0.06097
Agriculture	0.05761
Town plann.	0.0547
Livestock	0.04144
Forestry	0.03487
Social devt.	0.02887
Sewage/drain.	0.02823
Industry	0.02624
Fishery	0.02514
Transport.	0.02356
Poverty A.	0.02238
Energy	0.01876

RANKED MEDIAN WEIGHT	
	MEDIAN
Water	0.11221
Education	0.1042
Judiciary	0.09257
Gen. admin.	0.09086
Health	0.08537
Agriculture	0.06978
Livestock	0.05148
Information	0.04814
Hounsing	0.04424
Town plann.	0.04253
Forestry	0.03933
Social devt.	0.03529
Legislature	0.03233
Industry	0.03137
Fishery	0.02901
Poverty A.	0.02722
Transport.	0.0233
Energy	0.02181
Sewage/drain.	0.01894

Table 4.5 (a) shows the weight derived from the AHP analysis of data collected from questionnaire. Table 4.5(b) above shows the normalized weight of table 4.5(a). The two tables (i.e. 4.5a & 4.5b) are the mean & median weights of the consistent comparison matrices. Tables 4.5c & 4.5d are the ranked normalized mean and median weights respectively.

For the purpose of this study, the mean normalized weight derived above (in table 4.5c) was used in the next stage of our analysis or goal programming analysis.

4.7 GOAL PROGRAMMING ANALYSIS

Introducing the weights above into the goal programming model defined in equations (3.4.1) or (3.4.2) we have the following:

Min Z: $P_1\{0.1061(d_1^+ + d_1^-) + 0.09185(d_2^+ + d_2^-) + 0.09157(d_3^+ + d_3^-)\} + P_2\{0.07844(d_4^+ + d_4^-) + 0.07675(d_5^+ + d_5^-) + 0.06658(d_6^+ + d_6^-)\} + P_3\{0.0659(d_7^+ + d_7^-) + 0.06097(d_8^+ + d_8^-) + 0.05761(d_9^+ + d_9^-)\} + P_4\{0.0547(d_{10}^+ + d_{10}^-) + 0.04144(d_{11}^+ + d_{11}^-) + 0.03487(d_{12}^+ + d_{12}^-) + 0.02887(d_{13}^+ + d_{13}^-)\} + P_5\{0.02823(d_{14}^+ + d_{14}^-) + 0.02624(d_{15}^+ + d_{15}^-) + 0.02514(d_{16}^+ + d_{16}^-) + 0.02356(d_{17}^+ + d_{17}^-) + 0.02238(d_{18}^+ + d_{18}^-) + 0.01876(d_{19}^+ + d_{19}^-)\}$ (4.7)

Subject to:

$a_1x_1 - d_1^+ + d_1^- = 3.21$

$a_2x_2 - d_2^+ + d_2^- = 12.99$

$a_3x_3 - d_3^+ + d_3^- = 1.31$

$a_4x_4 - d_4^+ + d_4^- = 8.15$

$a_5x_5 - d_5^+ + d_5^- = 16.65$

$a_6x_6 - d_6^+ + d_6^- = 2.32$

$a_7x_7 - d_7^+ + d_7^- = 1.86$

$a_8x_8 - d_8^+ + d_8^- = 5.3$

$a_9x_9 - d_9^+ + d_9^- = 4.84$

$a_{10}x_{10} - d_{10}^+ + d_{10}^- = 3.32$

$a_{11}x_{11} - d_{11}^+ + d_{11}^- = 0.47$

$a_{12}x_{12} - d_{12}^+ + d_{12}^- = 0.28$

$a_{13}x_{13} - d_{13}^+ + d_{13}^- = 5.61$

$a_{14}x_{14} - d_{14}^+ + d_{14}^- = 0.62$

$a_{15}x_{15} - d_{15}^+ + d_{15}^- = 2.42$

$a_{16}x_{16} - d_{16}^+ + d_{16}^- = 0.06$

$a_{17}x_{17} - d_{17}^+ + d_{17}^- = 26.55$

$a_{18}x_{18} - d_{18}^+ + d_{18}^- = 2.28$

$a_{19}x_{19} - d_{19}^+ + d_{19}^- = 1.74$

$x, d^+, d^- > 0$ and P_k where k=1, 2,…5

where $w_{ik} = w_1 \ldots w_{19}$ (weights of Water, Gen. admin., Judiciary, Health, Education, Legislature, Information, Housing, Agriculture, Town planning, Livestock, Forestry, Forestry, Social development, Sewage/drainage, Industry, Fishery, Transport, Poverty Alleviation and Energy respectively)

Table 4.6: summary of data for goal programming analysis

ACTUAL BUDGET ALLOCATION (AND THE PERCENTAGE)						RANKED MEAN WEIGHT	
S/no	**SECTORS**	**2006-2010 Total**	**Percentage (%)**	**2006-2010 Average**	**Percentage(%)**	**SECTORS**	**MEAN**
1	Water	3,943,000,000.00	3.22	788,600,000.00	3.21	**Water**	0.1061
2	**General Admin**	**15,954,397,892.00**	13.01	**3,190,879,578.40**	12.99	**Gen. admin.**	0.0919
3	Judiciary	1,607,000,000.00	1.31	321,400,000.00	1.31	**Judiciary**	0.0916
4	Health	10,006,096,054.00	8.16	2,001,219,210.80	8.15	**Health**	0.0784
5	Education	20,442,573,874.00	16.67	4,088,514,774.80	16.65	**Education**	0.0768
6	Legislature	2,850,000,000.00	2.32	570,000,000.00	2.32	**Legislature**	0.0666
7	Information	2,284,999,145.00	1.86	456,999,829.00	1.86	**Information**	0.0660
8	Housing	6,510,000,000.00	5.31	1,302,000,000.00	5.3	**Hounsing**	0.0610
9	Agriculture	5,947,307,140.00	4.85	1,189,461,428.00	4.84	**Agriculture**	0.0576
10	Town & Country plann.	4,079,000,000.00	3.33	815,800,000.00	3.32	**Town plann.**	0.0547
11	Livestock	581,000,000.00	0.47	116,200,000.00	0.47	**Livestock**	0.0414
12	**Forestry**	**345,000,000.00**	0.28	**69,000,000.00**	0.28	**Forestry**	0.0349
13	Social Development	6,887,795,066.00	5.62	1,377,559,013.20	5.61	**Social devt.**	0.0289
14	Sewage & Drainages	610,000,000.00	0.5	152,500,000.00	0.62	**Sewage/drain.**	0.0282
15	Industry	2,975,000,000.00	2.43	595,000,000.00	2.42	**Industry**	0.0262
16	Fishery	75,000,000.00	0.06	15,000,000.00	0.06	**Fishery**	0.0251
17	Transport	32,599,796,485.00	26.58	6,519,959,297.00	26.55	**Transport.**	0.0236
18	Poverty Alleviation	2,800,000,000.00	2.28	560,000,000.00	2.28	**Poverty A.**	0.0224
19	Energy	2,137,000,000.00	1.74	427,400,000.00	1.74	**Energy**	0.0188
		122,634,965,656.00	100	**24,557,493,131.20**	100		1.0000

To carry the GP analysis we used data from AHP analysis in table 4.5 and percentages of original allocation presented in table 4.2. The two tables are summarized in table 4.6 below

4.8 RESULTS OF THE GP ANALYSIS

A GP analysis using TORA software (windows version 1.00) was carried out. The result showed the following (abstracted from Appendix vi and summarized in table 4.7):

$X_1=X_2= \ldots = X_{19}=0$ $d_1=0.35$, $d_2=1.17$, $d_3=0.12$, $d_4=0.65$, $d_5=1.33$, $d_6=0.16$, $d_7=0.13$, $d_8=0.32$, $d_9=0.29$, $d_{10}=0.17$, $d_{11}=0.02$, $d_{12}=0.01$, $d_{13}=0.17$, $d_{14}=0.02$, $d_{15}=0.07$, $d_{16}=0.00$, $d_{17}=0.53$, $d_{18}=0.05$, $d_{19}=0.03$

The above result can be improved upon since only one variable d_{16} is fully achieved. With sensitivity analysis the values of x_j will surely change and most d_i can be driven to or towards zero.

4.9 INTERPRETATION AHP AND GP RESULTS

To set priorities among the 19 sub-sectors the AHP was used. The final results of the eigenvalue (also in table 4.5c) in the AHP analysis are (w_1,w_2, …, w_{19}) = (0.1061, 0.0919,..., 0.0188). This result is interpreted as follows: the most high weight criterion in the budget allocation is w_1 (water sector). The next is w_2 (general administration) and so on. These imply that the stakeholders in this study prefer that government allocate more resources to water sub-sector followed by general administration … and lastly to energy sub-sector. These weights are used as priorities in goal programming formulation.

Using table 4.6 to formulate the goal programming in equation (3.4.2) with five (5) pre-emptive level, the final result obtained is shown in appendix vi (and also summarized in section 4.8 and table 4.7). This GP model was solved with TORA (windows version 1.00) using modified simplex in Taha (2005). Olson (1984) stressed that a major limitation in the use of GP has been the lack of an efficient algorithm for model solution.

The values of X_j (j=1,2,…,19) = 0 could best be explained by Olson's reason above and also not forgetting the fact that GP doesn't necessarily have to obey optimization principles due to its unique 'satificing' feature. We therefore suggest here that further study on developing efficient algorithm to satisfy both optimization and 'satisficing' principles be looked in to. We can however, make inferences to the values of d^+ and d^- obtained in this study. The results of deviations shown in section 4.8 shows that d_5 (education) has the highest deviation (1.33) from goal, followed by d_2 (general administration) with 1.17, then d_4, d_{17} and so on. These tell which sector lies the greatest disagreement between government and stakeholders and the need to reach a compromise – a vital information for future budget planning.

4.10 DISCUSSION

The Excel program developed for this study, was tested with standard results obtained from examples in textbook such as Introduction to Operation Research by Taha (2005),

Hillier & Lieberman (2001) and also web solvers such as ***CGI AHP Calculation Software*** found in the: www.isc.senshu-u.ac.jp~thc0456/eahp/ahpweb.html

The solution obtained in solving equation (3.4.2) with TORA showed that most of the deviations are not fully achieved meaning the goals set by government mostly varied from that preferred by stakeholders. The problem is solved pre-emptively using the row elimination method outlined in Taha (2005). The pre-emptive goal programming model essentially decomposed the problem into series of linear programming problem and the hierarchical structure ensures that the most important goal's values are not degraded by those at the lower end of the hierarchy.

TABLE 4.7: Summary of Data for Budget Allocation, AHP analysis and Goal Programming Analysis

Budget allocation				Result of AHP Analysis			Result of GP Analysis				
JRE	SECTORS	2006-2010 Average	Percentage (%)	S/no	RANKED MEAN WEIGHT		S/no	Sector		deviations	Ranked Deviations
1	Transport	6,519,959,297.00	26.55	1	Water	0.1061	1	Education	d5	1.33	23.792487
2	Education	4,088,514,774.80	16.65	2	Gen. admin.	0.09185	2	Gen. admin.	d2	1.17	20.930233
3	General Admin	3,190,879,578.40	12.99	3	Judiciary	0.09157	3	Health	d4	0.65	11.627907
4	Health	2,001,219,210.80	8.15	4	Health	0.07844	4	Transport.	d17	0.53	9.4812165
5	Social Development	1,377,559,013.20	5.61	5	Education	0.07675	5	Water	d1	0.35	6.2611807
6	Housing	1,302,000,000.00	5.3	6	Legislature	0.06658	6	Hounsing	d8	0.32	5.7245081
7	Agriculture	1,189,461,428.00	4.84	7	Information	0.06595	7	Agriculture	d9	0.29	5.1878354
8	Town & Country plann.	815,800,000.00	3.32	8	Hounsing	0.06097	8	Town plann.	d10	0.17	3.0411449
9	Water	788,600,000.00	3.21	9	Agriculture	0.05761	9	Social devt.	d13	0.17	3.0411449
10	Industry	595,000,000.00	2.42	10	Town plann.	0.0547	10	Legislature	d6	0.16	2.862254
11	Legislature	570,000,000.00	2.32	11	Livestock	0.04144	11	Information	d7	0.13	2.3255814
12	Poverty Alleviation	560,000,000.00	2.28	12	Forestry	0.03487	12	Judiciary	d3	0.12	2.1466905
13	Information	456,999,829.00	1.86	13	Social devt.	0.02887	13	Industry	d15	0.07	1.2522361
14	Energy	427,400,000.00	1.74	14	Sewage/drain.	0.02823	14	Poverty A.	d18	0.05	0.8944544
15	Judiciary	321,400,000.00	1.31	15	Industry	0.02624	15	Energy	d19	0.03	0.5366726
16	Sewage & Drainages	152,500,000.00	0.62	16	Fishery	0.02514	16	Livestock	d11	0.02	0.3577818
17	Livestock	116,200,000.00	0.47	17	Transport.	0.02356	17	Sewage/drain.	d14	0.02	0.3577818
18	Forestry	69,000,000.00	0.28	18	Poverty A.	0.02238	18	Forestry	d12	0.01	0.1788909
19	Fishery	15,000,000.00	0.06	19	Energy	0.01876	19	Fishery	d16	0	0

CHAPTER FIVE

SUMMARY, RECOMMENDATION AND CONCLUSION

5.1 SUMMARY

The major objective of this study is to assess the Taraba State budget, analyze it and then integrate Multicriteria Decision Analysis (MCDA) techniques into the budget allocation process as well as pinpoint the key problem areas that require attention and improvement.

To achieve the objective above budget was defined in chapter one as the tool government uses to achieve its economic and development goals because it enables it to balance a wide range of legitimate demands with limited resources at its disposal. It sets out what it is going to spend (expenditure) and the income it collects through taxes (revenue), which it needs to finance expenditure. Due to its relevance to governance, throughout the world, the process for determining how to raise, allocate, and spend public resources now than ever constitute the foundations of government. In the problem statement section of the same chapter, the problems of fiscal policy in Nigeria which includes inefficiency in resource use, waste and misplaced priorities in government expenditure… led to a high debt burden, huge recurrent expenditure burdens at all tiers of government, inefficient public delivery of services and distortion in the incentive structure for both the private and public sectors. This needs scientific intervention as oppose to traditional methods (budgeting only based on previous year's allocation – incremental budgeting).

The literature review carried out in chapter two was able to capture, detailed definition of budget and budget allocation, purposes of budgeting, types of budget and reforms, budget analysis etc. Also discussed is Multicriteria decision analysis (including both Analytical Hierarchy Process and Goal Programming procedures), the combination of AHP and GP prominently featured also, as this constitute the major thrust of this study.

Chapter three (or methodology section), outlined the types of data that were collected and how they were collected in other to provide reliable results when used with the MCDA tools adapted for this study.

Data collected using the methodology outlined in the preceding chapter enabled the researcher to apply the MCDA analysis in the analysis section (i.e chapter four). The secondary data collected from the budget department form the basis for the structured questionnaire that was used for this study. The weights derived from AHP analysis (using the

Excel-solver formulated by the researcher for this study) were used in the GP analysis as the weights of the deviations in the objective function of the GP. TORA software was used to solve the GP using the modified simplex method suggested by Taha (2005) to arrive at the results obtained.

Chapter five gives the recap of the entire study in the following sub-headings: summary, recommendations and conclusion. It recommends that MCDA should be adopted (even if not to the entire state – some sectors/subsectors) in Taraba State budget planning for efficient resource allocation. Due to its advantages, it is suggested that further studies in the additional areas such uncertainties, manpower allocation, growth etc, be carried out.

5.2 RECOMMENDATION

The results of this study have shown that MCDA can be successfully applied or used in the process of budget allocation in Taraba State budget as is the case with other fields it's been applied to. This study therefore makes the following recommendations:

1. Government should incorporate corporate (stakeholder's) preference or view into budget decision making process. The integrated AHP-GP process proposed by this study incorporates the quantitative and qualitative aspects of the decision making problem and provides a measure for determining the consistency of the decision maker. This will avoid inadequate decisions, lack of consistency and failure to consider all relevant criteria.
2. Government should use scientific methods/tools (as suggested by this study) in planning, implementation and monitoring of its budget process. A budget process that is well-integrated with other activities of government, such as the planning and management functions, will provide better financial and program decisions and lead to improved governmental operations. A process that effectively involves all stakeholders – elected officials, governmental administrators, employees and their representatives, citizen groups, and business leaders – and reflects their needs and priorities will serve as a positive force in maintaining good public relations and enhancing citizens' and other stakeholders' overall impression of government (NACSLB, 1998).

Although it is not possible to obtain a guaranteed optimal solution, we demonstrate that a satisfactory solution can be achieved. Other factors (budget performance, deficit/surplus, uncertainties etc) have not been included in the present model due to the non-availability of data, insufficient time and good software to handle complex case. Additional

research to the developed Computerized Multiple Criteria Decision- making Model should be conducted using the current/updated Software available. We therefore, recommend that future research incorporate uncertainties and not be based on a deterministic approach to decision making.

5.3 CONCLUSION

Governments allocate scarce resources to programs and services through the budget process. This is one of the most important activities undertaken by governments. As the focal point for key resource decisions, the budget process is a powerful tool. The quality of decisions resulting from the budget process and the level of their acceptance depends on the characteristics of the budget process that is used.

In this study an integrated approach for establishing an optimal allocation process in budget planning among competing sectors was suggested. The combined AHP-GP model was used in analyzing Taraba state budget. The AHP was used to deal with qualitative aspect of the analysis and the results were integrated with a goal programming model (quantitative aspect) that performed the actual allocations in such a way that deviation levels are driven closer to management goals (minimum deviation). The application of the GP technique combined with AHP methodology proved to be a flexible tool to optimally allocate the resources to the different sectors, a feature that is particularly important in situations where the decision maker can choose between different objectives subject to several constraint conditions.

The application and the use of this decision making approach is straightforward. However, the difficulty lies in the construction of the decision hierarchy which depends mainly on the decision maker's experience.

The solution shows that all except one goals have not been achieved, showing discrepancy in government and stakeholder goal preferences. A similar model can also be applied in a sub-sector or parastatal. This model can assist the administration in their planning of resource/manpower allocations. .

The method here presented can provide a framework to guide future investigations. In particular, in future works other kinds of goals and/or constraints could be potentially considered and added to the original model proposed.

It is hoped that identification of relatively efficient goal programming codes can further the use of multiple objective optimization techniques.

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Appendix i

Department of Statistics and Operations Research

Modibbo Adama University of Technology

P. M. B. 2076

Yola, Adamawa State

Sir/Madam

I am a postgraduate student of the above named institution and I am soliciting your response to this questionnaire to enable me fulfill one of the requirement for the award of masters degree in Operations Research in the Department of Statistics and Operations Research, Modibbo Adama University of Technology, Yola.

I assure you that ***all information given will be used for the purpose of this research only*** and nothing else.

Thanks, in anticipation of your honest opinion and contribution towards the success of this study.

Husseni Bala Habu

Personal information

Name……
……..

Sex: Male ( ) Female ( ) Marital status: Married ( ) Single ( ) Others ( )

Civil Servant ( ) Self employed/Businessman/woman ( ) Applicant ( ) Others ( )

Ministry/Parastatal/Dept……
…….

……
Rank/post…… GL……

INSTRUCTIONS: ***Please You must read this instruction before proceeding.***

This study is titled **Multicriteria Decision Approach to Budgetary Analysis: Taraba State in Perspective**. I intend to seek your honest opinion in regards to Taraba state budget.

You are required to use the nine point scale in tables below to make pair comparison on the left hand side of each table to all sectors indicated on the right hand side of the table.

Example:

Take table 1a comparing Agriculture sector to other sectors as an example.

If you tick under '5' in row comparing Agriculture with Livestock it implies that agriculture is 'strongly more important than Livestock, but if you tick under -5 'Agriculture is strongly less important than Livestock' in other words Livestock is strongly more important than Agriculture.

Comparing Agriculture – Forestry, 9 implies Agriculture is 'extremely more important than Forestry' while -3 implies Agriculture is 'moderately less important than Forestry', in other words Forestry is moderately more important than Agriculture.

Note: you can ***Only Tick One Box In A Row.*** Do not tick both positive and negative box in a row at the same time. **Do not tick the ashe coloured column under '1' please.**

ECONOMIC SECTOR

Table 1a: Comparing Agriculture with other sectors

Importance	More									Less								
Nine point scale	Extreme importance	Very strong - Extreme	Very strong	Strong - Very strong	Strong importance	Moderate - Strong	Moderate importance	Equal - Moderate	Equal	Equal - Moderate	Moderate importance	Moderate - Strong	Strong importance	Strong - Very strong	Very strong	Very strong - Extreme	Extreme importance	
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Agriculture																		Livestock
																		Forestry
																		Fishery
																		Industry
																		Energy
																		Poverty Alleviation
																		Transport

Table 1b: Comparing Livestock with other sectors

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Livestock																		Forestry
																		Fishery
																		Industry
																		Energy
																		Poverty Alleviation
																		Transport

Table 1c: Comparing Forestry with other sectors

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Forestry																		Fishery
																		Industry
																		Energy
																		Poverty Alleviation
																		Transport

Table 1d: Comparing Fishery with other sectors

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Fishery																		Industry
																		Energy
																		Poverty Alleviation
																		Transport

Table 1e: Comparing Industry with other sectors

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Industry																		Energy
																		Poverty

																	Alleviation
																	Transport

Table 1f: Comparing Energy with other sectors

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Energy																		Poverty Alleviation
																		Transport

Table 1g: Comparing Poverty Alleviation with other sectors

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Poverty Alleviation																		Transport

SOCIAL SECTOR

Table 2a: comparing Education with other sector

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Education																		Health
																		Information
																		Social Development

Table 2b: comparing Health with other sector

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Health																		Information
																		Social Development

Table 2c: comparing Information with other sector

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Information																		Social Development

REGIONAL DEVELOPMENT SECTOR

Table 3a: comparing Town & Country Planning with other sector

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Town & Country plann.																		Water
																		Sewage & Drainages
																		Housing

Table 3a: comparing Water to other sector

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Water																		Sewage & Drainages
																		Housing

Table 3a: comparing Sewage & Drainages with other sector

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Sewage & Drainages																		Housing

GENERAL ADMINISTRATION

Table 4a: comparing General Administration with other sectors

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
General Admin																		Legislature
																		Judiciary

Table 4b: comparing Legislature with other sector

Importance	More									Less								
	9	8	7	6	5	4	3	2	1	-2	-3	-4	-5	-6	-7	-8	-9	
Legislature																		Judiciary

THANKS FOR GIVEN US YOUR HONEST OPINION. YOUR OPINION WILL BE USEFUL IN THIS REASERCH ONLY WHEN THE CORRECTLY FILLED QUESTIONAIRE IS RETURNED TO THE RESEARCHER.

THANKS FOR YOUR COOPERATION ONCE MORE.

Appendix ii

Table 3: showing population figure of Taraba state

LGA	BOTH SEXES	MALE	FEMALE
Ardo-kola	87,784	44,533	43,251
Bali	211,024	107,979	103,045
Donga	133,105	67,582	65,523
Gashaka	87,166	45,587	41,579
Gassol	245,086	126,856	118,230
Ibi	84,302	42,654	41,648
Jalingo	140,318	71,997	68,321
Karim-lamido	193,924	98,315	95,609
Kurmi	91,282	46,383	44,899
Lau	95,190	48,582	46,608
Sardauna	224,357	112,060	112,297
Takum	134,576	68,062	66,514
Ussa	90,889	46,558	44,331
Wukari	238,283	124,285	113,998
Yorro	89,865	45,633	44,232
Zing	127,685	64,759	62,926
Disputed Areas	19,964	10,106	9,858
Total	**2,294,800**	**1,171,931**	**1,122,869**

Source: Federal Government of Nigeria official gazette published 2nd February, 2009

Appendix iii

THE STUDY AREA

The effort to articulate a development strategy for Taraba State must first of all start by understanding the history of the state. No one can conveniently chart the course for the future development of any political entity without understanding the elements that define the past and reconcile same with the present before attempting to forecast the future (TSEEDS, 2004).

Creation

Taraba State was created in August 27, 1991, when the Babangida military administration carved it out of the former Gongola State.

The state derives its name from one of the three major rivers, River Taraba and covers a land area of 9,400 square kilometers. At inception the state comprise only nine Local Government Arears (LGA) namely; Jalingo, Zing, Lau, Karim Lamido, Sardauna, Bali, Gashaka, Wukari and Takum.

The State currently has sixteen Local government Areas as a result of the creation of the following local government areas: Ibi, Yorro, and Donga in September 1991 and Ardo-Kola, Kurmi, Ussa and Gassol in 1996.

Politics

The state is politically divided into three senatorial zones namely; The Northern, Central and Southern zones. The Northern Senatorial zone comprises of six local government areas namely; Jalingo, Yorro, Ardo-Kola, Karim Lamido, Lau and Zing. The Central Senatorial zone is made up of the following Local Government Areas: Bali, Gassol, Kurmi, Gashaka and Sardauna. The Southern Senatorial zone is madeup of five Local government Areas namely; Wukari, Takum, Ibi, Donga and Ussa.

Geography

Taraba is bounded in the north by Bauchi State and Gombe State in the North West. The State is further bounded to the west by both Nasarawa and Benue States, while it shares international boundary with the Republic of Cameroon to the South and South East.

The dominant climatic conditions includes rainy and dry seasons typically common to tropical regions to which Taraba State belongs. The rainy season starts in April and ends October, while the dry season begins in November. The dry season reaches its peak in January and February when the dusty North-East trade winds blow across the state.

The vegetation of Taraba state comprises three types of vegetation zones namely; Guinea Savannah which is marked by mainly forest and tall grass and are found in the southern part of the state, like Wukari, Takum, Donga, Ussa; the sub-Sudan type characterized by short grasses are found in Jalingo, Lau, Ardo-Kola, interspersed with short trees; while the semi temperate zone are marked by luxuriant pasture and short trees found in Mambilla plateau.

Demography

According to the 2006 census figure released by the National Population Commision (NPC), Taraba State has a population figure of Two million, Two hundred and Ninety Four Thousand, Eight hundred (**2,294,800**).

The people

There are over 40 ethnic groups in Taraba State. Each ethnic group has its distinct historical heritage, cohabiting peacefully with one another. Some of these tribes include: Mumuye, Ichen, Wurkum, Mambilla, Kuteb, Chamba, Jukun, Yandung, Fulani, Jenjo, Kunini, Ndoro.

The predominant language used in Taraba State is the Hausa language. Other ethnic groups like Igbos and Yoruba also live in Taraba State. The State is also culturally rich with so many cultural festivals of the various ethnic groups. These festivals are celebrated on occasions ranging from death, birth, farming and hunting etc.

Occupation

Taraba State is an Agrarian State; as a result the main occupation of the people is farming. The population of the people engaged in farming is about 80% while 20% engage in other economic activities including white collar jobs. The agrarian nature and rich alluvial tract of soil found in most parts of the state makes Taraba State conducive for growing of various food and cash crops. Its agrarian economy can sustain the food requirements of not only the north-east region, but also to a large extent the entire Nigerian nation (TSEEDS, 2004).

Satisficing, a portmanteau "combining *satisfy* with *suffice*",[1] is a decision-making strategy that attempts to meet criteria for adequacy, rather than to identify an optimal solution. The word ***satisfice*** was coined by Herbert Simon in 1956.[2] He pointed out that human beings lack the cognitive resources to maximize: we usually do not know the relevant probabilities of outcomes, we can rarely evaluate all outcomes with sufficient precision, and our memories are weak and unreliable. A more realistic approach to rationality takes into account these limitations: This is called bounded rationality. (http://en.wikipedia.org/wiki/Satisficing)