Evaluation as a Decision Support System: an Interactive Multicriteria Approach

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At the moment in Italy only a few public resources are devoted to improving the quality of project evaluation.

The increasing interest in programming and in plan evaluation provides a new perspective on project evaluation as a stage in the planning process.

The evaluation of plans is concerned with the "macro" impacts of public expenditure on general, sectorial and territorial objectives, whilst project evaluation deals with "micro" effects, integrating the economic and financial ones with those provided by different sectorial analyses in a multicriteria approach.

In such a context, project evaluation will be fully reliable and can play a major role in the decision process. In showing this, we will refer to current research, undertaken in co-operation with the Italian Ministry of Cultural and Environmental Goods, in which the suggested approach is tested on the budgeting system of the Ministry itself.

The work shows in particular the interactive technique of multiobjective mathematical planning used for the programming expenditure on the basis of a linear programming model of the decision problem.

An interactive multicriteria approach, employable for discrete decision problems, is proposed for the budgeting stage.

Interrelation between decision-maker and analyst in the evaluation process

In the planning process, evaluation is presented as a continuous action that involves, simultaneously, on one side technicians and analysts, each with their own specific professional competencies, and on the other side decision-makers.

Analysts have the duty of singling out and describing the complex impacts connected with each decisional alternative and, then, the duty of presenting to the decision-makers a well-structured account of the decisional problem. Decision-makers, through an interactive procedure, acquire a deeper knowledge of the decisional problem and through their choices, they explicate the "value judgements" they are holders of, sometimes unawares.

The characterising and crucial stage of the evaluation is the one requiring the formulation of the value judgements necessary for comparing the desirability of the different options of choice, therefore, the person really making the evaluation is the decision-maker, since only his value judgement (the trade-offs among competitive objectives) can be incorporated in the decisional process.

The evaluation process, and the consequent interrelation between decision-maker and analyst, has to be adapted to the specific characteristics of the planning process. A "plan" is something quite different from a "project" and consequently plan evaluation is quite different from project evaluation.

The project is the instrument through which predetermined objectives are realised. It is the plan that defines these general objectives and indicates the main instruments available to realise them on the basis of foreseeable

interrelations among objectives, among instruments and between objectives and instruments.

The plan defines, then, the "environment" within which a project can be evaluated, without "the plan", project evaluation becomes a much more uncertain process, having to refer to many alternative environments based on different hypotheses concerning the relative importance of competing objectives, and concerning the availability of the alternative instruments (projects).

Limitations in the current project evaluation procedure

Before discussing plan evaluation we will briefly restate the main methodological limitations of project evaluation, limitations which, at least in the current Italian experience, contribute to shifting the emphasis from project evaluation to plan or program evaluation.

The need to value and compare many projects, relative to different social-economic and territorial sectors and contexts, within an assigned budget, may cause negative effects on the same procedure or economic evaluation. The problem is that it becomes necessary to:

- consider every micro and macro economic effect connected to each project;

  express these effects in only one dimension, money, so as to single out just one main indicator for comparing all different projects.

Criticism of cost-benefit analysis, in particular directed against the construction of a single indicator and its use to arrive "technically" at the choice of the projects to finance, are well known. Among them are:

(i) the employment of complex shadow-prices that make the analysis less transparent for political decision-makers;

(ii) resort to operational short cuts, such as conversion factors[1], for arriving at "economic-social" values, in this way, useful information about the distribution of benefits and costs between the different social groups affected by the project, gets lost;

(iii) the need to extend this single-criterion evaluation to "intangibles" too, because of the increasing importance of objectives concerned with environmental protection, cultural goods conservation, equity, etc., inside socially important decision problems.

(iv) the presence of several decision-makers further reduces the informational content of the single indicator and its possible function in determining the decision in addition to the reduced transparency for the single decision-maker, there is lack of meaning for the different decision-makers, each one with his own objectives and priorities that are unlikely to be represented by the same indicator.

Difficulties encountered in applying these evaluation procedures, and the limitations inherent in the evaluation techniques used, have certainly been important in shifting the emphasis from project to program evaluation, at least in the Italian case.

Project Evaluation in the Cultural Goods Sector

The shortcomings indicated in general connected with the use of Cost-Benefit Analysis in project evaluation become particularly evident when applied to the cultural goods sector. For the sake of

[1] "Conversion factors" allow transition from market price values to economic values, separating transfer payment from real resources. This operational short cut, however, can produce distorting results: the economic cost of skilled labour, for example, is reduced more (because income-tax incidence is more elevated) than that of unskilled, probably unemployed.

example, we will refer to a specific type of cultural good, that is, single buildings or groups of monumental architectural value.

The interventions involving this type of cultural good pursue, sometimes singly but more often combined together, different levels of objectives which could be defined thus[2].

(1) safeguarding, carried out through a system of:
  1.1 prevention
  1.2 indirect protection
  1.3 direct protection

(2) collective use

(3) familiarity with the heritage (and awareness of its value)

(4) research and innovation.

The necessity to pursue such objectives springs from a social demand which might be articulated as follows:

(*a*) a demand for preservation, which expresses the will of collective society to preserve the good for the sake of its "intrinsic value";

(*b*) (1) a demand for general formation, in which the good, through use as a museum, library, records office, congress centre, or for temporary exhibitions, etc., acquires a central role in the satisfaction of a basic need of individuals and society as a whole;

(*b*) (2) a demand for recreation, linked to the previous point but with a different emphasis and motivation, connected with leisure, travel and spare time activities in general;

(*c*) a demand for specific formation, connected with the desire for a deeper, though not highly specialised, knowledge; such a desire leads to a demand for exhibitions, congresses, specific publications, etc.;

(*d*) a demand for research, on the part of professional operators in the sector;

(*e*) a demand for individual consumption (or investment) where the cultural good is required in order to satisfy individual needs, precluding consumption of the good by others.

In the first four types of demand described the cultural good assumes the nature of a public good (with no rivalry in its consumption); the problems connected with the assessment of a demand function and the calculation of the benefits are therefore complex.

In the final example, on the other hand, this task is simplified by the greater volume of data supplied by the market; for example, in the case of utilisation for public functions which could also take place in buildings of less monumental interest, the production costs avoided may well represent a valid indicator of the recovery benefits.

The benefits associated with demands of fruition of type (*a*) are the most difficult to quantify; since they prove crucial in determining whether or not to carry out a certain plan of intervention, they are assessed in the same way as "merit goods"[3]. The benefits derived from the demand of type (*d*) are also difficult to quantify, since their impact is less noteworthy than that of the type (*a*) demand, they are frequently assessed only qualitatively.

In the applications of cost-benefit analysis, the maximum emphasis is accorded to benefits connected with the

[2] For a more complete illustration of the possible systems of objectives for a cultural goods policy, see AA.VV. Formez. (1992).

[3] Following the detailed discussions to which it gave rise, the initial definition of Musgrave (1959, page 13) could be rewritten thus ".... they become public needs if, on the basis of the preferences of the public decision-maker, they are considered so meritworthy that their satisfaction is guaranteed by means of the public spending budget beyond the quantity offered by the public market and paid for by private buyers. Their satisfaction implies an interference with the principle of the sovereignty of the consumer."

demand of type (*b*) (2), which are easier to quantify; a similar assessment is used for benefits associated with the demand of type (*b*) (1).

The benefits connected with the demand of type (*c*) are generally quantified, for a minimum part, in a similar way to saleable services (catalogues, entrance fees, etc.). For the rest they are treated like those connected with type (*d*).

The demand of a "recreational" type is generally measured on the basis of the number of visitors. To express the number of visitors in terms of social benefits it is not sufficient to refer to the income from entrance fees, since these take into account neither the greater benefit for the visitor, represented by the "consumer's surplus", nor the benefit for collective society in terms of added value with respect to the total outlay of the visitors.

The gross "consumer's surplus" (including entrance fees) and the social benefits in terms of added value are usually expressed as a function of the total expense the visitor incurs in order to benefit from the service.

This expense includes costs such as transport, lodging (if necessary) and differential costs of meals; catalogues, souvenirs etc., and proves to be a function of the distance travelled, the income of the visitor and his motives. It is clear that such an assessment procedure is based on the "demand for recreation", and, in particular, on the "travelling expenses" method[4], extended to include the added expenses incurred by the visitor for lodging, board, entertainment, etc., at the destination visited[5].

For each type of demand, as well as the "effective" demand for direct benefit such as the recreational demand for the visitors described above – it is possible to establish an "optional" demand to which a "non-use value"[6] may be associated for collective society. Above all with regard to environmental and cultural goods of a particular worth – and therefore not easily replaceable with other goods of similar utility to society, the non-use value of goods may be defined as the "value which indivuduals attribute to the mere awareness of their existence, even when they know for sure that they will never have, or avail themselves of, the opportunity to experience them directly"[7]; in the same way, the "potential" demand is a demand for future benefit possibilities by those who do not expect to enjoy them in the immediate future but who do not want to forego the opportunity of enjoying them in a more distant one[8].

Even if a large proportion of the public interventions in favour of the preservation and formation of the environmental and cultural heritage has been justified on the grounds of the "optional" value, that is of the benefits for non-users, it is difficult to quantify this value in monetary terms; in general the good which is the object of a public intervention is considered, with a political choice, as a "merit good" (and in this way the problem of quantifying the demand is avoided) or, more conveniently, the benefits associated with the optional demand may be considered as a residual value, a

[4] This method, proposed by Hotelling in 1947, was adopted for the first time by Clawson (1959). The assessment procedure adopted at present in Italy for exhibition activities attracting an affluence of tourists allows for a calculation of the benefits on the basis of a visitors' shadow price (10,000 lire per visitor) and the tourism expenses (established at 95,000 lire per day) incurred by them, without including the opportunity-cost of the services purchased.

[5] On ways to render the assessment of tourist expenses in different situations more articulated and closer to reality, see N. Liechfield ..... MBCA-ICOMOS (1992).

[6] The non-use value was introduced for the first time by Krutilla with reference to environmental goods (cf. Krutilla (1967).

[7] Cf. Krutilla J. V., Fisher A.C. (1975). page 124.

[8] On this subject see, among others, Muraro G. (1984).

threshold for the justification of the project, with respect to those calculated for the effective demand.

Among the methods most commonly used for the assessment of benefits, we can remember the interview method (survey by samples), the reference to prices paid for similar recreational services, and pro-capita expenditure in the sector.

In CBA, in conclusion, the quantifiable cultural benefits are only those derived from the effective demand of direct benefit from the cultural good, therefore the emphasis in the project phase must necessarily be placed on the objective of direct collective utility rather than on that of indirect or potential benefit connected with the safeguarding objective.

This approach to assessment is over-favourable to those areas which are already established as the principal tourist attractions, attributing to tourism for culture also that part of tourist traffic which has different objectives (business, pleasure, the enjoyment of other cultural goods, etc). In the case in point, the enjoyment of the cultural good should be considered a coproduct of the visit, together with the other reasons for the trip[9].

Some of the limitations we have pointed out in the use of cost-benefit analysis find a partial solution in other assessment methods, these are in any case included in the wide range of techniques of which also cost-benefit analysis is one: financial assessment, social financial assessment[10], the Adep method[11], Community Impact Analysis (CIA)[12].

In particular, CIA distinguishes between the "effects" and "impacts" of the project. The former are the physical and natural changes resulting, directly or indirectly, from development, these changes do not of themselves require an identification of incidence on particular people. The latter do require such identification for they are the end product of those "effects" on the way of life of the people who are "impacted" CIA attempts to take into consideration all the relevant impacts on the objectives of all the groups of operators constituting collective society (even if the costs and benefits of these cannot be expressed in monetary terms).

CIA, therefore, may be considered one of the family of multicriteria techniques. Another one of the most interesting approaches of the latter type is the "Generalised Regime Method" proposed by Nijkamp[13], with which it is possible to deal with information of both a quantitative and a qualitative type. In the following paragraphs we shall illustrate in more detail two multicriteria approaches: the first may be used in continuous problems, the second in discrete problems.

An Approach to Program Evaluation

The role of project evaluation in the decision making process could be preserved by a proper definition of the decisional procedure, and by the use, at each stage, of decision support techniques which best meet its specific demands.

[9] A proof of the need to diversify the hypotheses regarding the expenses incurred by visitors as a function of the characteristics of the specific object, seems to be offered also by a recent survey conducted for Italy by the Ministry for Environmental and Cultural Goods and by Formez (Cf. A. Di Maio (1992).

[10] We will discuss this technique in the following paragraph 6.

[11] The Adep method. "Analyse de la Dimension Economique du Patrimoine Monumental" was developed by R. Lemaire and C. Ost. commissioned by the European Parliament in 1984. While cost-benefit analysis is confined to assessing and comparing investment projects. The Adep method aims to evaluate the economic benefits which can be imputed to the existing cultural heritage.

[12] Cf. Lichfield N. (1985). (1988).

[13] For an illustration of the method and its applications to problems of preservation and development, see, among other works, E. Hinloopen and P. Nijkamp (1986) and P. Nijkamp. H. Voogd (ed. L. Fusco Girard) (1989).

In illustrating this, we will refer to a current research, made in co-operation with the Italian Ministry of Cultural and Environmental Goods, in which the suggested approach is tested on the budgeting system of the Ministry itself[14].

The main duty of the budgeting system is to divide the financial resources of the Ministry among the specific basic activities around which the budget is structured in order to realise the "best compromise" among the pursued objectives.

With this aim, the programming procedure has been articulated in three stages, concerning respectively:

* the definition of general objectives to be pursued in the long period (planning stage),
* the formulation of medium term programs, and quantification of the financial resources available, within the global budget, for their achievement (programming stage),
* for each program and in the limits of its budget, allocation of financial resources to specific projects (budgeting stage).

Specific decision support techniques can be devised for each stage. In particular, planning is the most difficult to model because it requires decision to be supported predominantly on political-strategic considerations. The most suitable techniques have to be singled out according to the specific problem; but in any case, subjective elements will prevail even if decision making is supported by the analytical results achieved in the two following stages (of programming and, in part, of budgeting).

Programming involves decisions about the amount of resources to be assigned to the different elements in which the program has been articulated; this choice can be based on the medium effects generated by the resources devoted to each element; the effects, at least for "ordinary and marginal" projects, can be regarded as independent of the specific projects which will be achieved (which is the decision concerning the third stage of budgeting).

Thus the problem can be represented by a linear model and can be handled with techniques of mathematical programming (in this specific case, with multiobjective interactive techniques).

In the case of the Ministry in question, the decision problem has been articulated in three main blocks resource allocation on (1) national, (2) regional and (3) local levels. Each decision-making stage concerns different categories or subcategories of the program and, therefore, the effects of the choices are effects on different social groups. It is these that constitute the different objectives on which policies impact.

To represent the decisional problem by means of a mathematical model it was necessary to formulate the objectives in operational terms. In order to do this, decision criteria were adopted which could represent in the best possible way the general objectives pursued. While at the same time easily available quantitative data was used (taken, where possible, from official statistical sources). The objectives described within the single models answer this double requirement, in that they are easy to quantify and able to represent a convenient "proxy" for more general decisional objectives (such as those described in paragraph 3 above).

The decision criteria used in the model concern "macro" effects determined by the spending of resources allotted to the various elements of the program; these effects are not likely to be much influenced by the specific aspects of the project which this expenditure concerns.

The decision support system is an interactive one and, therefore, it alternates between the calculation phase

[14] See Esposito E. and P. Rostirolla (1992).

and the decision phase; it seeks to define that solution (if it exists) which represents an acceptable compromise in terms of achievement of the different objectives, and it facilitates the identification of the implicit weights given to each objective within the solution.

At every step the program provides a new non-dominated solution to the decision-maker and its description in terms of values taken from the objectives, of the shifting from the optimal values feasible at that step, of the weights assigned to the objectives.

The decision-maker is asked if all the objectives are at a satisfactory level; if so, the suggested solution represents an acceptable compromise and the program ends; if not, the decision-maker has to indicate which objective is at an unsatisfactory level, and the minimum thershold of acceptability.

The program considers a new proposal with respect to the additional constraint introduced by the decision-maker and starts a new step of interaction.

At each stage of the decision-making process, the employment of this technique allows the calculation of the mix of actions which achieve, in an acceptable way, the mix of objectives pursued by the decision-maker, within those considered by the analyst, with respect to all the constraints imposed on the problem.

Employing the procedure in an iterative way, it is possible to test impacts of different choices on the program structure upon the levels at which objectives are achieved, upon realisable assets, upon resource requirements, etc. In this way the content of the strategic plan (the mix of objectives and instruments) and that of the tactical one (the program as an instrument for achieving the contents of the strategic plan), are developed at the same time.

Summing up, each step of the procedure is supported by a Multi Criteria Decision Making model; these models can be defined as:

* continuous: if admissible solutions exist, they are infinite;
* multi-person or multi-committee; since it is impossible to assume unambiguous and a priori known trade-offs, evaluation methods reflect this;
* multi-step evaluation procedures; flexibility for dynamic preference articulation and bargaining must be ensured; in our case flexibility is obtained by the iterative use of interactive models;
* hard information user; all information must be quantitative; qualitative information has first to be transformed into figures.

In decision problems of the kind we have referred to, continuous, deterministic and interactive methods may be preferable to those based on a multiattribute utility function because of greater simplicity, lack of implicit value judgement and transparency to the decision-makers.

Project Evaluation

After singling out resources to assign to each element of the program, based on the effects on the different "macro" objectives pursued, the next stage of budgeting requires the choice of the specific interventions to be adopted within that budget.

Project evaluation concerns projects within the same program element; they therefore have homogeneous "macro" effects. These effects have already been taken into account in the programming phase when determining the level of resources to assign to that program element. Project evaluation can thus concentrate on the more precisely "micro" aspects of the projects, that is, those connected to the technical, economic, qualitative, cultural, etc. peculiarities of the single project.

Within this approach, project evaluation is remarkably simplified, because it consists essentially in an accurate description of project impacts

on every possible decision-making criterion, important to the micro level. Impacts which are more immediately quantifiable in economic and financial terms can be dealt with by using the usual instruments of financial analysis or cost-benefits analysis; in this case, the use of cost-benefit analysis proves to be greatly facilitated by the reduced necessity to resort to shadow prices, otherwise needed for the assessment in homogeneous terms of macro impacts. The other impacts will require the employment of different measurement units, and the resort to other multi-criteria techniques.

In the application to cultural goods, mentioned above, the choice among projects is supported by a multicriteria interactive technique (MIP, Multicriteria Interactive Programming)[15] that allows us to manage a large quantity of information and to select, if they exist, solutions in which the compromises among different objectives that are considered important to that decision-making level are acceptable to the decision makers.

The MIP program is a Decision Support System for discrete multi-decision-maker problems. Decision makers are called upon to make a choice among a plurality of projects envisaged in a medium and long-term Plan in order to single out those projects they want to include in the implementation program for the short term.

Each project is described by its impacts upon objectives that the several decision-makers involved in the process are likely to pursue, though with different priorities. Being information of a "mixed type", qualitative data measured on a nominal or ordinal scale are to be transformed into cardinal information.

In the procedures of public investment analysis a decisive importance is usually attributed to economic analysis (cost-benefit analysis) while financial analysis is considered as integrative information, that is, merely an input to the economists.

Financial analysis gives results based only on the cash-flow of the operator who will manage the investment; financial analysis fundamentally aims to avoid embarking on projects for which the funds would not be forthcoming.

This does not imply that a positive net present value is required in financial terms, because if that were so, the project could be financed on the market instead of out of public resources.

The fact of limiting the analysis only to the public agency that must carry out the intervention, instead of extending it to all the other operators interested in it – making it a social financial analysis – is certainly a failing in the current procedure.

The cost-benefit flow, both financial and economic (the latter derived from the former or calculated with other procedures) would be articulated depending on the "homogeneous group" that gains or loses from it.

The making of such a cost-benefit budget distinctly for those economic ones and those financial ones, each one for each homogeneous group interested in the project, makes it possible to verify the individual interest of each group in the achievement of the project.

This verification, besides possible motivations concerning problems of equity, is important for forecasting their participation in or opposition to the foreseen project effects.

As a matter of fact, obtaining maximum net social benefits does not ensure the feasibility of the proposed project, because collectivity as a whole is an empty entity, scarcely if at all represented in decisional groups. Feasibility requires to know how benefits

[15]For an example of the MIP procedure applied to a different decision problem, see Esposito E., Rostirolla P., (1989a).

and costs are allocated among different operators in order to consider measures of mitigation or compensation (e.g. incentives, tariffs, etc.) able to reduce oppositions to the project.

In a market economy with highly decentralised decision making, individual interest is the "conditio sine qua non" to obtain from the project all those expected effects which constitute the social profit. It is not a problem of equity but only one of feasibility in a market system and, therefore, of efficiency.

Special attention to the analysis of financial flows is required because, in a market economy, budget constraints may press heavily on both private and public operators. These constraints prove to be particularly pressing in the cultural goods sector where the majority of the financial benefits are "external" to the operator generating them.

To consider the economic and financial effects of the investment separately for each socially and economically important operator does not involve much extra information management. In fact, to achieve overall values, it is necessary to arrange each elementary cost and benefit which contributes to it; therefore further analysis is not required, because the elementary items are unchanged.

The difference consists in keeping distinct, for each important homogeneous group of operators, the different items of benefit-cost until the final aggregation of the different budgets. Such a task can easily be performed with the support of a simple procedure of automatic accounting, based for example on electronic sheets.[16]

Some Reflections on the Evaluation Role in the Cultural Goods Sector

Within the described approach, the "evaluation" of the project no longer coincides with its "economic evaluation."

Nowadays economists are often pressed to evaluate "intangible" costs and benefits, if possible by applying generalizable criteria which would facilitate comparisons with any other economic evaluation inside the same project area or even with those in quite different areas.

This task cannot be accomplished completely and, anyway, it concerns theoretical research more than effective planning problems. If the decision problem has been well formulated, a more useful support to decision making could be derived from a qualitative-quantitative description using an instrumentation and a scale of measurement different from the economic ones but able to show accurately the aesthetic, historic, etc., value judgements of the analyst. These aspects can be committed to experts of the specific disciplines interested in them so that they can be analysed with the most suitable instruments; in this way the multidimensional nature of the multiobjective decision problem is completely recognised and the resort to multicriteria evaluation techniques is fully justified.

[16] In exemplifying it, we can refer to a generalized procedure, called "Metodo FORMEZ" (edited by P. Rostirolla), aimed at facilitating that analysis at a disaggregated level. It is supported by two "standard schedules" which are systematically linked to each other.

The first schedule concerns the public operator, directly responsible for the management of the proposed project, as well as the total aggregate of all the effects relative to each operator interested in it. It provides an articulated analysis of all the effects concerning the "public operator" and reports, in a more concise way, also the effects relative to all the other operators which contribute to the calculation of the total aggregate.

Based on the same cost-benefit structure employed for the public operator, the second schedule presents an articulated analysis of effects relative to the single operator (or homogeneous group of operators) in order to calculate his budget in terms of discounted net benefits.

Results given by the different schedules of the second kind provide the input for the first schedule; in this way data relative to each operator are articulated in a homogeneous way and the overall social balance sheet is derived in a consistent manner.

In this context, the economist can be asked to contribute to the correct definition of the decision problem, as well as the fulfilment of his usual job concerning the identification, forecasting and evaluation at market prices of the economic impacts connected to the decision.

The described approach to evaluation is, therefore, designed as a decision support system which provides the decision-maker with structured information on the problem which is, as far as possible, neutral (i.e. it contains no value judgements that have not been expressed or formally accepted by the decision-maker), transparent (understandable by a non-technician) and easy to read (not time-consuming).

The decision-maker acquires a deeper knowledge of the decision problem through this interactive process and, through its choices, makes explicit his "value judgements" on the relative importance of objectives; he is the origin of such judgements but, usually cannot make them until he knows the frontier characteristics of the feasible solutions.

It is not true that the political decision-maker is not able to accomplish that task of "evaluation" if the analyst has done his work well in providing him with useful information.

On the contrary in theory and in practice, there are a lot of evaluation techniques tending to single out choices, depriving the decision-maker of his institutional duty or, as often happens, carrying out a merely justificative role for decisions already formulated.

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