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OPTIMUM STRATEGY FOR THE MANAGEMENT OF ANAMBRA STATE GOVERNMENT FUNDS VIA GOAL PROGRAMMING MODEL

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ABSTRACT

This study focuses on the management of State Government funds in Nigeria with special reference to Anambra State Government funds from 2017 to 2021. A structured questionnaire was used to obtain data from the public with regard to project priorities and preferences from which the priority weights were determined and the degree of the responses taken at the priority order. Quantitative and Qualitative analytic methods were employed in the analyses of data. The goal formulation and weighted pre-emptive goal programming model were used to optimize the management of the State funds because of the involvement of multiple goals. The goal programming model is formulated to find an optimal solution for seven different goals using the modified simplest method and the two-phase techniques of TORA software for the analysis .The result of the analysis outlines the projects among many projects government embark on such as : reduction of levy/tax on ordinary citizen, increase in personnel cost and security fund, increase in Internal Generated Revenue (I G R), reduction of dependence on federal allocation fund and increase in capital expenditure and development funds like construction of roads, community development and social amenities, that have the highest impact (in terms of utility) on the people. The results established from the findings portrayed that out of the seven goals addressed, goals 3, 4, and 6 were not accomplished while goals 1, 2, 5, and 7 were totally accomplished. These results therefore, is of great importance and provides a guide through priority ranking and goal formulation when there are multiple goals to be accomplished by the State Government in making some future financial decisions such as investment, financing and dividend decision that will be a special benefit to Anambra State Government in curtailing and balancing the expenditure with the available income.

Keywords: Optimum Strategy, Goal programming, Model formulation, Deviational variables · TORA Package.

Mathematics Subject Classification (2000) 49J53 · 49K99 · more

1. INTRODUCTION

The effect of good governance should be felt equally and also according to the geo-political needs especially in the implementation of State allocation budget: Maintenance of workers, Development, Security, and in the share of the federal government allocation fund etc. A measure of the success of any well-meaning government is meeting the needs of the people at their moment of value i.e when the people need it (Time), where the people need it (location), how the people need it (form) and in the manner that is satisfying to the people, [15]. The implementation of any development should be made to touch the lives of the people, it is only then that one could say that democracy

is fully effective. Governance entails proper and efficient management of available resources of the State to meet various demands of the people. [12]. Good governance is the process and institution of government which produce results that meet the needs of the people while making the best use of the available resources at their disposal and then creating real and safe investment opportunities for the masses. Financial management comprises generally financial planning, budgeting, accounting and allocation of an existing fund in an organization or institution. Financial management in government is a strategic planning, organizing, directing, controlling, allocating of financial undertakings by the government or any organizational body instituted by the government. It also includes applying management principles to the financial assets of the government, while also playing an important part in fiscal management of government expenditure, revenue or tax, etc. The main objectives involved in financial management in government are: Maintaining enough sup- ply of funds for the government; Optimum and efficient utilization of funds. One of the fastest-growing areas within the fields of operations research and management science, is goal programming. From its inception in the early 1950s, this tool has rapidly evolved into one that now encompasses nearly all classes of multiple objective programming models. It has demonstrated ability to serve as an efficient and effective tool for the modeling, analysing and solution to real life problems that involve multiple and, sometimes conflicting, goals and objectives.

Goal programming is an approach used in solving any multiple objective optimization problem that balances trade-off multiple and often conflicting in- commensurable (dimension of goals and unit of measurement may not be the same) goals in a particular priority order (hierarchy). Goal programming model takes a particular priority structure by ranking, weighing various goals and their sub-goals in accordance with their importance. The idea is to covert the original multiple objectives into a collective objective. This yields an efficient solution which may not be optimal with respect to each of the conflicting objectives of the problem.

Goal programming was originally proposed by [2] as a multi-criteria method- ology that builds linear programming models by explicitly considering both continuous and discrete variables in which all linear and / or nonlinear functions can been transformed into goals.

The earliest example of goal programming implementation in financial management in the field of budgeting was given by [3], while [15] presented a study that applies goal programming to economic planning in small rural town. Decision-makers can be satisfied either by finding optimum solutions for a simplified solution or by finding satisfactory solutions for more realistic approach. Hence, goal programming is a realistic alternative to those mathematical models based on a single-objective function, where constraints are relaxed to construct a simplified model and eventually achieve an optimal solution. It is an extension of Linear Programming (LP) but a mathematical tool to handle multiple, normally conflicting objectives. Goal Programming Models are multi-criteria decision models which is suitably applied in analysing and solving real life and multi-objective problems.

A goal programming model was proposed by [8] to analyse multi conflicting objective problem while taking into account the constraints and preference of decision maker. The strong desire to understand goal programming models and its application in the real-life problem is because of its positive feature of simplicity and it is easy to use. The purpose of goal programming is to minimize deviations between the achievement of goals and aspiration levels. It demonstrated ability to serve as an efficient and effective tool for the modeling, solution and analysis of mathematical models that involve multiple and conflicting goals and objectives, the type of model that most naturally represent real world problems.

Many researchers have really applied goal programming model mainly based on theoretical approach. Goal Programming model which was first introduced by Charnes and Cooper in the early 1960s as a simply linear program have leaped to a success in the 21st century. Today, goal programming is alive, more active than ever as supported by a net of researchers and practitioners. An example of [9] provides the use of an alternative goal programming solution procedure which is applied to solve a lexicographic goal programming problem discussing a number of unique technical problem and solution procedures. The study provides a flow chart as a procedural guide to aid in its use. The article also provides a comparative analysis of goal programming algorithms. The results gotten demonstrate the tableau element reduction capabilities of the proposed alternative goal programming solution procedure.

Both Lexicographic Goal Programming (LGP) and weighted Goal Programming (WGP) are best known and widely used as goal programming variants. However, the variants lie heavily on the amount of information that this goal targets, weights as well as pre-emptive ordering of preferences. These requirements can cause possible weakness if the decision makers are not confident of the value of these parameters. The number of cases along with the range of fields to which goal programming has been, and is still applied is very impressive as shown by the recent surveys by [6] affirmed that weighted goal programming (W G P) and Lexicographic goal programming (L G P) can be mixed in a model, for example, weighted lexicographic and min-max lexicographic goal programming. The model was specifically developed for the capital improvement requirements of a town for a three-year planning horizon. And the model presented shown that, with the existing limitation of financing, tax schedules, and service charges, and the priority structure, it was not possible to achieve full completion of all the projects. However, the most important goals were met to the greatest extent, consistent with the assigned priorities which is quite common in municipal planning. They also applied the goal programming model to design optimum aggregate model for municipal economic planning.

A goal programming model for allocating time and cost in project management was prosed by [10] and a construction SEROR'S company case was utilized to test the model. The results reveal that the model provides satisfactory levels of achievement for managing the three projects with preemptive goals, but the solution value (0) of time allocated for planning is illogical and impractical because without the planning phase, the project fails. And he suggested the introduction of additional constraints to the model by specifying the lower bound for each time allocated to planning, scheduling, and control.

Goal programming technique was applied in Government Statutory Budget in Anambra State by [5] to implement the allocation of various capital budget with input taken from the budget allocation from 2003 to 2008 using pair-wise comparison method to assign weight to priority projects, data obtained from 15 different community of Orumba South Local Government Area of Anambra State, also [7] used goal programming in an application to budgetary allocation of an institution of learning using Imo state University as a case study. Data were collected from the University bursary department and Imo State ministry of Finance between 2006 and 2008 with five goals in the budget estimates of the university. At the end some goals were met while some were not met and it was recommended that the budget should be reviewed upward annually, which should be properly and timely monitored by active Government budget monitoring team.

Cited in [7] contributed that the weights and the pre-emptive method con- vert the multiple goals into a single objective function stating that these methods do not generally produce the same solution. Neither method, however, is superior to the other because each technique is designed to satisfy certain decision-making preference.

An efficient method of solving Lexicographic Linear Goal Programming within a pre-emptive priority structure was discussed in [13] as the most widely used techniques in solving multiple objective problems. They noted that the revised or modified simplex algorithm has been used widely in the past and it has been very accurate in computational formulation. They developed a

generalized linear goal programming algorithm that is most efficient and a new approach in solving linear goal programming.

At 2nd Global Conference on Business and Social Science [1] discussed Bank Financial Statement Management using a Goal programming Model. The Six goals of the premier banks in Malaysia, namely asset accumulation, liability reduction, equity wealth, earning, profitability and optimum management items in the financial statement were examined. The data were collected from the bank's annual report and bank scope from 2010 to 2014. The goal programming model was developed to find an optimal solution for six different goals by using LINGO Software version 11. The result showed that all the six goals were fully achieved. The model proposed can be used as a guideline for financial institutions in making decisions and develop strategies to deal with various economic scenarios.

2. THOUGH, some researchers have detected a decline in the life cycle of goal programming with regard to theoretical developments, while Some have really worked on goal programming model and its applications. The work of [16], applied goal programming model for optimization of financial planning in a distribution company in India. The work maximized both capital structure and growth in earnings for an organization called S V R Karnataka. They talked about post optimal analysis and considered their model as a route map for making financial decisions and to develop strategies to deal with various economic outline. The results of the study were calculated and verified using the LINGO 18.0 software. Also [11], worked on the application of Goal Programming for Financial Management of a Listed Industrial Goods Firm in Nigeria resolving lots of problems of setting goals, planning how the goals can be achieved through organization and control of how the available scarce resources can be used to satisfy the aim and the objectives of the company. The result gotten showed that two out of the five objective goals were achieved using TORA Optimization package, the Big M-Method of Simplex algorithm.

Chikwendu and Atuokwu (2024) applies Goal programming Model to optimize the management of Government Funds in Anambra State, with the multiple but conflicting objective where the present administration in the government of Anambra State looks into the increase of Internal Generated Revenue(IGR) collection in Anambra state, at the same time looks forward to ameliorate the life of the citizenry in Anambra state by increasing the provision of security of life and property, being consistent in the maintenance of workers, reducing budget deficit, reducing dependence on Federal Government allocation funds and the tax or levy burden on the ordinary citizen. Therefore, this work is an addition to the work of Chikwendu and Atuokwu (2024) presenting the seven deviational variables both positive and negative deviational variables in a graph to analyse the increment and decrement of the minimization of the goal programming problem.

The Weighted Preemptive Goal programming model as affirmed by [6], helped to achieve the objective of this work by looking at the financial management of Anambra State from 2017 to 2021. The data collected from the finance office of the State and the responses from different categories of peoples in all the 21 local Government in Anambra State, the use of questionnaire in ranking the priority of the goals and the assignment of weight to each goal, help to analyse the management of

funds in Anambra State. Therefore, there is need for a study that will fill-up the gap of using goal programming model for the optimum strategy for the management of the State Government Finance in Anambra, which has not been studied.

Flowing from the social contract perspective, governance should be for the wellbeing of the masses. However, it has been observed that the reverse seems to be the case and the majority of the State Governments in Nigeria including Anambra State Government suffer the following problems

i. Poor payment of workers (salaries, allowances, wages, maintenance packages etc.)
ii. Lack of Security of lives and property and needs thorough strategic spending on security
iii. Lack of maintenance culture in capital projects like education, roads and social amenities.
iv. Heavy dependence on Federal Allocation, borrowing money for consumption and most often imposing heavy levy burden on the citizens.

The critical issue is how optimization of management of fund using goal programming model can help the State Government solve these problems, some of which seem to conflict, simultaneously.

Therefore, the aim of this study is to determine an optimum management strategy for Anambra State Government funds using the methodology of goal programming model (goal programming approach), while the specific objectives are to,

(i) identify the key challenges of the State Government and set their resolution as goals, targets to achieve.
(ii) determine the priority rankings of these goals if any
(iii) construct a goal programming model for the problem in issue.
(iv) solve the goal programming problem and obtain an optimal solution.
(v) proffer from (iv) an optimal strategy for management of Government funds. Therefore, the goals to be optimized are to:

1. Reduce Levy/tax burden on ordinary citizen
2. Increase Internally Generated Revenue (I G R) yielding projects
3. Reduce overhead cost such as cost of Governance
4. Increase Personnel cost and Security fund
5. Reduce Budget Deficit and Servicing of Loan
6. Reduce dependence on federal allocation fund
7. Increase capital expenditure and Development funds.

3. METHODOLOGY

The procedures for structuring Goal Programming model are similar to those for a Linear Programming. The main difference between the LP and GP is that, LP optimizes (maximizes or minimizes) a single objective function whereas, G P minimizes the deviations between the target values of the objectives and the realised results or satisfying solutions.

The two main methods out of several methods that is employed in solving this goal programming problems are:

1. The Weights method

2. The Pre-emptive method

The Weights Method: The single objective function is the weighted sum of the functions representing the goals of the problem. The weighted goal programming model or the combined objective function used in weights method is of the form:

$$Minimize\ Z = \sum_{i=1}^{n} w_i(d_i^+ + d_i^-) \qquad (1)$$

Subject to

$$\sum_{j=1}^{s} (a_{ij}x_j + d_i^- - d_i^+) = g_i \quad (i = 1, 2, \ldots, n) \qquad (2)$$

$$x_j, d_i^+, d_i^- \geq 0$$

Where, x_j is the decision variable for j = 1,2,..., r, a_{ij} represents the parameter of the decision variable, d^+ and d^- represent non-negative constraints and w^+ and w_i^- can be real numbers representing the relative weights assigned within a priority level to the deviational variables.

The Pre-emptive Method: The pre-emptive method is also known as Lexicographic method. With this method, the decision maker must rank the goals of the problem in order of importance. The model is then optimized using one goal at a time such that the optimum value of a higher priority goal will not be degraded by the lower priority goal in any form. The generally proposed pre-emptive model is given as;

$$\text{Min } Z = \sum_{i=1}^{n} p_i(d_i^+ + d_i^-)$$

Subject to

$$\sum_{j=1} (a_{ijxj} + d_i^+ - d_i^-) = g_i \quad (i = 1, 2, \ldots, n)$$

$$d_i^+, d_i^-, x_j \geq 0S$$

The weights' goal and the pre-emptive lexicographic goal programming can be combined in a model and it is called the weighted pre-emptive or lexicographic goal programming. The weight and rank model according to [14] cited in [13] is given as;

$$\text{Min } Z = \sum_{i=1} w_i p_i(d_i^- + d_i^+)$$

Subject to

$$\sum_{j=1} (a_{ijxj} + d_i^- - d_i^+) = g_i \quad (i = 1, 2, \ldots, n)$$

$$d_i^+, d_i^-, x_j, w_i \geq 0 \text{ for all i, j}, \ d_i^- \times d_i^+ = 0$$

The Weighted Lexicographic goal programming model, a combination of weighted and pre-emptive goal programming models proposed by [9] cited in [7] is applied in the model formulation of the goal programming with priorities in this work. The financial statement of Anambra State from 2017 to 2021 is considered with target values.

Through these financial records of Anambra State Government from 2017 to 2021, goals were formulated based on the economic situation of the state and constraints were also imposed based on the needs of the states and availability of the resources at hand from the year 2017 to 2021. We also considered the summary of financial statement, the target value of the objective goals and goal formulation, using the collected data from 2017 to 2021 of the financial statement records from the Anambra state finance office.

Summary of Financial Statement over the Period of Five Years (2017 - 2021) Table (i) gives the financial records of Anambra State government over the period five years from 2017 to 2021 showing the Levy collected, Internal generated Revenue, Overhead cost, Personnel cost, Budget deficit, Federal Government Allocation and Capital expenditure.

The coded summary of financial statement over the period of five years (2017 - 2021) Table(ii) gives the coded values of the State financial statements on the levy, internal generated revenue, overhead cost, personnel cost and security fund, budget deficit, federal allocation fund and capital expenditure. The reason for coding the financial statement values is to be able to work with smaller figures in the analysis.

Note that x_1, x_2, x_3, x_4, x_5 are the decision variables in the model representing the total amount of each component that contains several items in

Summary of Financial Statement of Anambra State Government Fund for Five Years (2017 to 2021) in Billions of Naira/Year

Item (Goal)	2017	2018	2019	2020	2021	Total
Levy	17,295,974,132	6,386,907,370	22,588,758,348	23,566,392,098	29,897,355,593	99,735,387,010
I G Revenue	18,197,787,013	17,161,534,822	25,183,562,697	27,237,691,221	25,453,011,294	88,723,587,010
Overhead Cost	18,333,006,312	18,785,328,885	23,550,642,802	18,344,243,971	22,439,232,469	101,452,450,110
Personnel Cost	13,983,281,189	15,412,966,988	14,969,316,706	14,631,002,393	18,638,513,835	77,635,081,189
Budget Deficit	11,867,805,497	5,988,886,010	5,630,360,339	837,979,672	10,990,270,688	35,315,301,289
F G Allocation	55,143,002,684	71,388,000,345	56,779,676,128	55,234,993,585	62,331,855,206	300,877,528,001
Capital Exp.	54,371,000,756	50,582,767,371	49,512,752,062	63,234,344,473	57,578,248,336	275,279,114,011

Coded values for the summaried Financial Statements of the State with weight in a priority order in Tens Billions of Naira/Year

Item (Goal)	2017	2018	2019	2020	2021	Total	Weight	Priority
Levy	1.73	0.63	2.26	2.36	2.99	9.97	12	P_1
Personnel Cost	1.4	1.53	1.5	1.46	1.86	7.76	10	P_2
I G Revenue	1.84	1.72	2.52	2.72	2.55	8.86	8	P_3
Overhead Cost	1.83	1.88	2.36	1.83	2.24	10.15	8	P_4
Budget Deficit	1.19	0.6	0.56	0.08	1.1	3.53	6	P_5
F. G Allocation	5.51	7.14	5.68	5.52	6.23	30.09	4	P_6
Capital Exp.	5.43	5.06	4.95	6.32	5.76	27.52	2	P_7

each fiscal year 2017, 2018, 2019,2020,2021, such as;

x_1 = the total unit amount for each component of financial statement in the fiscal year 2017
x_2 = the total unit amount for each component of financial statement in the fiscal year 2018
x_3 = the total unit amount for each component of financial statement in the fiscal year 2019
x_4 = the total unit amount for each component of financial statement in the fiscal year 2020
x_5 = the total unit amount for each component of financial statement in the fiscal year 2021

4. THE GOAL FORMULATION IN PRIORITIES WITH THE TARGET VALUES

Therefore, the target value of the objective goals or the goals expression of the financial statement of the state fund for the period five years were as follows:

i. Reduce the total levy to at most 8.50 billion

ii. Increase the total personnel cost and security fund to at least 8 billion
iii. Increase the total Internal Generated Revenue (IGR) to at least 7.50 billion
iv. Reduce the total overhead cost to at most 12 billion
v. Reduce the total budget deficit to at most 10 billion
vi. Reduce the total dependence on F.G allocation to at least 40 percent
vii. Increase the total Capital expenditure to at least 30 billion

Since goals have been discovered, it is then converted mathematically into constraints known as goal constraints as thus;

$1.73x_1 + 0.64x_2 + 2.26x_3 + 2.36x_4 + 2.99x_5 \leq 8.5$ (levy constraint)
$1.40x_1 + 1.54x_2 + 1.50x_3 + 1.46x_4 + \geq 1.86x_5$ 8 (Personnel cost/ Security Fund Constraint)
$1.82x_1 + 1.72x_2 + 2.52x_3 + 2.72x_4 + 2.55x_5 \geq 7.50$ (I G R constraint)
$1.83x_1 + 1.88x_2 + 2.36x_3 + 1.83x_4 + 2.24x_5 \leq 12$ (Overhead cost constraint) $1.19x_1 + 0.60x_2 + 0.56x_3 + 0.08x_4 + 1.10x_5 \leq 10$ (Budget deficit constraint) $0.4(5.51x_1 + 7.14x_2 + 5.68x_3 + 5.52x_4 + 6.23x_5)$ $\geq$ 0.4 30.09 percent (F.G Allocation)
$\Rightarrow 2.20x_1 + 2.86x_2 + 2.27x_3 + 2.21x_4 + 2.49x_5 \geq 12.04$

$5.4x_1+5.06x_2+4.95x_3+6.32x_4+5.76x_5 \geq 30$ (Capital expenditure constraint)

$x_1, x_2, x_3, x_4, x_5 \geq 0$

The goals can also be expressed by introducing deviational variables,
d_i^+ = amount by which we numerically exceed the ith goal.
d_i^- = amount by which we are numerically less than the ith goal.
d_i^+ and d_i^- are referred to as deviational variables

The Goal Programming Model Formulation

Let Z be the weight sum associated with meeting the financial records of the fiscal year 2017 to 2021. Using the weighted pre-emptive goal programming model, the problem can now be expressed as goal programming model in priority order by changing from canonical or inequality forms to standardised form as follows:

$$\text{Min } Z = 12d_1^+ + 10d_2^- + 8d_3^- + 8d_4^+ + 6d_5^+ + 4d_6^+ + 2d_7^-$$

$1.73x_1 + 0.64x_2 + 2.26x_3 + 2.36x_4 + 2.99x_5 + d_1^- - d^+ = 8.5$
$1.40x_1 + 1.54x_2 + 1.50x_3 + 1.46x_4 + 1.86x_5 + d_2^- - d^+ = 8$
$1.82x_1 + 1.72x_2 + 2.52x_3 + 2.72x_4 + 2.55x_5 + d_3^- - d^+ = 7.50$
$1.83x_1 + 1.88x_2 + 2.36x_3 + 1.83x_4 + 2.24x_5 + d_4^- - d^+ = 12$
$1.19x_1 + 0.60x_2 + 0.56x_3 + 0.08x_4 + 1.10x_5 + d_5^- - d^+ = 10$
$2.20x_1 + 2.86x_2 + 2.27x_3 + 2.21x_4 + 2.49x_5 + d_6^- - d^+ = 12.04$
$5.4x_1 + 5.06x_2 + 4.95x_3 + 6.32x_4 + 5.76x_5 + d_7^- - d^+ = 30$

$x_i, d_i^-, d^+ \geq 0$ where i = 1,2, ..., 7

Then, the coefficient of the variables are put in a table form as an initial table and the TORA software is used to get the optimal solution table.

Initial Feasible Table

Basic Variables	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}		RHS
Name of Variable						d_1^+	d_1^-	d_2^+	d_2^-	d_3^+	d_3^-	d_4^+	d_4^-	d_5^+	d_5^-	d_6^+	d_6^-	d_7^+	d_7^-		
Minimize Z	0	0	0	0	0	12	0	0	8	6	4	0	0	10	8	0	0	0	2		
Constraint 1	1.73	0.63	2.26	2.36	2.99	1	0	0	0	0	0	0	1	0	0	0	0	0	0		8.5
Constraint 2	1.4	1.54	1.5	1.46	1.86	0	1	0	0	0	0	0	0	1	0	0	0	0	0		8
constraint 3	1.82	1.72	2.52	2.72	2.55	0	0	1	0	0	0	0	0	0	1	0	0	0	0		12
Constraint 4	1.83	1.88	2.36	1.83	2.24	0	0	0	1	0	0	0	0	0	0	1	0	0	0		7.5
Constraint 5	1.19	0.6	0.56	0.08	1.1	0	0	0	0	1	0	0	0	0	0	0	1	0	0		10
Constraint 6	2.2	2.86	2.27	2.21	2.49	0	0	0	0	0	1	0	0	0	0	0	0	1	0		12.04
Constraint 7	5.44	5.06	4.95	6.32	5.76	0	0	0	0	0	0	1	0	0	0	0	0	0	1		30

The Optimal Table , Phase Two (Iteration 10)

Basic Variables	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	R_{20}	R_{21}	R_{22}	R_{23}	R_{24}	R_{25}	R_{26}
Name of Variable						d_1^+	d_1^-	d_2^+	d_2^-	d_3^+	d_3^-	d_4^+	d_4^-	d_5^+	d_5^-	d_6^+	d_6^-	d_7^+	d_7^-							
Z_{min}	0	0	0.45	0	0	8.89	4.07	8	0	5.11	0	1.77	3.11	5.93	0	8	0.89	4	0.23							
x_5	0	0	0.58	0	1	0.36	1.54	0	0	0.02	0	0.52	0.36	1.54	0	0	0.02	0	0.52	0.36	1.54	0	0	0.02	0	0.52
x_{11}	0	0	0.17	0	0	0.42	1.72	0	0	0.01	1	0.09	0.42	1.72	0	0	0.01	1	0.09	0.42	1.72	0	0	0.01	1	0.09
x_{15}	0	0	0.53	0	0	0.19	1.1	1	0	0.09	0	0.03	0.19	1.1	1	0	0.09	0	0.03	0.19	1.1	1	0	0.09	0	0.03
x_2	0	1	0.03	0	0	0.6	1.87	0	0	0.07	0	0.31	0.6	1.87	0	0	0.07	0	0.31	0.6	1.87	0	0	0.07	0	0.31
x_4	0	0	0.06	1	0	0.03	0.16	0	0	0.13	0	0.06	0.03	0.16	0	0	0.13	0	0.06	0.03	0.16	0	0	0.13	0	0.06
x_6	0	0	0.5	0	0	0.01	0.75	0	1	0.02	1	0.14	0.01	0.75	0	1	0.02	1	0.14	0.01	0.75	0	1	0.02	0	0.14
x_1	1	0	0.39	0	0	0.21	3.55	0	0	0.24	0	0.08	0.21	3.55	0	0	0.24	0	1.08	0.21	3.55	0	0	0.24	0	1.08

5. RESULTS AND DISCUSSION

This Model is solved using TORA software of two phase method, the optimal solution was obtained at the tenth iteration by taking different iterations as follows:

$Z_{min} = 38.13$

$x_1 = 3.49$

$x_2 = 1.38$

$x_4 = 0.54$

$x_5 = 0.11$

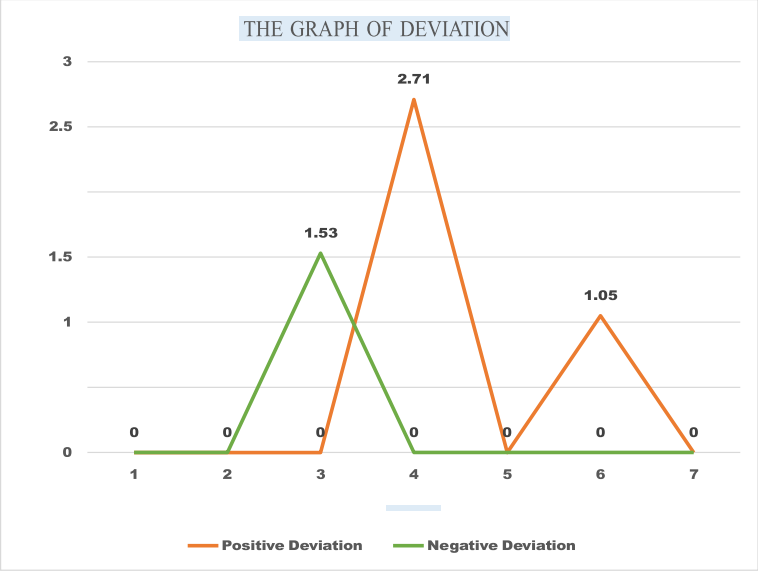
$d_3^- = 1.53$

$d_4^+ = 2.71$

$d_6^+ = 1.06$

$x_3, d_1^+, d_1^-, d_2^+, d_2^-, d_3^+, d_4^-, d_5^+, d_5^-, d_6^+, d_7^-$ are all equal to zero

The seven deviational variables both positive and negative variables can be represented in a graph to analyse the increment or decrement of the minimization of Goal programming problem.



- From this graph of deviation , it can be seen that in minimization problem , the decrement cannot always be determined by negative deviation variables nor in maximization problem the increment be determined by positive de- viation variables especially where the targeted goals were not completely achieved. But if all of the objectives were achieved and the potential of target goal identified, the positive values of deviation variables can be used to detect possible increments or decrements. In the maximization problem, the increment can be determined by using a positive deviation variable, while in the case of a minimization problem, the decrement can be deter- mined by using a negative deviation variable, Ali and Teg (2021).
- Furthermore, from the optimal table, it is observed that, $Z_{min} = 38.13$ which implies that all the objective goals were not achieved, because Z_{min} is not equal to zero and that optimum solution satisfied goals 1, 2, 5, and 7, which are levy reduction, increase in personnel cost, minimizing budget deficit and increase in capital expenditure.
- It is also noticed that both the positive and negative deviations d_1, d_2, d_5, and d_7 are zeros, indicting that their targeted goals were totally achieved which means that ,it is very necessary to reduce the total levy/tax imposed on ordinary citizen, increase the personnel cost and security fund, reduce the total budget deficit and increase the capital expenditure that is profit yielding , work creation projects for community development to increase the standard of living for the citizenry.
  Then, the value of $d_3^+ = 0$ and $d^-_3 = 1.53$ is numerically less than the amount at the target goal by 1.53 billion naira. This implies that the total Internal Generated Revenue targeted at least 12 billion can actually be 13.53 billion in five years.
- More so, the value of $d_4^+ = 2.71$ and $d_4^- = 0$ exceeded the amount at thetargeted goal by 2.71 billion. This implies that the total overhead cost targeted at most 7.50 billion is overstated.
  This is also applicable to the total dependency on F.G allocation targeted to be reduced to at least 40 percent has the value of $d^-_6 = 0$ and $d^+_6 = 1.05$ which implies that it is above the targeted value by 1.05 billion which can actually be reduced to 10.99 billion naira in five years.

6. SUMMARY AND RECOMMENDATION

Since these goals are conflicting, we need to find a compromise solution among the goals. Thus, the method of finding this compromised solution is to con- vert each inequality into flexible goal

in which the constraints may be violated. Note that, the item in the financial statement forms the essential parts in the financial records of every established government. The solution value at the goal 1,2, 5, and 7 shows that targets were fully established and the goals accomplished, since the value of the positive and negative deviational variables d^- and d^+ are zeros.

In conclusion therefore, the findings from the model established that, all the seven goals were properly addressed but some of the goals were not achieved. The 3th, 4th, and 6th goals were not accomplished. Though, the study examined the problem of finding the optimal solution to the conflicting goals of Anambra State utilization of funds. Each of the inequalities in the goal programming formulation represents each goal the State Government wishes to satisfy: the reduction on levy, increase in personnel and security fund, in- crease in I G R, reduction of overhead cost, budget deficit, F.G allocation and increase in capital expenditure are the necessary goals. The study fully investigates the management of resources in the financial statement of Anambra state government and should be of special benefit to the state governments to balance their expenditure with the available income.

Recommendation

This Study is useful and essential for future use. It then recommends the following ways forward:

1. The levy imposed directly or indirectly on the citizen by the State Government should be reduced and should not exceed 8.5 billion Naira in the period of five years
2. The personnel cost and the security fund should be increased at least 8 billion Naira
3. The State Government should also balance its spending with the available income and increase the Internally Generated Revenue to at least 1.53 billion Naira yearly
4. Avoid deficit and borrowing for consumption to reduce the budget deficit yearly at all cost.
5. The Government should channel its expenditure more on capital projects that are profit oriented, creates jobs and circulate income for the masses by increasing the Capital expenditure and make sure that the money allotted to it for the period of five years which is at least 30 billion Naira do not change.
6. This work should be more seen as a consulting tool for other researchers, Governments and those in the area of finance management. Finally, every State Government should set up an Operation Research Group to at least assist with Optimization techniques for allocation of funds and proper management and utilization of funds

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References

1) Bushra, A.H, Hilwana, A.K., Norasyikin, et al: Bank Financial Statement Management Using a Goal Programming Model. Procedia social and behavioral sciences 211, 498-504 (2015)
2) Charnes, A. and Cooper, W.: Management models and the Industrial Application of Linear Programming. John Wiley, New York (1961)
3) Charnes, A. Cooper, W. and Ijiri, Y.: Breakeven budgeting and programming to goals. Journal of accounting research, 1(1), 16 - 43, Wiley Black (1963)

4) Chikwendu, C.R, and Atuokwu, M.I. (2024). Optimization of Management of Government Funds Via Goal Programming Model: A case study of Anambra State Government. African Journal of Educational Management, Teaching and Entrepreneur- ship Studies, 12(2), 223-239
5) Chikwendu, C.R., Umeh, M.N., Nwachukwu, E.O. and Mbeledogu, N.N.: Application of Goal Programming technique in Government statutory budget in Anambra State. Scientia Africa, 11(2), 74- 80 (2012)
6) Diaz-Balteriro, L. and Romero, C.: Forest Management Optimization Models when Carbon captured is considered. A goal programming model Approach. Forest Ecology Management. 174, 447-457. https://doi.org/10.1016/S0378-1127(02)00075-0 (2003)
7) Ekezie, D.and Onuoha, D.: Goal programming an application to budgetary allocation of an institution of higher learning. Research Journal in Engineering and Applied Sciences, 2(2), 95-105 (2013)
8) Ignazio, J.P.: Goal programming and Extensions. D.C, Health and Company, Lexington. (1976)
9) Kwak, N.K and Schniederjans, M.J.: An Alternative Solution Method for Goal Programming Problem: The Lexicographic goal programming case. Socio-Eco. Plan Sci, 19(2), 101-107 (1985)
10) Mubiru.: Application of Goal programming Model for Allocation Time and Cost in Project Management. A Case Study from the Company of Construction Seror. Yugoslay Journal of operation Research 25(2), 283-289. (2010), doi:10.2298/YJOR 131010010Y
11) Ngutor, N., Bamidele, B.D., Agnes, I.N., Patience, O.E, and Abubarkar, U.Y.: Application of Goal Programming for Financial Goods Firm in Nigeria. Journal of Advances in Mathematics and Computer Sciences 37(5), 1-9 (2022)
12) Okoye, E.I and Ani, W, U. Adoption of International Public Sector Accounting Standard in Nigeria. Anals of Government and Public Sector Accounting, Rex Charles and Patrick Limited, Nimo (2004)
13) Orumie, U.C. and Ebong, B.W.: An Efficient Method of Solving Lexicographic Linear Goal Programming Problem. Journal of Natural Science Research ISS 2224-3186 (paper) ISSN 2225-0921(online), Vol.4, No, 20 (2014)
14) Schniederjans, M.J. and Kwak, N.K.: AN Alternative method for solving Goal Programming Problems: A reply. The Journal of the operational Research Society, 33, 859-860 (1982)
15) Sang, M.L and William, R.S.: Goal Programming in economics Planning. Policy Sciences Vol.2. No 2,99-115 (1971)
16) Vasantha, L.K, Hanisn Babu, G.A. and Uday, K.N.: Application of Goal Model for Optimization of Financial Planning: Case study of a Distribution Company. Palestine Journal of Mathematics, 10(1), 144-150 (2021)

