

Ranking Mechanisms in Public Investment¹

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Abstract

Properly spending the budget on public investments is the main issue of public authorities. The investment projects sustained by the state are very important for the entire socio-economic life. This is the reason that put the selection process of the solution under question marks and suspicions.

A stable and honest rankings mechanism that is taking into account multiple socio-economic indicators and their social importance could be a solution. The transparency of the process and the implication of the contributors/citizens should be taken into consideration.

The paper presents the main characteristics of the public investments regulation and procedure in Romania and it focuses on three mechanisms of ranking the solutions for an investment project. The validation of the mechanism could be made using existing data by a panel of experts as further development of the research.

Keywords: *public investments, ranking, decision making, effectiveness, project management.*

JEL classification: M10, H57, H83

Introduction

Investing in the public sector is particularly important because it refers to many aspects of the socio-economic life. Through public investment, institutional capacity is developed in order to ensure a better relationship with citizens, to provide quality public services and to stimulate economy in different areas of interest or during difficult times. For this reason, the need to invest in the public sector is very high in relation to the financial availability of the state budget and its institutions.

Currently, the whole economy directs its decisions within the limits of the principle of rationality depending on performance criteria. Economic growth and

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diversification of socio-economic needs, in terms of limited, non-renewable or increasingly less accessible, and expensive resources, all of them lead to development of new solutions, and technological and behavioral shifts. Other pressing issues on investment decisions are environmental protection, infrastructure development, providing advanced techniques and technologies, and coming into the line with European and international quality standards, increasing the standards of living, sustainable development, and regional development.

The economic activity is given particular attention, as it is considered to be the main factor / engine of social development. The economic development and the results of the economic activity bring the improvement and development of the society as a whole. However, in this context, we must emphasize the importance of the socio-economic activities which are due to ensure social stability and social protection.

Meeting the individual and social needs is the rational nature of the economic activity. Thus an optimal balance between needs and resources establishes. The main objective of this balance is the proper and efficient use of resources in order to achieve the best results. An interesting aspect of the debate is that one of establishing the algorithm for evaluating the results and quality-quantity balance in the framework of the economic and social optimum. Knowing that consumption and investment are the two forms of using the labour result, an issue of the greatest importance concerning the public expenditure is how to establish a relation between the different types of the public expenditure. The difference between the two forms of using the owned resources is fundamentally in terms of their purposes. The role of the consumption is to meet the current needs, with immediate effects, and without any measurable effects on medium and long term, from a certain perspective. But they condition the smooth running of these systems and we can say they maintain the self-generation mechanism. Unlike consumption, investments produce effects within a long period of time. However they are great resource consumers, mainly financial resources, which they often withhold within average-sized periods of time (3 to 5 years during the implementation of the investment).

Unquestionably, an advanced socio-economic system cannot exist without making use of the two forms of using its resources, while establishing an optimal balance between them, for each period, is the main concern. It should be mentioned that an investment project has the role to drive and multiply its effects regardless the sector where it is implemented. Socially speaking, investment leads to improving the quality of life, protecting the environment, protecting the non-renewable natural resources, ensuring a climate of social security and providing quality public services.

1. Public investment – role and importance

Investments can be seen as a bridge between generations, both for creating jobs for the young generation, and for inheriting the fixed assets, which it receives

from previous generations. Also, investments are the material support for introducing the technical progress in all sectors of activity, while systematic updating allows maintaining them within the superior performance parameters.

The concept of economic sustainable development means both resource protection in terms of raw materials, and environmental protection and restoration of ecological balance in order to provide equal opportunities to the future generations. Any investment project has an environmental component on which the investment decision will be built³.

Public investments are defined as funds allocated by the authorities of the central or local public administration to achieve objectives or works of general interest in a certain administrative unit⁴. Public investments are designed to ensure the development of the society in general, seen as a whole. The effects of the public investments can be found in the social, cultural, health, science, public order, etc. fields.

Public investment funds are limited through budget restrictions, however consuming and exceeding the limits granted in the originally approved budget can be made only by obtaining additional allowances or by redistributing the funds within the budget.

The whole community benefits directly or indirectly by the effects of public investments because they are designed to improve infrastructure, relationships, and services, all of them being available to all citizens.

Due to the complexity, role and importance of the public investment in the economic and social development, the concept has been interpreted in different forms and has acquired different meanings:

- Economic - investment is all mobilized resources, necessary to complete it, in order to achieve a higher economic performance in the future;
- Financial - investment represents all costs incurred for creating items that will generate additional revenue for a long time in the future and whose depreciation will be made gradually, during the same period of time;
- Accounting - investment consists of all movable and immovable, tangible or intangible assets, acquired or produced to remain in the same form and that participates in several production cycles.

2. Specificity of public investments in Romania

Public investment has the particularity of being made of public funds. Due to that, public investment makes subject to the legislation on public procurement: Emergency Ordinance no. 34/2006, Law no. 337/17 July 2006, Law no. 128/5th

³ Negru Ionașcu, *Investment Management*, Perfect Publishing House, Bucharest, 2004, p. 7

⁴ Adriana Grigorescu, *Management of public sector investment projects*, course support, National School of Politic and Administrative Studies (SNSPA) in Bucharest

May 2007, Emergency Ordinance no. 94/26th September 2007, Decision no. 569/15th May 2008, Emergency Ordinance no. 143/28th October 2008, Emergency Ordinance no. 228/30th December 2008, Emergency Ordinance no. 19/7th March 2009, Emergency Ordinance no. 72/17th June 2009.

It is also known that each investment that aims at achieving certain objectives of constructing, procuring or developing technologies, developing activities of trade, education, health, public policy, is based on public or private financing projects.⁵

Public investments are done in four stages: preparation, implementation, operation and after-usage. Public investment projects involve three aspects during the course of their implementation, as follows:

- An operational aspect that is relative to its context;
- A technical aspect that is relative to the available technical solutions;
- An operational aspect that is relative to the involved costs and operational characteristics.

Establishing whether the implementation of a public investment project is advisable or not results from a complex process of analysis and synthesis, that includes: analysis of current situation, identification of public needs, analysis of existing problem, establishing the priorities related to the investment objectives, defining the general objective of the public investment project, defining the specific objectives of the public investment project, advising with stakeholders, organizing a public debate, determining the existence of technical and technological potential that is necessary to implement the investment project, determining the existence and availability of the human resources that are needed to implement the investment project, assessing the result at the completion of the public investment project and the taking-over possibility with a view to managing and subsequently operating it, including assessing the further operating costs, sizing the benefits from operating the accomplished investment.

To pass from the opening phase to the implementation phase of a public investment project, first of all one must determine whether technically and economically the accomplishment of the project is possible or not. This stage is reflected in drawing up a feasibility study.

The feasibility study is required when a number of important issues need to be clarified and alternative approaches must be taken into account. The purpose of the feasibility study is to check the basic assumptions, to assess the major risks and assumptions, to explore the possible approaches and to define which of these ones is the most appropriate for the project.⁶

The project feasibility is a phase during which they seek to demonstrate that the customer's requirements can be met through the project, following the identification and evaluation of the customer's options. He must motivate the

⁵ James K. McCollum, *Project Management - a practical approach*, University Publishing House, Bucharest, 2005, p. 283 and 285

⁶ Armenia Androniceanu, coordinator, cited work, p. 19

institutional authority that based on specific techniques and methods; he can decide whether to achieve the investment project or to abandon it.

3. Efficiency Indicators of public project investment

Strategies, represented by the goals of the public projects, are a need for local authorities which have the possibility to implement investment projects based on the following: election programs, making a poll of the public opinion, establishing a long- or short-term thinking, establishing the way forward so that the relationship authority - community can run in the most harmonious manner possible. Public investment projects provide a direct correlation between the fundamental objectives, which take the form of capital expenditure, which in their turn, lead to producing public assets.⁷

Also, to implement public investment projects, it is required to make a plan of the available financial resources, regardless of their nature, by splitting them into categories of goals that should be in line with the revenue and expenditure in the approved budget. Where there are differences from the planned targets, the public manager must take the necessary measures to improve the situation.

Particular attention is given to the relationship between the investment value and the value of the funding sources, i.e. the degree of ensuring financing sources for the investment.

The evaluation of the public investment projects shall be based on indicators of investment efficiency, of which we mention:

1. *Investment value (IV)* is the total amount required to achieve the public investment project, i.e. the necessary funds to mobilize all resources involved in the implementation and achievement of the desired results of the investment project.

2. *Operation outcome (OO)*. It is the change that the public investment project makes: increasing the production and service capacity, environmental protection, cultural development, creating better conditions to the citizens of the community. Due to the variety of forms that the effects which operating a public investment can take, this indicator is directly expressed, depending on the nature of the project.

3. *Investment lifetime (IL)*. Investment projects are implemented to meet the needs envisaged for a certain period of time. Thus, based on the regulations in force, different types of fixed assets, which can be components of an investment project, are provided with different operation periods of time. Investment lifetime is the period of time during which the manufacturer estimates that, if the operation is done correctly, the fixed asset will run under the technical and quality parameters provided in the data sheet. As the operation time passes, the fixed asset suffers physical aging. It should be noted that, alongside the physical aging, a moral aging

⁷ Peter Philip, *Local public administration management - a practical approach*, Economica Publishing House, Bucharest, 2007, p. 241, 244

also occurs, i.e. a technological depreciation of the fixed asset because advanced value engineering and technologies develop.

4. *Amortization period (AP)*. It is established by law and is the time interval during which the value of the investment is being payed-back out from the results generated by the fixed asset. The ratio between the investment lifetime and the amortization period should be bigger than 1 and as high as possible at the same time. It is appropriate to make a ratio between the moral aging time and the amortization period, which is desirable to be bigger than 1 and as high as possible at the same time. Not all expenses incurred during the implementation of an investment project are to be subject to amortization.

5. *Investment payback time (IP)* seems to be identical with the amortization period, but it's a different indicator because it takes into account the period of time during which all expenses made with a view to implement the investment project will be recovered from the operating results.

6. *Operating income (OI)*. It is the expression and quantification of the results obtained from operating the achieved investment. They can be cashing from from selling products or services, savings due to the existence of the investment, environmental benefits, quality of life or social impact.

7. *Operating expenditure (OE)*. It is the expenses that will be needed during one operating cycle of the investment. It must be sufficient in order to allow an optimal operation of the investment while keeping it at the set level. Regarding the public investment, there are situations when the investment neither require operating costs, nor generates income, and in this case the maintenance costs of the investment should be considered, as they can allow a longer duration of use, therefore an optimization of its operation.

8. *The operation benefit* is the difference between the effort incurred within an operation cycle and the effects corresponding to the same cycle of operation, i.e. the difference between income and expenses. Many public investments operate based on the non-profit principle.

9. *Cash flow (CF)* is the balance of cash flows arising from the implementation and operation of an investment project. The cash flow provides a detailed look on the sustainability of the public investment on medium- or long-term.

10. *The coefficient of economic efficiency (CEE)* is the ratio of the annual profit (benefit) resulting from implementing and operating the project and the investment value.

11. *Investment economic efficiency (IEE)* is the ratio of the results and the effort, but is materialized in the ratio of the profit (benefit) throughout the operation period and the investment value. One can calculate the gross economic efficiency and the net economic efficiency. The net economic efficiency is being calculated as the ratio between the total profit obtained after paying-back the investment effort and the investment effort itself.

12. *The cost of a job (CJ)*. Many public investments have a social nature; therefore highlighting the cost of a job creation may be a fundamental criterion in

selecting the investment projects. It is being calculated as the ratio between the investment effort (investment value) and the number of jobs created.

4. Proposed ranking mechanisms

Profitability is the ratio between EFFORT and EFFECT. Each of these two terms can have different expressions depending on the nature of the project and the socio-economic changes which it proposes.

To establish the investment priorities, we propose a three – dimensional system: a panel of evaluators, a set of criteria, and a number of projects necessary to be implemented. We consider the three coordinates as follows:

P_i = number of competing projects, where $i = \{1, 2, \dots, n\}$

C_j = number of evaluation criteria, where $j = \{1, 2, \dots, m\}$

E_k = number of members of evaluation panel, where $k = \{1, 2, \dots, q\}$.

Based on these three fundamental axes of the evaluation process, we propose two mechanisms to achieve the ranking so that the decision can be based on a multi-criteria integration. If a big amount of members are included in the evaluation panel, a polychrome vision will be offered (because the views of a large number of individuals, who were trained in different fields and present different levels of training, are included).

The scores double aggregated with the weighting criteria is the first proposed mechanism.

For set of the established criteria, the criteria will be allocated different weights depending on their importance in the decision making.

If S_j is the weight associated with criterion C_j , and for each criterion grades from 1 to 10 will be assigned, then the contribution of each criterion to the total score is Q_j :

$$(1) \quad Q_j = C_j * S_j$$

The aggregate score for each evaluator E_k , resulting from the contributions of all criteria, is the following:

$$(2) \quad Q_{tik} = \sum Q_{ij} = \sum (S_j * C_{ij})$$

To aggregate the scores, their summation Q_t or the weighted average MQ_t can be used.

$$(3) \quad Q_t = \sum Q_{tik} = \sum \sum (S_j * C_{ij})$$

$$(4) \quad MQ_{ti} = Q_{ti} / k$$

Thus each project gets a weight from 1 to 10, which will place it in a certain position in the list of priorities.

The successive peaks of the aggregated scores are the second proposed method. This method consists in calculating the aggregate score Q_{tik} for each evaluator E_k and for every project, and building a matrix as follows:

$$(5) \quad \left\{ \begin{array}{cccccc} Q_{t11} & Q_{t12} & \dots & Q_{t1x} & \dots & Q_{t1k} \\ Q_{t21} & Q_{t22} & \dots & Q_{t2x} & \dots & Q_{t2k} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ Q_{tyx} & Q_{tyx} & \dots & Q_{tyx} & \dots & Q_{tyk} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ Q_{tn1} & Q_{tn2} & \dots & Q_{tnx} & \dots & Q_{tnk} \end{array} \right\}$$

In the matrix above, the lines represent the scores obtained by a project from different evaluators, and the columns represent the scores obtained by the competing projects from each evaluator.

The list of priorities can be established by determining the successive peaks reported to the median of the scores. Mathematically, this may be expressed as follows:

$$(6) \quad \text{Max}_{1ik} = \max (Q_{tnk})$$

$$(7) \quad \text{Max}_{1ik} > \text{Med} (Q_{tnk}),$$

Where

$$(8) \quad \text{Med} (Q_{tnk}) = \Sigma Q_{ti} / i = \Sigma \Sigma Q_{tik} / i * k$$

$$(9) \quad \text{Max}_{2ik} = \max (Q_{tnk} - Q_{\text{max}_1})$$

The successive peaks which are bigger than the median scores obtained by all the projects from all the evaluators will be calculated.

By this method, uniformity by the second aggregation of the scores is removed and the projects that have registered the highest scores in the evaluators' views are to be selected.

However the limitation arises from the fact that the point of view of a single evaluator is practically considered essential. The number of projects which are bigger than the median may be small in relation to available funds and a project may taken into consideration several times, but this can be solved by means of an additional condition.

$$(10) \quad \text{Max}_{1ik} \neq \text{Max}_{2ik} \dots \neq \text{Max}_{nik}$$

The frequencies of occurrence of the aggregate scores are the third method of evaluation and ranking. This is done by calculating the aggregate score Q_{tik} for each evaluator E_k and matrix (5). The conversion of matrix (5) in a hierarchical matrix is the following:

$$(11) \quad \left\{ \begin{array}{cccccc} a_{11} & a_{12} & \dots & a_{1x} & \dots & a_{1k} \\ a_{21} & a_{22} & \dots & a_{2x} & \dots & a_{2k} \\ a_{y1} & a_{y2} & \dots & a_{yx} & \dots & a_{yk} \\ a_{n1} & a_{n2} & \dots & a_{nx} & \dots & a_{nk} \end{array} \right\}$$

where a_{nk} gets values from 1 to n in each column, based on the position where the project is placed in each evaluator's view.

$$(12) \quad a_{11} \neq a_{21} \neq a_{y1} \neq a_{n1}; \quad a_{1x} \neq a_{2x} \neq a_{yx} \neq a_{nx}$$

Thus one can determine the frequency with which a project is mentioned in the first choice of the evaluators, frequency on which the hierarchy can be established.

The calculation is to replace $a_{nk} \neq 1$ by 0 in matrix (11). Thus, matrix of frequency 1 (Mv1) is being obtained. By summing the terms of matrix (11) along the lines, we get a line matrix as follows:

$$(13) \quad \begin{array}{c} a_{1t} \\ a_{2t} \\ a_{yt} \\ a_{nt} \end{array}$$

Where $a_{nt} = \sum a_{nk}$

In this way, a project hierarchy is obtained, in descending order of frequency of occurrence in the evaluators' views.

Both proposed mechanism for ranking and selecting the best solution of a public investment could be easily used by the selection committee. At the same time the criteria used as indexes and their share must be carefully settled in order to avoid potential vicious of the result.

Conclusions

Although a very important issue, which should be addressed in a comprehensive manner, in our view, there are many forms of drawing up a list of priorities that has the three components mentioned before, as its basic structure: criteria, projects, and evaluators.

An interesting exercise would be to test the proposed mechanisms on real cases in order to check whether they lead to different results or not, and also to

make simulations for determining the optimal number of criteria and members in the evaluation panel.

Further development of the proposed mechanisms is to verify them using the information of already selected solutions by the public authorities.

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