Optimal allocation of resources in Iran's Forests, Rangelands & Watershed Management Organization with goal programming model

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Abstract. Having planned and efficient budget that can include all government's operations can provide the senior managements of the country an imaginable prospect as managers in organizations plan, control, organize, lead and allocate resources; and determining favorable objective with employing the existing resources in the form of an optimal method is one of their main duties. The main aim of this study is providing a model for optimization of the allocation of credit resources to administrative, headquarter and provincial activities in Iran's Forests, Range and Watershed Management Organization. The place domain or the population of the study is Iran's Forests, Range and Watershed Management Organization which is a subsection of Iran's Ministry of Jihad of Agriculture and the time domain of the study is the financial information of seven years related to year 2007 to 2013 that has been prepared yearly. In terms of aim, the method present study is applied. Also, in terms of time dimension the conducting of this study is retrospective (post-event) and in terms of the way of data collection it is descriptive-case study and in the framework of deductive-inductive reasoning. The results of this study indicate that this proposed model which is based on goal programming can fulfill the organization's objectives despite credit limitations.

Keywords: budget, expenditure and capital credits, allocation of credit, goal programming

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1. INTRODUCTION

The philosophy behind writing budgets is factors; one is the infinite needs of human and the other factor is limited resources that human has [1]. Budget is the program for financial operation of the government or governmental organizations in which the revenues and other sources of preparing the credit have been predicted and the necessary resources for the costs of implementing operations and other expenditures for a specific time (usually a financial year) have been estimated [2]. For preparing a budget, the formation of a budget committee is needed that should hold sessions regular, review the progresses of budget programming and solve possible problems [3].

One of the very important parts of budget is related to expenditure credits. Expenditure credits maintain the existing capacities through current activities and pave the way for the ruling of the government. Thus one of the main issues that should be considered is managing it. Another part of the budget is the credits of the plans of capital asset ownership and the way of implementing these plans are firstly considered as the symbol of technical-administrative system of the country and secondly considered as the main means for injecting budget resources in the economy of the country for expanding infrastructure and production capacities. The budgeting model of Iran is currently similar to planning-programming budgeting system. As it

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is evident from its name, planning-programming budgeting plans and makes accessible the organization's operations in the form of a work plan [2]. Of course in 2007 and 2008 according to the government the budget was performed but in fact the planning-programming budget is still allocated based on bargaining without considering the performance and operations of administrative systems.

Allocation of budget is one of the main duties of the financial managers in organizations and this important thing can help the organization in reaching the predetermined objectives in the minimum time and with the minimum costs. In today's world optimization of financial resources is one of the main issues and balancing financial resources can maximize the productivity with the minimum costs.

In developing and allocating resources, modeling is a regular tool that provides necessary information for decisions regarding achieving the objectives [4]. Mathematical techniques are methods that result in optimal allocation of limited resources to activities. Mathematical models and methods are used in public budget in which necessary financial resources are predicted for implementing yearly plan and (current) expenditure credits and ownership of capital (developmental) assets of the organizations are determined and on the other hand the complexity of regulating and allocating resources to needs and objectives and consumptions of financial resources of the future is so high that the maximum satisfaction cannot be obtained by common qualitative methods [5].

Goal programming is a multi-criteria decision making model in the domain of linear algebra that has been created for completing linear programming technique [4]. This model shows simultaneous moving towards several objectives even conflicting objectives which is one of the advantages of goal programming compared with other programming methods. Therefore this mathematical model will be one of the appropriate models, that considering the limited resources of the organization, helps us in optimization of the allocation of the resources so that the organization can achieve its multiple objectives. Use of this model results in control of resources in addition to directing the resources and use of this model in the section of allocation of resources is an introduction to expansion of the application of mathematical models in economic, social and cultural sectors in the country (Diagram 1).

Diagram 1. The analytical model of the study.
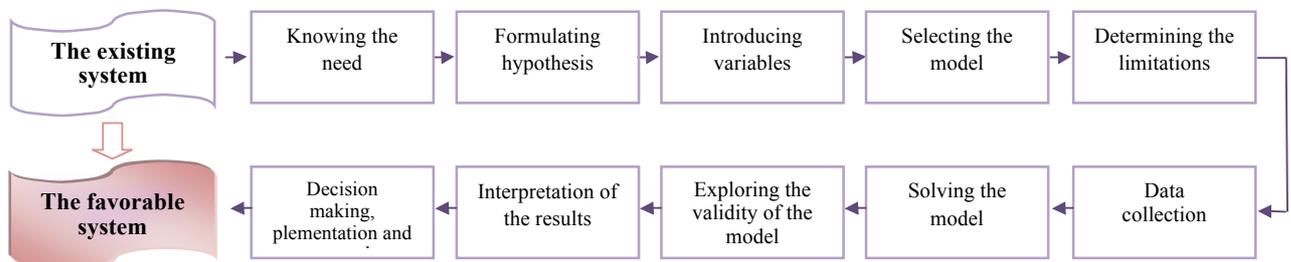
The necessity and significance of addressing the present study because the, Budgeting institutions have historically played a significant role in the gradual process of the moving of countries towards appropriate and responsible governing. However, problems such as political bargaining and ineffective financial management still exist in many countries. In developing

countries, budgeting institutions are in their early stage and are basically considered as a tool for legal monitoring and management. Thus, correction of these institutions is highly important in improving the performance of the public sector [6]. In addition, nowadays the increasing expansion of organizations and companies that have different duties with different objectives on one hand and the impact of progress of science and technology in its form and performance on the other hand have made managing organizations and companies difficult [7]. In most public organizations, due to the lack of employing a systematic method in allocating resources, each year the financial sections faces the problem of how to allocate resource to different domains considering the necessity of responsibility to multiple objectives of the organization. Iran's Forests, Range and Watershed Management Organization too faces the problem of optimal allocation of budget due to the limitation of resources and the lack of employing a systematic budget to different activities. Therefore it is necessary to develop a model that has the ability to optimally allocate budget to these (headquarters and provincial) activities.

The main aim of this study is providing an appropriate model for optimal allocation of budget credits to thereby facilitate the productivity of the resources and fulfill the organization's objectives considering the budget limitations and ultimately to pave the way for its practical application in the long term.

2. THE DEFINITION OF KEY TERMS

In his famous book titled "Management Accounting Performance Evaluation", Scarlet [8] has described budget as operation program based on specific values and for a specific period of time. Generally budgets have two functions; one is that they are the permit of expenditure which means that they allow managers to consider costs in the sections of their organization and the second function is that the budgets are the factor of comparison of the current performance, like a criterion by which the current operations can be controlled. These two roles are combined in the budget control and programming system; these are too tools that are vital for the survival of any organization.

Dehkhoda Dictionary [9] has defined allocation as assigning or making something specific to an issue. In his paper titled "definition, basic concepts and the principle of budget", Movahedzadeh regarding the principle of allocation has mentioned that all the numbers considered in the budget must be gained or spent with the same condition and order that have been determined and allowed in the budget. Based on this principle, each credit digit that has been predicted for cost in the budget is only spendable for that cost and it should not be spent for another purpose.

In his book titled "linear programming and its applications", Mohammad Reza Mehrgan [10] has pointed out that the word "optimal" has a special meaning in the science of management. Optimal answer is the best answer that can be verified mathematically but the best answer of the model does not mean the best answer for the real problem but can be a satisfactory answer for the problem. Finding a real optimal answer is very difficult, if not possible.

3. BACKGROUND OF THE STUDY

Generally the history of mathematical programming techniques goes back to the theories of linear and nonlinear equations and inequalities. George Dantzing who is known as the father of linear programming began searching for techniques for solving military programming for the first time in 1940s. Then his studies were continued by Newman and Kopman which resulted in linear programming. From 1950s onward others began expanding linear programming techniques; others such as Abraham Charles and William Cooper that presented goal programming for the first time in 1955. Now the main studied regarding the mathematical models for goal programming in budgeting are pointed out.

Devika Kannan et al (2013) presented an integrated approach of fuzzy tools and goal programming (multiobjective) for ranking and selecting the best green suppliers based on economic and environmental criteria and then the allocation of optimal order amount. For this purpose, first the process of fuzzy analytical hierarchy process and fuzzy method for the priority of the command similar to the ideal solution for the analysis of the importance of multiple criteria with combination with the views of experts for determining the best green suppliers were used. Then, multi-objective linear programming was used which resulted in the formulation of different limitations such as quality control, capacity and other objectives [11].

Wey and Wu (2007) have selected transportation infrastructure projects using ANP and goal programming. The result of this study is providing a flexible framework that covers many obstacles related to the lack of accuracy and explicitness. Many problems in decision makings are related to incomplete and inaccurate information [12].

Kwak and Lee provided a model for allocation of IT resources in Saint. Louis University using the combination of goal programming and AHP [13].

Habeeb (1991) proposed a goal programming model for Nigeria's economy. This model has three sets of goals that have special priority over each other. The model's goals are allocation of financial and monetary resources, economic growth and providing human resource respectively [14].

Lee and Shim presented the famous ZBB (Zero-Base Budgeting) model which is based on goal programming. According to them the basic step for effectiveness of ZBB in the public sector begins with determining and knowing the organizational structure, management, decision units and objectives. This model allows managers to identify goal and objectives in each organizational level and implement the optimal allocation of limited resources to important objectives [15].

Charnes and Cooper proposed the most valid model called PPBS (Planning Programing Budgeting System) in which management and monitoring were also paid attention to in addition to programming. This model which was exclusively prepared for the US Military is still valid [16].

4. THE HYPOTHESIS OF THE STUDY

The statement of the problem guides the study only generally and does not include all special research information. On the other hand if we include all research information in the problem, the problem grows in a way that guiding it will not be possible and therefor the problem will never be scientific unless it is turned into a hypothesis or some hypotheses. The relationship between the hypotheses with study is like the relationship of the road with the passenger; the more the road is smooth and safe, the safer is the travel. Therefore, in a study that lack hypothesis the researcher is bewildered [17]. The following hypothesis is developed based on the question posed which is the starting point of the study and based on the aim of the study: the method used in the organization is not optimal and results in the unused credit (budget surplus) or budget deficit and therefore it cannot help the organization in achieving the predetermined objectives (creating forest, rage management, watershed management and combating desertification).

5. METHODOLOGY

Identifying appropriate methods for allocation of credit resources will result in making more correct decisions that leads to optimization of resource allocation. Therefore, in this study the methods for optimization of allocation of credit resources in Iran's Forests, Range and Watershed Management Organization are explored. As the results of this study can be used in decisions of experts, deputies and managers, the present study is of applied type in terms of aim. In terms of time aspect, the present study is of retrospective type which means that the collected data (the financial data of Iran's Forests, Range and Watershed Management Organization) that have been used as the basis of data analysis have occurred in the past. On the other hand in terms of the way of collecting the data is considered as descriptive-case study. Also, the conducting of this study will be in the framework of deductive-inductive reasoning which means that the theoretical basis and the background of the study are in deductive form and the collection of the data for verification or rejection of the hypothesis of the study is in inductive form.

6. DATA COLLECTION METHOD

Library sources (books, papers and journals in on the subject of the study), theses, valid international journals that are available online and other scientific sources were used for collecting theoretical sources, literature review and theoretical discussions in this study. Only the data related to Iran's Forests, Range and Watershed Management Organization are used for data collection and for limiting the domain of the study. These data were extracted from the deputy of programming, developing management and resources of Iran's Forests, Range and Watershed Management Organization and using "goal programming" model of budget allocation to activities. Therefore the information in the following sources has been used for collecting the data for processing the hypothesis of the study:

a. The data in the organization's software that include the information of financial statements such as: credits system, payment and wage system and…

b. Agreements of (current) cost activities passed in the deputy of programming and strategic monitoring

c. The agreements of the capital assets (developmental) ownership activities passed in the deputy of programming and strategic monitoring

d. Documents and financial statements of the organization

e. Yearly budget law

f. The organization's website: www.FRW.org.ir

7. THE VARIABLES OF THE STUDY

As the aim in the present study is optimal allocation of credit resources in Iran's Forests, Range and Watershed Management Organization with goal programming model, the variables of the study were defined as follow:

The allocated credit (passed credits+ the revenues {R})	C_{ijn}
The weight or the coefficient given to each activity	P_i
The budget allocated to each activity	YY
Indices	
Administrative headquarter and provincial activities	I
Return of revenues	J
The studied year	N

8. THE GOAL PROGRAMMING MODEL, THE PROPOSED MODEL OF THE STUDY AND THE WAY OF IMPLEMENTİNG THE MODEL

Goal programming shows the way of multiple moving towards several goals. In this method, a specific number is determined for each objective as a goal and the objective function related to it is formulated then an answer is sought that minimizes the sum (weight) of deviation of each objective from the goal that has been determined for that objective. For mathematical expression of this suppose that $X_1, X_2,..., X_n$ are the variables of the decision of the problem and K is the number of the intended objectives. If C_{jk} is the coefficient of g_k goal, (j=1,2…,n) in the objective function number k (k=1,2…,K) and g_k is the goal determined for this objective, then we are after an answer that makes possible achieving all of the following goals as much as possible.

$$\sum_{j=1}^{n} c_j x_j = g_1 \quad \text{(goal 1)} \quad , \ldots , \quad \sum_{j=1}^{n} c_{jk} x_j = g_k \quad \text{(goal K)} \tag{1}$$

Consequently the goal programming model is turned into the following form:

$$Min \quad Z = \sum_{k=1}^{K} (y_k^+ - y_k^-) \tag{2}$$

Subject to:

$$\sum_{j=1}^{n} c_{jk} x_j - (y_k^+ - y_k^-) = g_k, \quad k = 1,2,...,K$$

$$y_k^+ \geq 0, y_k^- \geq 0, x_j \geq 0 (j = 1,2,...,n)$$

And any linear programming limitation that has existed from the beginning regarding x_j.

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The model of the present study for allocation of the resources includes developing objective function with considering goal limitation. For this purpose, first the function of the objective goal was developed and for collecting the data related to the objective function, the documents of Iran's Forests, Range and Watershed Management Organization were used and the data analysis was done using Excel ver:2007 and LINGO ver: 11.

$$Min \ z=yp(1)+ym(2) +yp(3) \hspace{4cm} (3)$$
$$\sum xl \ (R) +yp(l)-ym(l)=g(l);$$
$$\sum x2(R) +yp(2)-ym(2)=g(2);$$
$$\sum x3(R) +yp(3)-ym(3)=g(3);$$
$$x_{1,2,3} \geq 0 - i = 1,2 - j = 1,2,3,4,5$$

In order to improve the process of decision making in Iran's Forests, Range and Watershed Management Organization, it has been assumed that the goals should be better than the current conditions at least as much as 10 percent (Chart 2). It should be noted that the coefficients of goals (weight) have been considered as equal and the same to look at exploring credit, expenditure and revenue in the same way.

Chart 2. The goals of the study.

variable	Level of improvement	Final value
Cost (X1)		0.9X1
Revenue (X2)	10 percent	1.1X2
Capital (X3)		0.9X3

Lingo has been used in this study to explore the performance of the model. This powerful tool that has been designed to explore and solve different operation research problems can explore problem using different methods of solving mathematical programming problem (simplex method, branch, bound and…). The advantages of Lingo compared with Lindo or Gamas include its ability in modeling all problems that have been modeled by Lindo, without the need to determine the type of the model by the user while Lindo or Gamas do not have such ability. Another important ability of Lingo is having very strong, simple and complete guide in a way that one can become familiar with this software to a high extent using the guide. Lingo is a comprehensive language for facilitating all optimization problems such as operation research problems, problems of engineering economy, simulation, quality control, project control and inventory control. In other words, Lingo is a software package with the ability of two-way communication with the user. And it can be used in solving linear, nonlinear and integer problems. This software has conditions similar to those of Lindo but has more flexibility in expressing the model.

9. THE RESULTS OF THE FINDINGS OF THE STUDY

As it was pointed out before, linear programming should be used for obtaining different policies. In this regard, first it is necessary to determine some optimal polices in this regard. For this purpose, some probable policies for allocating different resources based on the current conditions and effectiveness have been obtained. For creating these different models and assessing each of them, the researcher should do the exploration based on the existing realities in previous actions of the units and centers of expenditure. In this regard, first the information of seven years (2007 to 2013) was selected and the programs of their expenditures, revenues and credits were determined in the form of specified imitations so that the proposed model gains specific parameters. Then using the powerful tool Lingo, the value of the relations provided in

the form of the mathematical model have been explored and the results have been investigated based on the outputs and the obtained information.

An important point that has been added to this study, unlike the previous approaches that have only explored one scenario and have called the parameters unchangeable, is that the sensitivity of the data has been explored and analyzed. The analysis of the sensitivity shows the amount that the function coefficients can be increased or decreased without the change of the optimal basis of the study (the set of non-zero variables). Sensitivity analysis is consisted of two parts; one part is related to the objective coefficient and the other related to the limitations and each of them have been mentioned by the real values and the increase and decrease values. This analysis specifies how much the improvement or deterioration of the models are impacted, if some of the centers act a little different. In other words, the distinguishing point of this study can be said to be in optimal policy making; with the analysis of sensitivity on the information obtained from the sample years, one can see that though the allocation can be done in different ways, the creation of different limitations results in change in the allocated amount and can give the organization an different value. This point can be helpful in determining effective policies for determining the appropriate work characteristics at provincial (strategic) level and hence in doing improvement actions.

Based on the collected data and the details obtained from solving the study problem using Lingo it was specified that significant differences between what occurs practically in Iran's Forests, Range and Watershed Management Organization and what should occur in the optimal state have been obtained. In other words, the optimal values of this study indicate that there is significant differences between these two values (current and optimal performances) in the aforementioned years and it has resulted in the inability to move towards reduction of costs, increase of revenue and optimal allocation of resources required for doing headquarters and provincial activities in the previous and experienced-bases state. As it has been shown in the mathematical model and objective function, these goals (reduction of expenditure, increase of revenue and optimal allocation of resources) should be adopted.

Also, based on the results of the goal programming, it was specified that budgeting can be done based on the data of the previous year or periods of consecutive past years and compare it with the realities from the years after and identify the deviations and differences. In such conditions it is necessary to use models based on mathematical modeling. And goal programming model with considering equal weights for the goals, conditions, limitations and the variables provides the answers to the questions specifically and it reveals that the experimental and traditional processes cannot correctly calculate budget with the same accuracy as that of the goal model processes.

10.DISCUSSION AND CONCLUSION

Budget is the main artery for the life of government whose sub-branches are current financial and economic resources [2]. Budget has a close relationship with accounting and they require each other. Budget considers objectives and programs and predicts credits for achieving these objectives so that accounting units can have a more accurate control which means that budget and accounting impact each other [18]. On the other hand negotiation and bargaining are

indispensible parts of the process of preparing budget. When it is said that the budgeting process is political it means that this process has opposite points in itself. When the process is managed through bargaining the only predictable result is the ineffectiveness in allocation of resources. The selections are based on political power of the different factors rather than being based on objective realities, truth and results. Instead of clear allocations of funds, wrong compromises are made that for example include increase of tax costs, creating allocated financial resources, too much cautionary loans or commitments. When bargaining dominates the process of preparing and regulating budget, mechanisms for transferring the main programs to outside of the budget emerge [6].

Now the questions taken from the hypothesis of the study can be answered based on the question of the study and statistical analysis:

1. Is the traditional method used in the organization is optimal?
No there is a significant difference between the optimal value and the traditional value.

2. Can a mathematical model for allocation of resources in Iran's Forests, Range and Watershed Management Organization be provided?

An appropriate goal programming model was presented and it was able to achieve its intended results considering the study method and based on the characteristics of Iran's Forests, Range and Watershed Management Organization and with the aid of the data from the organization. In such conditions other programming models such as zero-one programming model that can, unlike the goal programming model which is a flexible model, explore a common trend by considering different rends in different years.

3. Is the appropriate mathematical model for Iran's Forests, Range and Watershed Management Organization of goal programming type?

Based on the obtained results it can be claimed that theoretically such an action is not only possible but also results in great improvements whose results can be managed in the form of different aims and objectives in the organization. Nonetheless, creating this mental philosophy and its practical implementation in the organization needs more correct collection of information, constant monitoring and using continuous programming model so that the development and change of path can be done using such mathematical models in reality when there is deviation of forecasts with the performance.

11.SUGGESTIONS BASED ON THE RESULTS OF THE STUDY

1. Iran's Forests, Range and Watershed Management Organization can optimize the allocation of credit resources between administrative headquarter and provincial units based on the results of this study.

2. The findings of the study indicate that the deputies, managers, experts and researchers can be provided with optimized methods for allocation of resources that have been identified so that achieving the organization's objectives is implemented.

3. This study provides the decision makers with the ability to forecast possible deficit or surplus in addition to determining optimal allocations and act to resolve them so ultimately achieve optimal and balanced allocations.

4. Considering the principle of the flexibility in budget, it is recommended that the transfer of credits between programs be possible so that the programs that need more credit gain the budgets in proportion to their need.

5. Considering the lack of the adequacy of the existing budget for meeting the needs of the organization, it is recommended to pursue creating revenue for increasing the organization's resources.

6. As all the weaknesses in implementation of the budget are not due to the budgeting systems and their ways of implementation are the source of many of these weaknesses, it is recommended to do activities related to the improvement of budget discipline, improvement of the responsibility of all those responsible for implementation and reporting budget.

7. Simplicity, extensive applicability, validity and high consistency of the results with the model are among the main advantages provided in this study.

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