



## USING COST-EFFECTIVENESS ANALYSIS AS A HELPFUL TOOL IN THE PROCESS OF REDUCING COSTS IN DEFENSE PROGRAMMES

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*“Cost-Effectiveness Analysis” is a method of economic analysis that evaluates the efficiency of indicators and highlights the results of a project. This analysis determines the most effective way to complete a project, being a helpful tool in the decision-making process in the initial phase of a procurement programme.*

*Four years after signing the agreement on the allocation of a minimum of 2% of GDP for the budget of the Ministry of National Defence starting with 2017, we are again facing a critical moment in the recent history, that of the Covid-19 pandemic. In this context, the decline in the economic growth, as a result of the drastic measures imposed against the spread of the virus, will most likely lead to further budget cuts. Through this article, our aim is to present the concept of cost-effectiveness analysis, as a useful method in the decision-making process and one of the necessary tools for the efficient operation of the investment resources in defence procurement programs.*

*Keywords: cost-effectiveness analysis; budgetary policies; acquisitions programmes; defence; economic crisis;*



## INTRODUCTION

Since 2008, the global economic crisis has influenced the defence budget allocations in most NATO member states. The reduction in defence spending, as a measure to combat the effects of the crisis, continued between 2010-2014 and had a negative impact on the commitment of member states to allocate at least 2% of the GDP to the defence sector. Since 2015, the economic situation has started to recover and the defence budgets have been increased again. In the case of Romania, in 2015, the parliamentary parties signed an agreement to allocate a minimum of 2% of GDP for the budget of the Ministry of National Defence, starting with 2017 and to maintain it for the next ten years. This political agreement has been an important step in the process of implementing defence programmes and increasing the operational capacity of the Romanian Armed Forces.

Four years after signing this agreement, we are facing again a possible future financial crisis. The drastic measures that have been imposed against the spread of the virus Covid-19 globally have also resulted in a slowdown of the economic growth. According to the scenarios presented by economists during this period, the economic effects could include recessions in the United States, but also in the European Union (Orlik, Rush, Cousin, Hong, 2020). In the case of the financial crisis of 2008, one of the measures taken for economic recovery was to reduce the military spending, and this affected the process of equipping and modernising the armed forces on the medium and long term. Thus, the multi-annual planning of equipment programmes could not be implemented and the procurement projects were postponed or cancelled. Based on the premise that a new economic recession will have a similar effect on the defence budget, we consider it necessary to propose methods or solutions by which the cost reduction process will have as few negative effects on defence resources as possible.

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*The concept of cost-effectiveness analysis, together with cost-benefit analysis, systems analysis, policy analysis, operational research, management science, as well as other disciplines aim to provide a constructive direction in the decision-making process. The term cost-effectiveness was not conceptualised and it was not perceived as an organised activity in the economic literature until after the Second World War.*

This article presents the *cost-effectiveness analysis* concept, one of the tools that help the planners to use the investment resources efficiently in projects whose benefits are not easily measurable in monetary terms. The cost-effectiveness analysis compares the cost and effectiveness per unit of a program, in order to determine whether the value of an intervention justifies its costs. It also provides measurements to classify and compare similar interventions or projects, whose results are similar (The World Bank). The implementation of this analysis model can be used as a planning, documentation and decision support tool. For its application, we will consider the field of defence as a product that is necessary for the public environment but whose outcome is not of a monetary nature. The purpose of this article is thus the general presentation of the concept of cost-effectiveness analysis as a method of identifying, in an unstable financial context, the defence acquisitions programs that are really necessary and effective.

### COST-EFFECTIVENESS ANALYSIS CONCEPT

The concept of cost-effectiveness analysis, together with cost-benefit analysis, systems analysis, policy analysis, operational research, management science, as well as other disciplines aim to provide a constructive direction in the decision-making process. The term cost-effectiveness was not conceptualised and it was not perceived as an organised activity in the economic literature until after the Second World War (Quade, 1971, p. 1).

In 1960, Charles J. Hitch and Roland N. McKean proposed, in *“The Economics of Defence in the Nuclear Era”*, an application of economic theory to the problems in the military defence sector, being among the first authors to address the concept of *“economics of defence”* (Hitch, McKean, 1960). Within the Rand Corporation<sup>1</sup> organisation, the two authors drew up several studies and reports on the administration of the state budget and the expenditures made in time of war and peace, but also on their consequences on economic growth. According to the two authors, setting the budget for defence is a responsibility

<sup>1</sup> RAND Corporation (Research and Development) is an American non-profit global policy think tank created in 1948 by Douglas Aircraft Company to offer research and analysis to the United States Armed Forces.

that often has to be assumed in difficult conditions and circumstances. Although in the 1960s the researchers did not yet refer to the concept of *cost-effectiveness analysis*, Hitch and McKean devoted several pages to the concept of *efficiency* used in military decisions. According to them, the allocation and efficient use of resources is no longer just an issue studied in economic theory, but also applies to military spending. Decisions taken in this area can be assessed as effective when the purpose of ensuring the highest possible level of security and defence is met under a limited budget (Ibid, p. 107). The above-mentioned paper presents an approach that we found in most recent works on cost-effectiveness analysis: quantitative analysis and calculation are less important in the process of military planning; it is essential to compare all available alternatives in terms of the objectives and the costs which it involves and to select the best one (using an appropriate economic criterion) (Ibid, p. 118). The elements of an economic analysis in the military field are thus the following: *objectives, alternatives, costs or resources, the model or the representation of reality and the selection criteria*.

We found a first definition of the concept in the work of Edward Schaumberg Quade, a researcher and mathematician at Rand Corporation. In 1965, he placed the term cost-effectiveness analysis in a military context and suggested that this type of analysis involves a comparison between different directions of action, which can be perceived in terms of cost and effectiveness in achieving a desired goal (Quade, 1965, p. 1). The purpose of this comparison is to minimise the cost implications of a mission's requirements (which cannot be measured in monetary terms), or, on the contrary, to maximise performance, subject to budgetary constraint (Ibid). Quade's approach is trying to find answers to questions such as: which aircraft should be repaired at the warehouse rather than at the base; what are the possible characteristics of a strategic bomber and whether or not it should be developed; whether the air force should replace the US land forces in Europe, etc. (Ibid). According to the author, in the sector of defence planning, the decisions made by experts working individually or in committees can largely depend on one's judgment and intuition. The particularity of the cost-effectiveness analysis consists in the fact



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*Similar to Hitch and McKean's conception, according to Quade, the method of cost-effectiveness analysis involves five elements: goals, alternatives, costs, model, criterion. The first and perhaps most important part of the analysis is to set the goals. The examination of defence strategies, the comparison and choice of equipment and technologies are carried out in order to achieve these goals. The alternatives are the means by which these goals can be achieved. For the analysis to produce concrete results, these alternatives must have the same specific functions.*

that it allows the systematic and efficient combination of the judgment and intuition of the experts from several fields, and the result transcends the individual level (Ibid, p. 2). The analysis operates with a model, which can be a mathematical equation, a computer program or a scenario, and this involves a communication process and allows participants in the process to make judgments in a concrete context and receive feedback or other opinions.

Similar to Hitch and McKean's conception, according to Quade, the method of cost-effectiveness analysis involves five elements: *goals, alternatives, costs, model, criterion* (Quade, p. 5). The first and perhaps most important part of the analysis is to set the goals. The examination of defence strategies, the comparison and choice of equipment and technologies are carried out in order to achieve these goals. The alternatives are the means by which these goals can be achieved. For the analysis to produce concrete results, these alternatives must have the same specific functions. Costs can be both monetary values (differences between purchase and operating prices), but can also be calculated as future opportunities or avoidable damages. The model means a representation of the real world, the purpose of which is to predict the costs of each alternative and the way each alternative can achieve the goal. The criterion is the rule by which the alternatives are classified and by which the most favourable option is chosen.

In the set of tools for better regulation proposed by the European Commission, *cost-effectiveness analysis* is included in the series of analytical methods to compare options or evaluate performance, together with cost-benefit analysis, multicriteria analysis or SWOT analysis. Cost-effectiveness analysis and cost-benefit analysis are two approaches to cost analysis in project evaluation processes. Although connected, they have distinct purposes and are operated in different ways. The first compares the costs of alternatives that produce similar results, while the cost-benefit analysis quantifies in monetary terms the costs and benefits of a project (Johnson, 2014). Both methods evaluate the monetary value of a project, program or policy. Cost-benefit analysis is more often used, but cost-effectiveness analysis has gained notoriety in recent years, and in some cases can be more intuitive. Both are used to assess the benefits of an intervention

in relation to its costs, but cost-effectiveness analysis is mainly applied when to the benefits cannot be attributed a monetary value.

Both types of analysis are very often used in the evaluation process of investment projects implemented with European funding (Ministry of European Funds, 2012). Cost-effectiveness analysis is usually applied in projects whose benefits are not valued in monetary terms, being often a characteristic of the programs in the field of health, education or environmental protection programs. Although the bibliography is limited in terms of describing this analysis model, we can list the following key aspects that are being evaluated in the European projects: time horizon, discount rate, types of costs, updated value of cost, incremental/approach, cost-effectiveness (Ibid, p. 9). The time horizon can represent both the projected duration of the investment and the economic life of the investment and its components (Ibid); the discount rate refers to the change in the value of money as it is invested over time (Ibid); identifying the types of costs involves evaluating the costs of investment, operation, maintenance, but also fix and variable costs (Ibid, p. 11); the updated value of the costs determines the additional costs generated by the extension of the time horizon of the alternatives (Ibid); incremental analysis is needed where alternative projects are competing and mutually exclusive, with the aim of classifying projects and choosing the most cost-effective one (Ibid, p. 12); the cost-effectiveness ratio represents “the result of dividing the current value of the total costs by the effects / benefits expressed in physical terms” (Ibid).

Following the above considerations, we can note that cost-effectiveness analysis is a suitable method for analysing defence investment programs because it can be used in selecting a project that brings benefits with the lowest costs to society (this being an important aspect in times of economic instability) and allows the efficient use of resources in sectors where the benefits cannot be easily capitalised from a monetary point of view (the benefits of modernising and equipping the army cannot be expressed in monetary terms).



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*In 1982, the Department of Defence conducted several assessments to determine the needs of the U.S. Air Force. In 1983, DoD considered the option to procure 210 C-17 aircraft, this number being reduced to 120 in 1990, for financial reasons. Initial cost and risk assessments proved to be incorrect. The tests performed did not demonstrate the reliability, expected performance and costs for the development of the C-17 continued to increase.*

## EXAMPLE OF COST-EFFECTIVENESS ANALYSIS APPLICABILITY

The following example represents the applicability of a cost-effectiveness analysis in one of the major defence procurement programs in the United States: *the C-17 Globemaster II military transport aircraft*. Although it is one of the most popular and widely used military transport aircraft, the program was about to be cancelled in the early 1990s. The decisions made at that time are an eloquent example of analysis methods in major procurement decisions. The research conducted by the Institute of Defence Analysis of the US Department of Defence reveals the methodology applied in making these decisions (Greer, 2010). In 1982, the Department of Defence conducted several assessments to determine the needs of the U.S. Air Force. In 1983, DoD considered the option to procure 210 C-17 aircraft, this number being reduced to 120 in 1990, for financial reasons. Initial cost and risk assessments proved to be incorrect. The tests performed did not demonstrate the reliability, expected performance and costs for the development of the C-17 continued to increase. This put the Department of Defense in a position to choose one of the options: continue the C-17 programme, despite increased costs and low performance, cancel the C-17 program and extend the life of the C-141, or find other solutions (Ibid, p. 3). The spending for this program has been postponed until the completion of a study in 1994.

Following the cost-effectiveness analysis conducted by the Institute of Defense Analysis, the development program for 120 C-17 aircraft was approved. The methodology used consisted of the following steps:

- identification of alternatives (to replace the C-141 aircraft fleet);
- setting requirements for the aircraft transportation (criteria and attributes);
- estimating the effectiveness of each alternative in military transport missions;
- estimating the total cost of ownership for each alternative;
- preparing cost and effectiveness information to facilitate decision-making;
- performing sensitivity analyses, as needed (Ibid, p. 5).

The final conclusions of the report showed that the performance and costs of the C-17 alternative classified it as the preferred military air carrier, being more resistant to air constraints than the C-5 alternative and being superior in efficiency and cost to the C-141. The next alternative in the ranking was a combined program with C-17 aircraft and other modified commercial aircraft. This solution proved to be very attractive in terms of costs, but its effectiveness seemed to be compromised.

The analysis applied in this case was necessary not only for making a decision on army development programs. The open process facilitated the transparency of decisions and the objectivity of analysts, with all parties involved being able to observe the evolution of results and recommend different approaches. At the same time, the analysis highlighted the similarities between the two preferred alternatives that have been considered for implementation, encouraging competition and having beneficial effects on costs and the government budget.

### THE RELEVANCE OF COST-EFFECTIVENESS ANALYSIS FOR THE ACQUISITION PROGRAMS IN THE ROMANIAN MILITARY ORGANISATION

In most European countries and NATO members, the governments' efforts to counter the effects of the 2008 financial crisis have conditioned the ministries to apply spending cuts. In the case of Romania as well, the defence budget has been affected, and the investment projects have been successively postponed. In the context of forecasting a new crisis, the lessons learned and the identification and selection of the procedures to make the cost-cutting process more efficient, should be applied so that the army equipment process is no longer interrupted or postponed.

We believe that the application of the *cost-effectiveness analysis* can be a helpful tool in the decision process regarding the alternatives to develop defence acquisitions programs. This type of analysis also allows the comparison and classification of projects according to the costs required to achieve the objectives.

A major feature of cost-effectiveness analysis is that only programs with similar objectives can be compared. The strategic objective



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of the defence policy for the period 2020-2023 is the modernisation and adaptation of the Romanian Army to the risks and challenges specific to the current geopolitical context, as well as strengthening Romania's relevant strategic partner profile within NATO, EU and US (Document-sinteză). We have thus identified three levels at which this tool can be applied: the general goals analysis, the analysis of goals of the specific investment projects, the analysis of the procurement method (classical or other alternatives). The general analysis is performed around the common objective of equipping the Romanian Army with modern equipment, capable to face the current challenges. A premise in this case is that, in the efforts to prioritize the equipment programs, we must take into account those characteristics that can lead to the achievement of this goal. The acquisitions programs of new and modern defence equipment could be more efficient than maintenance or modernisation programmes. At the project level, cost-effectiveness analysis must be performed for each military sector.

Currently, according to the Armament General Directorate, the priority equipment programs in the preparation phase are:

- C4ISTAR capabilities;
- Integrated surface-to-air missile system;
- Revitalization and modernisation of IAR 99 aircraft;
- UAS (Unmanned Aerials Systems);
- Portable anti-aircraft missile system with short and very short range.

The investment of resources could be optimised by periodically performing analysis for the programs in the preparation phase, so that, in the case of the old postponed or interrupted programs, to determine whether the alternative of their continuation is advantageous or if other solutions could be found, depending of the evolution of the results. For example, the SHORAD-VSHORAD air defence systems have been on the priority list of the Ministry of National Defence since 2009. Cost-effectiveness analysis for this program, but also for other programs in preparation for many years, could determine the aspects that make the acquisition process difficult and could lead decision-makers to look at viable alternatives. At this level, the analysis will be performed following the goals of each sector and the equipment

needs specific to each type of force. With regard to the procurement method, its effectiveness should be established by comparing the traditional procurement method or using a public-private partnership.

The budget allocations for the Ministry of National Defence must be determined according to the National Political Agreement to increase the funding for defence. This agreement states that the budget should be increased to 2% of GDP and maintained at this level for at least 10 years. In these conditions and starting from the assumption that the budgets will be affected again by the economic crisis, the efficient investment of resources is a first step in supporting and implementing viable equipment programmes.

We consider that conducting such an analysis on a major equipment program and publishing its reports or conclusions would have many advantages: setting a precedent and improving decision-making, stimulating decision-makers to create debates, receive recommendations and inform about the evolution of results, transparency and increasing the level of trust in procurement processes, encouraging competitiveness.

## CONCLUSIONS

The type of analysis presented in this article can be performed, as in the example of the mentioned program for the American Air Force, by multidisciplinary teams of experts. By presenting studies and techniques and bringing to attention alternative methods of evaluating and choosing options, we can draw new directions on future programs in the field of military equipment.

In the decision-making process, aiming to spend the resources in the most efficient way possible, the monetary value of various programs will be frequently compared. Sometimes, such comparisons can be based on limited information, and one of the advantages of cost-effectiveness analysis is to create an informative and evidence-based context. Together with careful planning, adequate resources and transparency, this method of analysis can be a very helpful tool in preparing and making a decision (Johnson, *Ibid*).

In a long-term perspective, in addition to the classic equipping programs, we should look also to the necessity of developing



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some programmes capable to address new types of challenges, for example UAV capabilities or the implementation of artificial intelligence. The documentation of the alternatives, establishing and planning the resources, together with analysis and transparency in the decision-making process, would represent an innovative approach and a focus on achieving efficient equipment programs and efficient investment of resources, which can be so often limited.

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