Assessment of Budgeting by Utilizing Goal Programming Model  
Case Study: Qom Province, Iran

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Abstract

Budget system has surmounted important reformations and steps as the very important and sensitive tool for programming governments' proceedings and activities. Attempts are being expended for formulation and allocation of resources should maximize the use of present resources for reaching society aims. The goal of this study is to present a model for the improvement of allocating budgeting to different economic parts and activities.

So, three year budgeting of Qom 2008, 2009 and 2010 are being used. The resultant issue of the model shows that allocation of budgeting was not optimal and needs reformation. The resultant issue of solving this model can help to optimize it. Finally, operational suggestions and advices are presented.

Keywords: Budgeting, goal programming, allocation of budget.
1. Introduction

The aim of public budgeting in its new context is the best method in order to create equation between lawful claims of citizens through arranging resources allocation way to these claims and relative decision making processes which is the most suitable alternative for gaining public benefits in its frame. For reaching this aim, stable reformations in the method of public budgeting has been fulfilled in different countries especially in advanced countries (Panahi, 2010; Budie & Merton, 2000).

On this basis, four budgeting methods have been created that have been alternatively and proportionally used by governments. These budgeting methods are (Panahi, 2010):

a) Incremental Budgeting
b) Program Budgeting
c) Zero Based Budgeting
d) Performance Budgeting

Performance Budgeting is attended more than other methods by the administrative managers and governors. This study also focuses on Performance Budgeting (Budie & Merton, 2000).

Performance Budgeting is an annual working program along with annual budgeting which shows the relationship of allocated budget to any program with the achieved results from implementing that program (Panahi, 2010).

Meaning, a definite collection of aims should be provided with a specific range of spent expenses in a frame of any program. In this budgeting method, budget of any program or administrative system are presented along with anticipated results; and in the large level, possibility of communication between allocated budget by government and resultant issues are provided for the people. In other words, Performance Budgeting means the method of formulation and finalization of request of an organization for allocating resources being resulted from inductive design of that organization and stabilized on its lawful task (Budie & Merton, 2000).

In this definition, Performance Budgeting allocates resources on the basis of achieving appreciable aims that has relation with organizational vocation and goals. Implicit context of this definition is that not only all needful direct and indirect activities for achievement of aims of a program should be attended but also accurate expenses of any activities should be presented on the basis of different indexes (Chui, Park, 1998).

Performance Budgeting can equip budgeting decision makers to better data about issues of any program and all programs are being used for gaining definite and common aims, so possibility of assessment to different budgeting request was progressed (Panahi, 2010). Although, in this method, allocation of resources is subordinated to political choices and is not basis of decision making functional indexes, but functional data can help politicians to take a decision about:

Do the programs help to achieve organizational aims? Are the decision concerted with each other? Are the people who need services or benefits more than others attended?

This method can also present information about accomplishments and the matter that does the use of resources is more than its expenses? And do the managers include needful abilities for achieving promised issues or not?

In Performance Budgeting, this probability is provided to get measure of demand or need for goods and services of an organization of an administrative system, mass of necessary working or activity for requesting anticipated demand and measure of productivity and efficiency of activities of an organization (Panahi, 2010).

Furthermore, it associated politicians, managers and citizens in budgeting decisions through inductive programs and recognition of costly priorities, also long term perspective can be described with recognition of relationship between inductive programming and allocation of resources (Budie & Merton, 2000). Emphasizing on issues, organizations and systems can make responsible by defining functional indexes and increase discretion of managers. Moreover, expected levels of function would be designated for any level of expenses and determination of costly priorities in the budget.

Performance Budgeting relies on two axes during its process (Panahi, 2010):
• Technical efficiency through determining amount of efficiency and productivity of organizations for managers;
• Effectiveness through informing managers from rate of achieving goals and destinations of organizations.

Performance Budgeting follows allocation of resources improvement with programs and activities of an organization or administrative system. This allocation of improvement can occur in two manners. On one side, budgeting allocation mechanism characterized to programs and activities and on the other side, relation of programs and activities with organizational aims and goals or administrative system is accurate. In order to achieve this aim in the process of executing Performance Budgeting, following process can be considered (Budie & Merton, 2000):
• Recognition of vocation, ideals, destinations and aims
• Association of information deductive programming with budgeting
• Advancement and unification of functional indexes in the budgeting frame
• Report of results on the basis of functional indexes.

Performance Budgeting, unlike it seems simply executed in the steps of demodulation and it focuses on problems and difficulties. So, accurate fulfillment of it needs some steps being very important (Panahi, 2010):
• Getting agreement and obligation of principle players
• Arrangement of time programs for fulfillment
• Delivery of necessary educations
• Assessment and advancement of adductive programs
• Creation of data and account system with cost price
• Assessment and report of results
• Providing management fields
• Final activities.

2. Background and Literature of Research
Advancement of societies is accompanied with advancement of organizations requiring efficiency systems in the allocation of resources and mechanisms of control and programming. In the later two decades, different mathematic models have been presented about economic financial budgeting and programming (Chui, Park, 1998). Among, we can refer to goal model of Nigeria economy. This model which was presented by E. A. Habibb is a typical model for the economy of Nigeria. Creating Planning Programming Budgeting System in 1965, process of Zero-based Budgeting became general in 1973 (Chiampi & Fuertratt, 1998).

In Iran, the most principle models of budgeting in governmental organizations were suggested by Azar and Seyed Esfahani (Azar, Seyed Esfahani, 2008-2009). Regarding budgeting by goal programming and its role in the distribution of credits, we can refer to suggestive model of distributing developmental budgeting in education. This model was being presented by Goshtasb, is a typical model for optimal allocation of education budgeting during third five years of advancement planning (Goshtasb, 2000).

Another model of goal programming about allocating budgeting (Fars Province) is the goal model of Kamali and Namazi that was paid attention to allocation of budgeting through five years data from the second and third five years of law budgeting (Namazi & Kamali, 2002; Namazi, 1999).

Other model of goal programming is connected to investment of insurance Company of Iran that amount of errors and optimum was distinguished (Anvari Rostami Nematollahi Ardestani, 2003).
3. Goal Programming
Goal programming is one of the most important methods being firstly introduced by Charnz and Copper in 1961 (Winston, 1994). These methods were propounded about systems that involved contradictory and multi criteria aims. A pattern of a definite goal programming can be shown as follow (Azar, 2008):

Minimize: \[ Z = \sum_{k=1}^{K} (y_k^+ + y_k^-) \]

Subject to
\[ \sum_{j=1}^{n} C_{j,k} X_j - (y_k^+ - y_k^-) = g_k \quad k=1,2,...,K \]
\[ y_k^+ > 0, y_k^- > 0, X_j > 0 (j=1,2,...,n) \]

In this method, a definite number is appointed as a goal for any of aims and then the relative aim is arranged, as it. Mathematically, we suppose \( x_1, x_2, ..., x_n \) as the variables of decision making matter and K is considered as the numbers of aims. \( C_{j,k} \) is the factor of \( X_j \) \((j=1,2,...,n)\) and subordinator of goal No K \((k=1,2,...,K)\); also \( g_k \) is the distinguished goal for this aim. By defining variables of \( y_k^+ \) and \( y_k^- \) of assigned aims \( g_k \), we are going to find a request in order to help probability achievement to all goals. Errors can be shown as \( d^*d^- \) in which this symbol was used in this research.

4. Method of Research
This study paid attention to the allocation of budget credits by the process of goal programming and seasonal budgeting of three years of Qom province (2008-2009-2010). Goal data was read from budgeting and programming part of Qom and was modeled by goal programming.

This study is operational and involve following steps:
1. Study of research literature and its background
2. Collection of related data to budget
3. Definition of variables and model forming (involving subordinator of aim and limitations)
4. Solving model

5. Formulation of Model
Suggestive model of the research allots budgeting on the basis of appointed priorities and limitations to different sections. Relative sections have been shown in table 1. Planning model is linear and goal programming (Lee, 1979). So it is able to improve allocations on the basis of priority of every one. Formulation of limitations is equivalently (=) and shows that we should not focus with maximizing or minimizing of budgeting in allocations. Software of LINDO was used in order to solve model and its improvement concerning limitation of sections' budgeting. It is mathematically defines as follow:

\[
\text{Minimize : } p_{20}(d_{20}^* + d_{20}^-) + p_{30}(d_{30}^* + d_{30}^-) + p_{18}(d_{18}^* + d_{18}^-) + p_{19}(d_{19}^* + d_{19}^-) + p_{14}(d_{14}^* + d_{14}^-) + p_{13}(d_{13}^* + d_{13}^-) + p_{12}(d_{12}^* + d_{12}^-) + p_{11}(d_{11}^* + d_{11}^-) + p_{10}(d_{10}^* + d_{10}^-) + p_9(d_{9}^* + d_{9}^-) + p_8(d_{8}^* + d_{8}^-) + p_7(d_{7}^* + d_{7}^-) + p_6(d_{6}^* + d_{6}^-) + p_5(d_{5}^* + d_{5}^-) + p_4(d_{4}^* + d_{4}^-) + p_3(d_{3}^* + d_{3}^-) + p_2(d_{2}^* + d_{2}^-) + p_1(d_{1}^* + d_{1}^-) + p_0(d_{0}^* + d_{0}^-) + p_{15}(d_{15}^* + d_{15}^-) + p_{16}(d_{16}^* + d_{16}^-) + p_{17}(d_{17}^* + d_{17}^-) + p_{18}(d_{18}^* + d_{18}^-) + p_{19}(d_{19}^* + d_{19}^-) + p_{20}(d_{20}^* + d_{20}^-) + p_{21}(d_{21}^* + d_{21}^-) + p_{22}(d_{22}^* + d_{22}^-) + p_{23}(d_{23}^* + d_{23}^-) + p_{24}(d_{24}^* + d_{24}^-) + p_{25}(d_{25}^* + d_{25}^-) + p_{26}(d_{26}^* + d_{26}^-) + p_{27}(d_{27}^* + d_{27}^-) + p_{28}(d_{28}^* + d_{28}^-) + p_{29}(d_{29}^* + d_{29}^-) + p_{30}(d_{30}^* + d_{30}^-)
\]

It is done in order to have facility in writing subordinator of aim:
Minimize $Z = \sum_{i=1}^{m} p_i \left( \sum_{j=1}^{n} \sum_{k=1}^{p} d_{ij}^* + d_{ij}^- \right)$

Subject to:

(1) $X_1 - d_1^* + d_1^- = y_1$
(2) $X_2 - d_2^* + d_2^- = y_2$
(3) $X_3 - d_3^* + d_3^- = y_3$
(4) $X_4 - d_4^* + d_4^- = y_4$
(5) $X_5 - d_5^* + d_5^- = y_5$
(6) $X_6 - d_6^* + d_6^- = y_6$
(7) $X_7 - d_7^* + d_7^- = y_7$
(8) $X_8 - d_8^* + d_8^- = y_8$
(9) $X_9 - d_9^* + d_9^- = y_9$
(10) $X_{10} - d_{10}^* + d_{10}^- = y_{10}$
(11) $X_{11} - d_{11}^* + d_{11}^- = y_{11}$
(12) $X_{12} - d_{12}^* + d_{12}^- = y_{12}$
(13) $X_{13} - d_{13}^* + d_{13}^- = y_{13}$
(14) $X_{14} - d_{14}^* + d_{14}^- = y_{14}$
(15) $X_{15} - d_{15}^* + d_{15}^- = y_{15}$
(16) $X_{16} - d_{16}^* - d_{16}^- = y_{16}$
(17) $X_{17} - d_{17}^* + d_{17}^- = y_{17}$
(18) $X_{18} - d_{18}^* + d_{18}^- = y_{18}$
(19) $X_{19} - d_{19}^* + d_{19}^- = y_{19}$
(20) $X_{20} - d_{20}^* + d_{20}^- = y_{20}$

$X_{i1} \leq X_{20} \geq 0$

$y_{i1} \leq y_{20} \geq 0$

$d_i^*, d_i^- > 0$

This research shows method of credits allocation between different parts of budgeting that is as follow:

Table 1: Allotted amount to different section of Qom Province budgeting

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 1: managing public affairs</td>
<td>0.89</td>
<td>10000.00</td>
<td>2.02</td>
<td>15410.00</td>
<td>1.91</td>
<td>34975.00</td>
</tr>
<tr>
<td>Section 2: judicial affairs</td>
<td>3.10</td>
<td>35000.00</td>
<td>1.70</td>
<td>12960.00</td>
<td>1.06</td>
<td>19305.00</td>
</tr>
<tr>
<td>Section 3: financial, technical,</td>
<td>0.36</td>
<td>4100.00</td>
<td>0.56</td>
<td>4300.00</td>
<td>0.19</td>
<td>3414.00</td>
</tr>
<tr>
<td>management and programming services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section 4: advancement of science and</td>
<td>1.33</td>
<td>1500.00</td>
<td>0.62</td>
<td>4750.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section 5: defense</td>
<td>0.44</td>
<td>5000.00</td>
<td>0.01</td>
<td>100.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Section 6: public peace and security</td>
<td>0.44</td>
<td>5000.00</td>
<td>0.26</td>
<td>2000.00</td>
<td>0.11</td>
<td>2100.00</td>
</tr>
<tr>
<td>Section 7: education</td>
<td>12.50</td>
<td>141130.00</td>
<td>7.28</td>
<td>55448.00</td>
<td>9.83</td>
<td>179767.00</td>
</tr>
<tr>
<td>Section 8: culture, art, media</td>
<td>10.63</td>
<td>120000.00</td>
<td>18.03</td>
<td>137330.00</td>
<td>15.70</td>
<td>287073.00</td>
</tr>
<tr>
<td>and tourism</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section 9: sanitation</td>
<td>3.37</td>
<td>38000.00</td>
<td>2.03</td>
<td>15460.00</td>
<td>3.59</td>
<td>65714.00</td>
</tr>
<tr>
<td>Section 10: social welfare</td>
<td>3.99</td>
<td>45000.00</td>
<td>1.75</td>
<td>13292.00</td>
<td>3.21</td>
<td>58702.00</td>
</tr>
<tr>
<td>Section 11: sport</td>
<td>4.25</td>
<td>48000.00</td>
<td>3.38</td>
<td>25770.00</td>
<td>2.17</td>
<td>39746.00</td>
</tr>
</tbody>
</table>
Table 1: Allotted amount to different section of Qom Province budgeting - continued

<table>
<thead>
<tr>
<th>Section</th>
<th>Allotted amount</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>12: agriculture and natural resources</td>
<td>3.54</td>
<td>40000.00</td>
</tr>
<tr>
<td>13: water resources</td>
<td>3.54</td>
<td>40000.00</td>
</tr>
<tr>
<td>14: industry and mine</td>
<td>8.42</td>
<td>95000.00</td>
</tr>
<tr>
<td>15: environment</td>
<td>0.13</td>
<td>1500.00</td>
</tr>
<tr>
<td>16: business and cooperation</td>
<td>0.09</td>
<td>1000.00</td>
</tr>
<tr>
<td>17: energy</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>18: transportation</td>
<td>4.87</td>
<td>55000.00</td>
</tr>
<tr>
<td>19: connections, technology and information</td>
<td>0.89</td>
<td>10000.00</td>
</tr>
<tr>
<td>20: building, urban, rural and tribal development</td>
<td>37.21</td>
<td>420000.00</td>
</tr>
<tr>
<td>Total Sum</td>
<td>100</td>
<td>1128730</td>
</tr>
</tbody>
</table>

6. Explanation of Model

We firstly focus on explanation of aim subordinator. Subordinator of aim is the collection of errors \( \sum_{i=1}^{20} d^+ \sum_{i=1}^{20} d^- \) that should be minimized. Errors of \( d^+ \) shows maximum of budget and \( d^- \) shows minimum of budget in any section (for example \( d_i \) shows priorities of errors of goal subordinator). Priorities have been distinguished on the basis of allotted percentage amount to the section of budgeting.

Limitations of 1 to 20 shows budgeting of any section should be equivalent to allocated budgeting. Amounts of \( Y_1 \) to \( Y_{20} \) are the allocated budgeting to the section of budgeting. In fact, this model allocated budgeting should not be minimum or maximum.

After solving model, results present this issue that allocated budgeting involve many errors that those results can be shown in table 2.

Table 2: Results gained from model

<table>
<thead>
<tr>
<th>Sections</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: managing public affairs</td>
<td>2</td>
</tr>
<tr>
<td>2: judicial affairs</td>
<td>4.4</td>
</tr>
<tr>
<td>3: financial, technical, management and programming services</td>
<td>0.36</td>
</tr>
<tr>
<td>4: advancement of science and technology</td>
<td>3</td>
</tr>
<tr>
<td>5: defense</td>
<td>1.3</td>
</tr>
<tr>
<td>6: public peace and security</td>
<td>10.44</td>
</tr>
<tr>
<td>7: education</td>
<td>11</td>
</tr>
<tr>
<td>8: culture, art, media and tourism</td>
<td>7.8</td>
</tr>
<tr>
<td>9: sanitation</td>
<td>8.63</td>
</tr>
<tr>
<td>10: social welfare</td>
<td>4.99</td>
</tr>
<tr>
<td>11: sport</td>
<td>4.25</td>
</tr>
<tr>
<td>12: agriculture and natural resources</td>
<td>1.38</td>
</tr>
<tr>
<td>13: water resources</td>
<td>3.54</td>
</tr>
<tr>
<td>14: industry and mine</td>
<td>8.42</td>
</tr>
<tr>
<td>15: environment</td>
<td>4.7</td>
</tr>
<tr>
<td>16: business and cooperation</td>
<td>0.09</td>
</tr>
<tr>
<td>17: energy</td>
<td>2.3</td>
</tr>
<tr>
<td>18: transportation</td>
<td>8.3</td>
</tr>
<tr>
<td>19: connections, technology and information</td>
<td>2.3</td>
</tr>
<tr>
<td>20: building, urban, rural and tribal development</td>
<td>10.8</td>
</tr>
<tr>
<td>Total Summation</td>
<td>100</td>
</tr>
</tbody>
</table>
Shown amount of table reflect that allocated budgeting is not optimal and needs an accurate programming in terms of studying aim of this model that is optimum of allocating budgeting.

For example, section of managing public budgeting that has been anticipated for 2010 is 89. Whereas in the model, its percentage is 2 that shows 1.1 and is the percentage of shortage in the relevant part.

7. Discussion and Conclusion
This research has paid to assess the allocation of seasonal budgeting in Qom Province. In fact, chromatistics of this research is functional and different sections of budgeting were used for optimal allocation. The resultant issues of this research show the possibility of reformation. One of reasons for non-success of organization can be inaccurate estimation of budgeting or wrong anticipations which can reduce these errors with the scientific approaches among models involving suitable and high conclusion like goal programming.

Absolutely, presented model in this research analyze total section of authorized budgeting and it is expected to bring in the model the section detailed in the next research in order to improve substructures of budgeting with the goal approach. Answers of the model note that using mathematic and scientific approach will have important share in improvising budgeting system. It is suggested to use goal-fuzzy models, non linear models and analytic technique of covering data for assessment of budgeting system in the next studies.

Resources