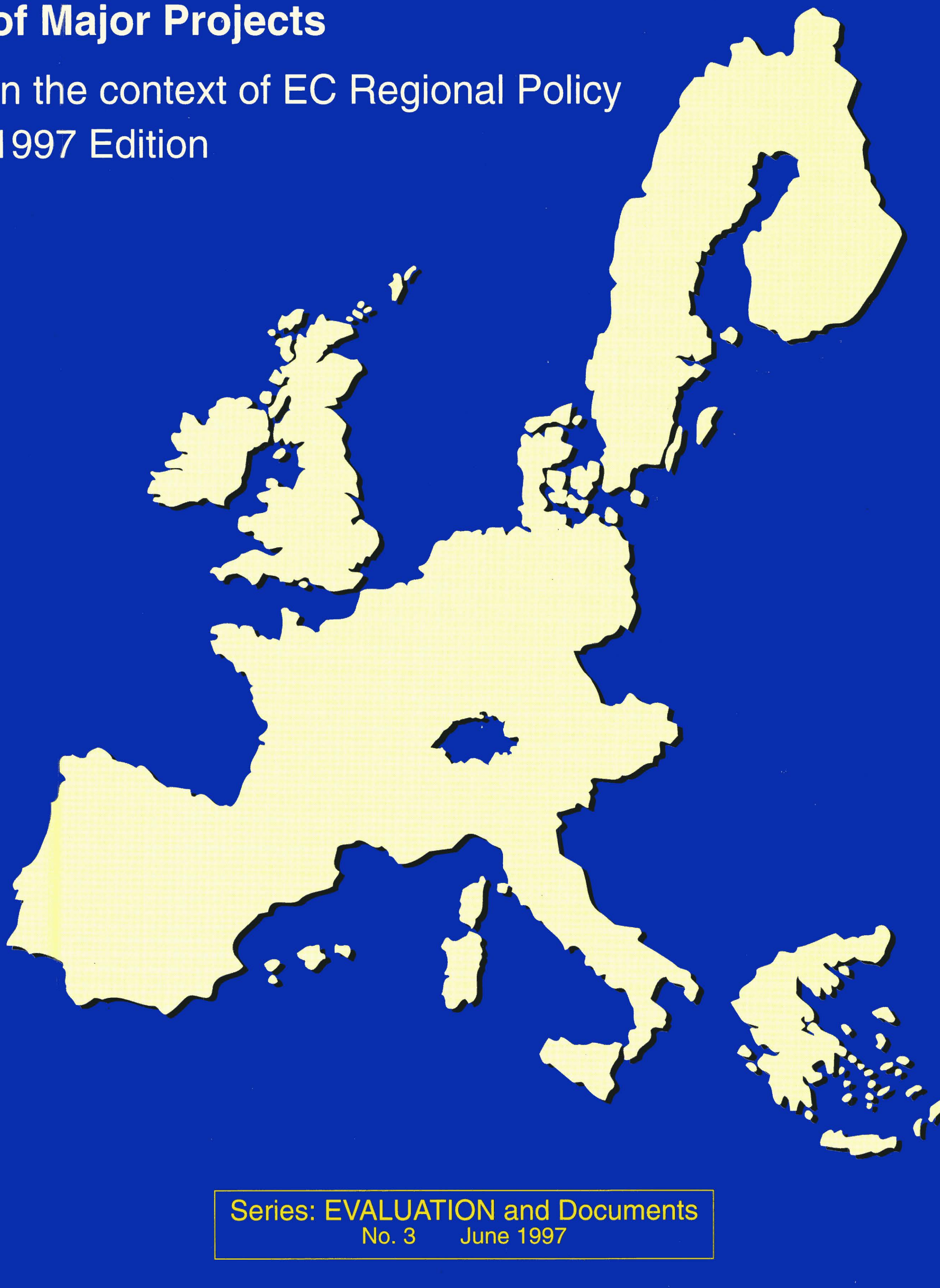
EUROPEAN COMMISSION
DIRECTORATE-GENERAL XVI
REGIONAL POLICY AND COHESION

Guide to Cost-Benefit Analysis of Major Projects

In the context of EC Regional Policy
1997 Edition



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IMPORTANT NOTE

This guide is a follow up to a previous version. It is an initiative of the Coordination of Evaluation Unit, Directorate-General XVI Regional Policy and Cohesion, European Commission. The guide is prepared by Prof. M. Florio. It aims to offer an agenda for the appraisal of costs and benefits of major projects under Structural Funds and Cohesion Fund financing, in the context of EC regional and cohesion policies.

The current version offers an entirely new section with specific suggestions for project analysis of different kinds of infrastructures and productive investments.

The economic, political, administrative and legal situation in different Member States and in different regions and sectors may influence issues and techniques of project appraisal. The methods and examples given in this guide cannot be transferred without careful adaptation to individual cases. Nevertheless, the guide draws from a standard body of project appraisal techniques and from wide international experience. Thus the guide offers useful indications for the cost-benefit analysis of major projects proposed for financing by Structural Funds and Cohesion Fund.

The Coordination of Evaluation Unit working group received useful feedback and suggestions from a number of Commission units, from participants in seminars where the guide was presented and discussed, and from independent experts. Further suggestions are welcome.

DG XVI: REGIONAL POLICY AND COHESION
Coordination and evaluation of operations
Coordination of evaluation

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APPENDICES

Acronyms

CBA	Cost Benefit Analysis
CF	Cohesion Fund
CIF	Cost, Insurance, Freight
CSF	Community Support Framework
DG	Directorate General
EAGGF	European Agriculture Guidance and Guarantee Fund
EC	European Commission
EIB	European Investment Bank
ENPV	Economic Net Present Value
ERDF	European Regional Development Fund
ERR	Economic Rate of Return
ESF	European Social Fund
EU	European Union
FIFG	Financial Instrument of Fisheries Guidance
FNPV	Financial Net Present Value
FOB	Free on Board
FRR	Financial Rate of Return
GDP	Gross Domestic Product
IRR	Internal Rate of Return
SF	Structural Funds
VAT	Value Added Tax

Introduction

The analysis of the socio-economic costs and benefits of major projects is explicitly requested by the new EC Regulations governing Structural Funds (SF). Such an analysis is also required by the Cohesion Fund (CF) Regulation, regardless of the size of the project co-financed. In the expectation that Member States will take the responsibility for prior appraisal and provide the Commission with the relevant information, the Commission itself should in turn carefully assess the quality of such an appraisal.

This guide

This guide offers Commission officials, external consultants and any other interested parties, an agenda for the process of checking the appraisal of major projects under SF financing, including FIFG (Financial Instrument of Fisheries Guidance) and CF. The text is specifically designed for Commission officials, who are not specialists in **Cost-Benefit Analysis** (CBA). At the same time, the text gives some indications to external experts, who may need to understand the Commission's specific needs for information on costs and benefits of proposed projects.

Cost-Benefit Analysis. A procedure for evaluating the desirability of a project by weighting benefits against costs. Results may be expressed in different ways, including internal rate of return, net present value and benefit-cost ratio.

A relatively short text such as this cannot cover all the aspects of CBA that a project examiner has to deal with.

There are important differences between investments in infrastructure and in productive sectors; there are great disparities among regions and countries, leading to differences in crucial aspects of project appraisal; there are different theories, styles and shortcuts behind a number of practical approaches to CBA, as used by government and private bodies.

Nevertheless, most major projects share some common key-issues and their analyses should be expressed in a common language.

While this document does not provide strict guidelines about the preparation and the evaluation of major projects, it may help Commission officials in discussing with their counterparts in Member States ways of reducing costs and of improving the socio-economic benefits of the projects. In some cases, Commission officials may use this agenda to suggest a revision of the project analysis. This revision work may lead to a new project design or even to its abandonment in favour of other more promising projects.

Checking for costs and benefits is a vehicle for dialogue among partners, between the Member States and the Commission, between project proposers, officials and consultants: an instrument for collective decision-making.

In this respect, the guide is more about how to establish good communications than about technicalities. Some technical issues may require some training or further reading as suggested in Annex C.

Cost-Benefit Analysis. A procedure for evaluating the desirability of a project by weighting benefits against costs. Results may be expressed in different ways, including internal rate of return, net present value and benefit-cost ratio.

Structure of the guide

The guide is in Three Sections. The First Section gives an overview of the appraisal of major projects under SF assistance and of projects financed by the CF.

The Second Section is a structured path leading to the assessment of the quality of CBA. No pretence is made of providing a systematic introductory text, nor is this possible in such a short space. However, the guide offers a presentation of the key-issues in the project appraisal.

The Third Section offers some useful material concerning major projects in specific sectors of relevance for EC regional and cohesion policies.

Each chapter in this section is about a crucial item on the agenda of a project examiner, and we recommend seeing it as a sequence of checks and controls to be tried, rather than as chapters of a manual to be read. References to appropriate text-books are provided for some technical aspects of CBA.

Appendix A contains some additional tools that may help practical work. This includes a comprehensive check-list for a typical Project Appraisal Report.

Appendix B is a Glossary which may help the reader who is less familiar with the jargon of project appraisal. For the reader's convenience, Glossary items and examples are also to be found in boxes in the main text.

Appendix C is a structured bibliography by sector (transport, agriculture, energy, etc.) and it gives a very selective list of state-of-the-art manuals and other reading material that may set a standard of quality for CBA of major projects under SF financing.

A reference text for Structural Funds and Cohesion Fund is:
European Commission, *Structural Funds and Cohesion Fund 1994-99*, Regulations and Commentary, Brussels, 1996.
A series of seven handbooks on methods for evaluating actions of a structural nature have been prepared by the Centre for European Evaluation Expertise (Lyon) in the context of Means programme, on behalf of European Commission DG XVI/G2, Coordination of Evaluation.
A broad assessment of the impact of European Regional Policies is: European Commission, first report on Economic and Social Cohesion, preliminary edition, Brussels, 1996

Section One

Major projects in the framework of the Structural Funds and the Cohesion Fund

1.1. Scope and objectives

Major projects co-financed by Structural Funds are an important part of the implementation of EC regional policy. They are explicitly mentioned in different articles of SF Regulations where it is understood that major projects may be either a component of operational programmes or individual actions. The success or failure of major projects may have a crucial impact on the whole EC regional policy in some countries, and this justifies a careful appraisal.

The need to assess the socio-economic costs and benefits of major projects is also mentioned in different articles of the Structural Funds Regulations.

Under these Regulations both infrastructure and productive investments may be co-financed by one or more Community financial instruments: grant instruments (Structural Funds, Financial Instrument of Fisheries Guidance and Cohesion Fund) and loan or guarantee instruments (European Investment Bank, European Investment Fund, Financial Mechanism of the European Economic Area, etc.).

This guide was specifically designed for the process of appraisal of projects co-financed by grant instruments. Obviously, this does not mean that it cannot also be applied to projects co-financed by other instruments, especially as the same project may in many cases benefit from financial contributions which combine grants and loans (Art. 5 (4) of Reg. 2081/93).

It should be pointed out that when the guide mentions Structural Funds in general, this also implicitly includes the Financial Instrument of Fisheries Guidance (FIFG), since this is also subject to the provisions of the Framework Regulation (Reg. 2081/93) and the Coordination Regulation (Reg. 2082/93) of SF.

The CF finances projects that, for the specific purposes of this guide, may in many respects be similar to the major projects under SF assistance. Similar treatment is further justified by the fact that Art. 10 (5) of the Council Regulation (EC) No 1164/94 establishing the Cohesion Fund explicitly requests an appraisal of "the medium-term economic and social benefits (of projects), which shall be commensurate with the resources deployed" and states that "an assessment shall be made in the light of a Cost-Benefit Analysis".

There is already a wealth of experience on major investment projects implemented by the "first and second generations" of reformed Structural Funds and by the Cohesion Fund. Table 1 gives the distribution by sector of a survey of 200 major projects co-financed by SF between 1989-93. Table 2 gives the same kind of information for a sample of 200 major projects financed by ERDF for the period 1994-99 and by CF between 1993-96. Elsewhere we shall consider data drawn from the cumulative sample of 400 projects.

EU Structural Funds may support a very wide range of projects, both in terms of sectors involved and in terms of size of investment.

While the CF exclusively finances projects in the transport and environment sectors, the SF, and the ERDF in particular, may also support projects in the energy, industry and service sectors. The scope of SF activities includes agriculture, fisheries and water-culture if we also consider the European Agricultural Guidance and Guarantee Fund (EAGGF) and the Financial Instrument of Fisheries and Guidance (FIFG).

Since, in principle, for projects related to the environment and to infrastructure linked to trans-European transport networks, there could be some overlapping of grant instruments (CF, on the one hand; ERDF and, to a certain extent, also the EAGGF, Guidance Section on the other), Art. 9 (1) of the CF Regulation states that no item of expenditure of the same project may benefit both from the Cohesion Fund and from one of the Structural Funds. This does not however mean that different phases of the same major project may not be financed separately by the CF and by the SF. Anyway, the same Article permits assistance from the CF to be combined with that from other financial instruments, such as those set up under the EU transport and environment policies, provided that total Community support granted to a project does not exceed 90% of total and related costs. Either CF or SF support may be combined with loan instruments such as EIB financing.

A good appraisal of the investment decisions in such a wide range of sectors may improve their success rate and thus strengthen development opportunities in the general framework of regional and cohesion policies. It is then important to learn from past experience and to promote a better appraisal. First comes the question: what should we consider a major project for the purpose of socio-economic appraisal? Then: what kind of appraisal does the Commission need for such major projects?

Table 1. Composition of the 'first generation' of major projects by sector. SF 1989-93 *

	No.	*%*
Energy	9	4.5
Water and environment	23	11.5
Transport	82	41.0
Industry	74	37.0
Other services	12	6.0
TOTAL	200	100.0

* The table is based on an ad hoc survey carried out in 1994 by a working team of the Evaluation Unit, DG XVI Regional Policy. It is not necessarily representative of the composition of the larger number of major projects co-financed by SF in the period 1989-93.

Table 2. Composition of the 'second generation' of major projects by sector. ERDF 1994-99 and CF 1993-96 *

	No.	*%*
Energy	3	1.5
Water and environment	41	20.5
Transport	97	48.5
Industry	47	23.5
Other services	12	6.0
TOTAL	200	100.0

* In 1996, the Evaluation Unit carried out a new survey of a sample of 200 major projects. In addition to the second generation of projects co-financed by the ERDF (1994-99), the analysis was extended to projects co-financed by the CF since its temporary establishment in 1993 (as "Cohesion Financial Instrument"). Although CF projects generally carry an investment cost of at least 10 million ECU, for ease of comparison with projects co-financed by ERDF, only CF projects with a minimum investment cost of 25 million ECU were considered in the survey. Once again the new sample is not necessarily representative of the composition of the larger number of major projects co-financed by SF and CF in the period concerned.

1.2 Definition of major projects

As far as the SF are concerned, Art. 16 (2) of Council Regulation 2082/93 (Coordination of Structural Funds) defines major projects as "those the total cost of which taken into account in determining the amount of Community assistance is, as a general rule, greater than ECU 25 million for infrastructure investments or greater than ECU 15 million for productive investments".

For such major projects the proposer is required to prepare an in-depth socio-economic appraisal and to give the Commission detailed information on its results. Obviously, the Commission expects that an appropriate investment appraisal be done by proposers for smaller projects as well, but normally the Commission will focus on the evaluation of programmes and of major projects. The requirement of detailed information on the appraisal of major projects is strictly binding both when they are part of a wider programme, or when individual projects are proposed to the Commission for co-financing.

The above mentioned limits of 25 million ECU for infrastructure and 15 million ECU for productive investments are to be understood as follows:

a) the relevant economic dimension is the total amount of investment costs. In order to assess this figure, one ought not to consider sources of finance (e.g. public sector finance only, or the EC co-financing only) but the overall economic value

The following list gives some examples of the sectors supported by the **ERDF**, which is the SF most frequently involved in part-financing of suitable projects.
Transport. Railways, airports, roads and highways, ports, underground, trans-European networks (Objective I Regions)
Water and environment. Aqueducts, dams and irrigation; depurators, waste treatment plants and other environmental works
Energy. Energy production, energy distribution, trans-European networks (Objective I Regions)
Other services. Health and education (Objective I Regions), culture, arts, telecommunications (including trans-European networks for Objective I Regions), tourism, research and technological development, and other services to enterprises
Industry. Productive investments, infrastructure

of the proposed infrastructure or of the productive investment;

b) if investment costs are expected to be incurred over different years, one has to consider their sum across the years;

c) while one has to consider investment costs only, excluding running costs, it is advisable also to include in the calculation of total investment cost any once-for-all expenditure such as recruitment and training costs, licences, preliminary studies, design and other technical studies, price contingencies, allocation for net working capital, etc.;

d) in some cases a group of small projects is so interwoven that it is better understood as one large project (e.g. five sections of the same highway, each section at a cost of 6 million ECU, should be treated as a major project of 30 million ECU).

Major projects, as defined above, may be financed, in principle, by different Structural Funds and by FIFG (see **Art. 5, Reg. 2081/93**), by the Cohesion Fund and by other means of assistance.

As far as the CF is concerned, support is exclusively in the form of financing of projects, stages of a project or groups of projects (see **Art. 1, Reg. 1164/94**). Art. 10 (3) of Council Regulation 1164/94 establishing the Fund states that "Projects, including groups of related projects, shall be of a sufficient scale to have a significant impact in the field of environmental protection or in the improvement of trans-European transport infrastructure networks. In any event, the total cost of projects or groups of projects may in principle not be less than ECU 10 million", with duly justified exceptions.

For such significant projects, whatever the size, the proposer is required to prepare a Cost-Benefit Analysis, including the direct and indirect effects on

The **CF** finances projects in the fields of the environment (aqueducts, dams and irrigation; depurators, refuse and waste treatment plants and other environmental works, including reforestation, erosion control, nature conservation, beach resetting, etc.) and trans-European transport infrastructure networks (railways, airports, roads and highways, ports) in Member States with a per-capita GNP of less than 90% of the Community average and with a programme leading to the fulfilment of the conditions of economic convergence as set out in Art. 104c of the EU Treaty (Greece, Ireland, Portugal and Spain).

The **EAGGF** (Guidance Section) and the **FIFG** may participate in the co-financing of investment projects in the agricultural, forestry and silviculture sectors, and the fishing and water-culture sectors, respectively. In the case of less developed Regions, the EAGGF may also finances projects in the fields of environment, energy, roads, irrigation and other water related programmes, as well as investments in the tourism and craft sectors.

The kind of projects co-financed by the **ESF** (vocational training and employment incentives) are not covered by this guide, due to their specific nature.

Art. 5, Reg. 2081/93 (SF Framework Regulation). Forms of assistance
"1. Financial assistance under the Structural Funds, from the EIB and the other existing Community financial instruments shall be provided in a variety of forms that reflect the nature of the operations. 2. In the case of the Structural Funds and the FIFG, financial assistance may be provided principally in one of the following forms: (a) part-financing of operational programmes;... (d) part-financing of suitable projects; (...)"
This guide concerns both major individual projects and those which are a part of an operational programme.

Art. 1, Reg. 1164/94 (Regulation establishing the CF). Definition and objective
"3. The (Cohesion) Fund may contribute to the financing of:
- projects, or
- stages of a project which are technically and financially independent, or
- groups of projects linked to a visible strategy which form a coherent whole."

As in the case of SF, CF assistance may also be granted for preliminary studies related to eligible projects and technical support measures, including those undertaken at the Commission's initiative.

employment, possibly integrated with other evaluation methods, in the case of projects in the environmental field.

It is clear that the considerations listed above for identifying major projects under SF assistance (see points a) to d) above) are also pertinent in the case of projects financed by CF.

1.3 Responsibility for prior appraisal

The regulations governing the SF and the CF both establish similar responsibilities for the prior appraisal of investment projects. Our analysis below will be based on the more general norms of the SF, while the corresponding provisions of the CF Regulation governing responsibility for project appraisal will be shown in boxes.

According to **Art. 14 of Reg. 2082/93** "Applications shall contain the information the Commission needs in order to assess them". The responsibility for appraisal and evaluation of major projects is, as for any other aspect of SF implementation, a joint-venture between the Commission and the Member States. **Art. 26 of Reg. 2082/93** states "Appraisal and evaluation shall be the responsibility both of the Member States and the Commission and be carried out within the framework of the partnership". The appraisal must show "medium term economic and social benefits commensurate with resources deployed".

Art. 26 (3) states that "in vetting individual applications for assistance, the Commission shall take into account the findings of appraisal and evaluation".

Art. 26, Reg. 2082/93 (SF Coordination Regulation). Appraisal and evaluation
"1. appraisal and evaluation shall be the responsibility both of the Member States and the Commission and be carried out within the framework of the partnership. The competent authorities in the Member States shall contribute in such a way as to ensure that this appraisal and evaluation can be carried out in the most effective manner. In this connection, appraisal and evaluation shall make use of the various particulars that the monitoring arrangements can yield in order to gauge the socio-economic impact of the operations, where appropriate in close association with the monitoring committees.
Assistance will be allocated where appraisal shows medium-term economic and social benefits commensurate with the resources deployed (...)."

Art. 13, Reg. 1164/94 (Regulation establishing the CF). Appraisal, monitoring and evaluation
"2. In order to ensure the effectiveness of Community assistance, the Commission and the beneficiary Member States shall, in co-operation with the EIB where appropriate, carry out a systematic appraisal and evaluation of projects.
3. On receipt of a request for assistance and before approving a project, the Commission shall carry out a thorough appraisal in order to assess the project's consistency with the criteria laid down in Art. 10 (5) (medium-term economic and social benefits shall be commensurate with the resources deployed). The Commission shall invite the EIB to contribute to the assessment of projects as necessary".
"5. In vetting individual applications for assistance, the Commission shall take into account the findings of appraisals and evaluation made in accordance with this Article".

It is therefore clear that Commission decisions on major projects must be based on in-depth appraisal, in the first instance by proposers. When the appraisal presented by the proposer is not deemed sufficient and convincing, the Commission may ask the proposer for a revision or an extension of the analysis, or the Commission may also prepare a project appraisal exercise of its own, and - when necessary - ask for independent evaluation. In this respect, in the specific case of the Cohesion Fund, the regulation states that the Commission may avail itself of the assistance of the European Investment Bank in the evaluation of projects, where appropriate. In practice, recourse to the expertise of the EIB is most common in the case of larger projects, regardless of whether or not they are co-financed by the EIB itself.

In any case, the Commission decision will be the outcome of a dialogue and of a joint-effort with the proposer, in order to achieve the best investment results.

Member States often have their own internal structures and procedures for the evaluation of large projects, but in some cases there may be difficulties in the implementation of quality appraisal. The Commission may help to overcome these difficulties in different ways. Technical assistance in the preparation of project appraisal may be co-financed in the context of the relevant Community Support Framework.

The proposer is advised to ask the Commission services for any information he/she needs about these aspects. In principle there is no lack of means for an appropriate appraisal of projects: the Commission asks Member States to perform such a task, difficult as it may be, but also offers financial and technical help for its better implementation.

Art. 14, Reg. 2082/93 (SF Coordination Regulation). Processing of applications for assistance
"2. Applications shall contain the information the Commission needs in order to assess them where this is not already included in the plans, including a description of the proposed measure, its scope, including geographical coverage, and specific objectives. Applications shall also include the results of prior appraisal of the medium-term economic and social benefits of the proposed measures commensurate with the resources to be deployed, the bodies responsible for implementation, the proposed beneficiaries and the proposed timetable and financing plan, together with any other information necessary to verify that the measure concerned is compatible with Community legislation and policies".

Art. 10, Reg. 1164/94 (Regulation establishing the CF). Approval of projects
"4. Applications shall contain the following information: the body responsible for implementation, the nature of the investment and a description thereof, its costs and location, including, where applicable, an indication of projects of common interest situated on the same transport axis, the timetable for implementation of the work, a *Cost-Benefit Analysis* including the direct and indirect effects on employment, information enabling possible impact on the environment to be assessed, information on public contracts, the financing plan including, where possible, information on the economic viability of the project, and the total financing the Member State is seeking from the Fund and any other Community sources. They shall also contain all relevant information providing the required proof that the projects comply with the Regulation and with the criteria set out in paragraph 5, and particularly that there are medium-term economic and social benefits commensurate with the resources deployed.
5. The following criteria shall be applied to ensure the high quality of projects:

- their medium-term economic and social benefits, which shall be commensurate with the resources deployed; an assessment shall be made in the light of a *Cost-Benefit Analysis*,
- (...)
- the contribution which projects can make to the implementation of Community policies on the environment and trans-European networks,
- (...)

6. ...the Commission shall decide on the grant of assistance from the Fund provided that the requirements of this Article are fulfilled, (...)"

1.4 Information required

Whilst establishing that projects requesting support from the Fund must contain an adequate socio-economic appraisal, the CF regulation also gives some indications of the evaluation methods that can be used: a Cost-Benefit Analysis integrated, in the case of projects related to the environment, with other evaluation methods possibly of a quantitative type such as multi-criteria analysis (see **Art. 10(5), Reg. 1164/94**, and Statements added to Council minutes). Other information that applications for CF assistance should contain are: an appraisal of the direct and indirect effects on employment; an indication of the contribution of the project to the EC environment policy or trans-European networks policy; a "financing plan including, where possible, information on the economic viability of the project" (see Art. 10 (4), Reg. 1164/94).

In the case of the SF, the ERDF regulation gives indication of the evaluation methods that should be employed. **Art. 5 of Reg. 2083/93** states that applications to ERDF concerning both individual projects and those within an operational programme, must provide additional information, besides that specified in Art. 14 of Reg. 2082/93. Whilst this can be sent to the Commission at a "later date" when the project is part of an operational programme, for individual projects such additional information must be considered as an essential part of the application. For investments in infrastructure, an "analysis of costs and socio-economic benefits of the project" is in the forefront of the information requirements. For productive investments market outlook, profitability and employment are the criteria mentioned.

A project examiner should consider these and similar lists in legislation more as a general indication of information requirements rather than a rigid set of criteria. In some cases, external social benefits and costs may also be important also in productive investment projects, and it would be a mistake to disregard them.

On the other hand, even when infrastructure projects financed by the public sector are considered, it is advisable to conduct a financial analysis. As we shall explain in the second section of the guide, it is particularly important to understand to what extent,

Art. 5, Reg. 2083/93 (ERDF Regulation). Projects
"In addition to the information specified in Article 16 of Regulation (EEC) No 4253/88, applications for ERDF assistance for the projects referred to in Article 5 (2) (d) of Regulation (EEC) No 2052/88 submitted individually or within the framework of an operational programme shall provide the information set out below. However, in the case of projects forming part of an operational programme, the information may be sent to the Commission at a later date."
The information shall cover:
(a) for investment in infrastructure:
- analysis of the costs and socio-economic benefits of the project, including an indication of the expected rate of use,
- the expected impact on the development or conversion of the region concerned,
- an indication of the consequences that Community participation will have for the completion of the project;

(b) for productive investment:
- an indication of the market outlook for the sector concerned,
- the effects on employment,
- an analysis of the expected profitability of the project".

Timing of information may be different between individual projects and those within an operational programme. But the information requirement is the same.

Statement added to Council minutes (during negotiations on the Cohesion Fund Regulation)
"The Council and the Commission state that a Cost-Benefit Analysis is the rule. Moreover, in the case of environmental projects and depending on the nature of the projects submitted, other methods of assessment, normally quantified methods such as multi-criteria analysis, should be submitted in cases where Cost-Benefit Analysis did not yield conclusive results so that a view may be reached on the extent to which the project is likely to achieve the objectives sought".

over the course of the years, the capital invested in the project may be at least partially recuperated. This can be achieved, for example, by means of sales of services, when this is contemplated, or by other non transitory funding mechanisms which may generate financial inflows large enough to cover the outflows for the whole horizon of the project.

Another reason for which a consistent financial analysis is important for all projects, regardless of whether they generate revenue or not, is that this analysis is the basis for CBA and its availability would improve the quality of project appraisal (*see paragraph 2.4 of the guide*).

This guide will help to better understand the Commission's information requirements in subjects mentioned in the previously cited articles of ERDF and CF regulations and elsewhere, such as how to assess costs and socio-economic benefits; how to consider the impact on regional development and environment; how to weight direct and indirect, immediate and permanent effects on employment; how to assess economic and financial profitability, etc. There are different ways to respond to this information requirement: the guide focuses on some key-issues, methods and criteria.

1.5 Reports and publicity

Under the new Regulations of the Structural Funds and the CF Regulation, the Commission's task in connection with major projects may be summarised as follows:

a) to identify, following proposals by Member States, major projects (ibid.) that qualify in principle for SF (or CF) assistance;

b) to collect the relevant information on the economic and social appraisal of these projects, as prepared by the proposers, and to consider with the proposer, any need for further appraisal and evaluation;

c) to take the necessary administrative decisions;

d) to report regularly to the European Parliament, the Council, the Economic and Social Committee and to other concerned bodies about the evaluation of these projects.

With reference to the SF, in addition to the usual auditing and reporting procedures, **Art. 26 (5) Reg. 2082/93** states an obligation for the Commission to inform the European Parliament and the Economic and Social Committee by appropriate reporting on ex-ante and ex-post evaluation. This provision is reinforced for major projects by Art. 31 (1), which states that "The annual reports referred to in the first subparagraph of Article 16 of regulation (EEC) No 2052/88 shall review, inter alia...

Art. 26, Reg. 2082/93 (SF Coordination Regulation). Reports and publicity
"5. The results of the appraisals and evaluations shall be submitted to the European Parliament and the Economic and Social Committee within the framework of the annual report and the three-yearly report provided for in Article 16 of Regulation (EEC) No 2052/88."

Annex to Annex II, Art. J, Reg. 1164/94 (Regulation establishing the CF). Information
"The annual report shall provide information on the following: (...)
9. The preparatory studies and technical support measures financed, including a specification of the types of such studies and measures;
10. The results of appraisal, monitoring and evaluation of projects, including information on any adjustment of projects to accord with the results of appraisal, monitoring and evaluation; (...)"

- the list of major productive investment projects which benefited from assistance granted under article 16(2); these projects should be the subject of a concise evaluation".

Also, in the case of the Cohesion Fund the Commission is obliged to present an annual report on the activities of the Fund to the same bodies mentioned above and to the Committee of the Regions (Art. 14 of Reg. 1164/94). Included in the information to be given in the annual report (see Annex to Annex II, Reg. 1164/94) there is a description of the results of appraisal, monitoring and evaluation of projects, including a specification of the types of preparatory studies and technical support measures financed.

Art. 10 (7) of Reg. 1164/94 made it compulsory for the Commission to provide precise information about the projects, by stating that "The key details of the Commission's decisions shall be published in the Official Journal of the European Communities".

Thus, major projects are in the focus of the Commission's need for public information, transparency and co-responsibility with Member States in the appraisal process.

This guide is part of such an effort, in the expectation that the implementation of better investment appraisal will enable the Commission to ensure greater effectiveness in decisions and a higher standard of reporting and publicity by all parties concerned.

Recent EC Reports concerning the implementation of Structural Funds include the following:

- European Commission, *European Regional Development Fund, 1992*, Brussels 1993
- European Commission, *Cohesion Financial Instrument and Cohesion Fund, Combined Report 1993-1994*, Brussels, 1995
- European Commission, *6th Annual Report on the Structural Funds, 1994*, Brussels, 1996
- Commission Européenne, *Rapport Annuel du Fond de Cohesion, 1995* Bruxelles, 1996

An agenda for the project examiner

Overview

In this Section we offer a quick overview of the essential checks the Commission official or an external consultant is advised to make when assessing the quality of Cost-Benefit Analysis of major projects. The analysis may be presented in different documents, for instance as a project appraisal report attached to the application forms for assistance by ERDF, or the Cohesion Fund or other financial instruments; or it may be part of a wider evaluation exercise. We are not discussing here specific administrative arrangements for the preparation of the supporting documentation, but we suggest a broad and flexible approach to reading and assessing the quality of the project analysis as it reflects itself in the various documents transmitted to the Commission by the proposer.

The agenda is structured in **ten steps**. Some of these steps are preliminary but necessary requirements for Cost-Benefit Analysis.

1 Project identification
2 Definition of objectives
3 Feasibility and option analysis
4 Financial analysis
5 Socio-economic costs
6 Socio-economic benefits
7 Discounting
8 Economic rate of return
9 Other evaluation criteria
10 Sensitivity and risk analysis

2.1 Project identification

✔ **The project must be a clearly identified unit of analysis.**

✔ **Part of a larger project is not a well defined object for the purpose of CBA.**

✔ **An assembly of smaller, not interconnected, independent projects is not a project either (it may be a programme or part of it). Programme evaluation is not covered by this Guide which focuses on project analysis.**

While the Regulations mentioned in Section One seem to trace a clear dividing line between "large" and "small" projects, e.g. the lower limit of 25 Million ECU for infrastructure financed by ERDF, sometimes an appropriate CBA needs to go beyond the administrative definitions. The proposer should produce a suitable appraisal not just for the part of the project that qualifies for SF or CF assistance, but also for those other parts which are closely connected. Examples:

- a highway project connecting town A with town B, that is justified only by the expectation that an airport will be located near town B and that the main traffic will be between the airport and A: the project should be analysed in the context of the airport-highway system as a whole;

- a hydroelectric power station, located in X, and supposed to serve a new energy-intensive plant: again, if the two objects are mutually dependent for the assessment of costs and benefits, the analysis should be integrated, even if the SF assistance is only requested for the energy supply component;

- a major productive forest project, financed by public funds, justified by the opportunity to supply a private cellulose company: the analysis should consider both costs and benefits of the forest project and of the industrial plant.

The ten steps and the definitions of technical terms will be presented, step by step, in the following paragraphs. Definitions of technical terms are also to be found in the Glossary (Appendix B).

First step: check that the dossier is about a self-contained object of economic analysis. There is no way to appraise half a project.

In all these cases, the appropriate unit of analysis may be much larger than its individual components. It is clear that CBA of just one component may be misleading. Should the examiner receive a dossier about an incomplete appraisal, he is advised to ask for a more comprehensive assessment.

Obviously this also applies if the dossier comprises only some initial steps of the investment, whose success depends upon completion of the investment as a whole: it is particularly important to stress this point, because in practice the administrative decision taking process may need to split projects in subsequent tranches.

In some cases there may also be a different problem: a comprehensive project is considered, but co-financing is requested only for individual components, and it is not clear whether other crucial components will be eventually implemented.

Identification and definition of projects that need a better appraisal may imply, in some cases, asking Member States to reconsider some individual sub-projects as one major project and to produce the additional information, including CBA, as requested by the above mentioned regulations.

See also the objectives and identification paragraphs of the outlines by sector, Section Three.

2.2 Objectives

✔ **The application should state which are the key socio-economic objectives that the project aims to influence.**

✔ **Particularly the applicant should say which one of the main objectives of the *EU regional and cohesion policies* could be achieved by the project and how the project itself, if successful, is supposed to influence the attainment of the objectives.**

The appraisal report should state which relevant socio-economic objectives the project is liable to influence. The applicant should indicate which objectives of the EU regional and cohesion policies are to be achieved by the project and, in particular, how the project can influence the attainment of these objectives.

Objectives should be **socio-economic variables** and not just physical indicators. The objectives should be logically connected with the project and there should be an indication of how to measure changes in the level of attainment.

It is important to avoid some frequent errors:

- a vague statement that the project will promote economic development or social welfare is not a measurable objective;
- hectares of new forests are easily measurable, but they are not themselves a social objective: they are project outputs, not outcomes;
- per-capita GDP within a given region is a measurable social objective, but only very large projects, probably those of interregional or national scale may have a measurable impact on it; only in such cases it may be worthwhile trying to forecast how aggregate regional GDP will change in the long term, with and without the project.

While the assessment of prospective social benefits of any project depends upon the policy goals of the different partners, the crucial check from the Commission perspective is that the project is logically related to the main objectives of the Structural Funds.

The legislation concerning SF, particularly **Reg. 2081/93** gives some broad indication of the relevant social objectives. These are also relevant for major projects.

We do not want to discuss here the whole range of objectives of the Structural Funds and the Cohesion Fund.

"**Socio-economic variables** should be measurable, such as per capita income, rate of employment, consumption value per capita, etc."

How to measure these objectives, how to weight them and how to consider additional criteria, are discussed below, but it is important to stress that the spirit of Cost-Benefit Analysis is to condense as far as possible most of this information in the calculation of simple and comparable indicators, such as the economic rate of return.

✔ **A project expected to have a high economic rate of return, is socially efficient.**

✔ **It creates social benefits greater than social costs. An efficient project generates social profits. GDP in principle is increased by any increase of social profits.**

✔ **Internal economic rate of return of a project is a microeconomic projection, which may be easier to estimate than macroeconomic projections, such as per capita GDP.**

Firstly, in very broad terms any investment project has an impact on social welfare of residents in the concerned region and maybe elsewhere as well. Social welfare is a multidimensional concept, including components which are more correlated to income (consumption, investment, employment) and other components which are less strongly influenced by income (equity, health, education and other aspects of human well-being). A project draws resources that have a social value and produces outputs that have a social value as well. These values may be fully reflected by prices that investors pay to buy project inputs and consumers pay to buy project outputs. However, in many cases prices fail to play this role, particularly in public sector projects, or where there are externalities or other market failures. In such cases social benefits and social costs, if it is possible to measure them in money terms, may differ from private values. The key question is: can we say that the overall welfare gains arising from the project are worth its cost?

Secondly, as already stated, welfare changes may have a number of components. An investment project may increase income of residents and in principle this may be measured by local or regional GDP statistics, if available. Moreover, future income may be influenced by increased competitiveness of the regional economic structure. Employment conditions may become better because formerly unemployed labour is hired during the construction phase or permanently: this effect may be measured by the consideration of trends in the labour market. Environment may become better because the project reduces the emission of pollutants: environment impact analysis may help to quantify this aspect. Some of these income, employment and environment aspects may generate indirect benefits as well: for example a better environment may sustain tourism and hence additional income, and additional employment opportunities; additional income in turn may contribute to better environment because it allows higher safety standards. All these benefits may have their counterparts: income generated by the project may be partially compensated by income lost elsewhere in the economy; some projects may affectthe environment to some extent; etc. All these aspects should be consistently considered in the framework of project appraisal.

Thirdly, it may often be difficult to forecast all the impacts of the project. For example, usually regional data do not allow us to make reliable estimates of the overall impact of individual projects on trade with other regions; indirect employment effects are sometimes difficult to forecast; competitiveness may depend upon external trade conditions, exchange rates, changes in relative prices, all variables for which it may be too expensive to make project-specific analyses. Because of these difficulties it may be wise to focus on a small number of key-data: the financial and economic rate of return of the project, and some simple indicators of environment and employment impact or of additional criteria, if they are relevant for the concerned region. We give a number of suggestions below on how to calculate some of these indicators.

Objective 1 Regions are those whose per capita GDP, on the basis of the figures for the last three years is less than 75% of the community average.

GDP. Gross domestic product.

Internal rate of return. The discount rate at which a stream of costs and benefits has a net present value of zero. When values are estimated at actual prices, it is known as the financial rate of return (FRR). If values are estimated using appropriate accounting prices, it is called economic rate of return (ERR).

2.3 Feasibility and option analysis

✔ **The applicant should give evidence that the project is the best option among other feasible projects and that the particular option that is being proposed for EU assistance is feasible. This should be documented by detailed support studies (e.g., engineering, marketing, management, implementation analysis, environmental impact statements etc.).**

In some cases a major project could be considered positive in terms of CBA, but inferior to alternative options. The Commission official in charge of reviewing a major project, before making his own assessment of the social impact of the project, should check two crucial, connected issues:

Firstly, has the applicant given evidence of the **feasibility** of the project?

This may be documented by the existence of a feasibility report and support studies. A typical feasibility report for a major infrastructure may contain information about the economic and institutional environment, forecasted demand (either market or non-market), available technology, production plan (including the utilization rate of an infrastructure), personnel requirements, scale of the project, location, physical inputs, timing and implementation, phasing of expansion, financial planning, environmental aspects. In most cases, major project analysis implies detailed support studies (engineering, marketing, etc.)

Secondly, has the applicant given evidence that other options have been properly considered?

In some cases a project can pass a CBA test, yet it may be socially inferior to other alternatives. Typical examples are transport projects where different routes and/or different technologies may be considered; large hospital buildings against a more diffuse offer of health capacity; plant location in area A, as against area B; different peak-load arrangements for energy supply; energy efficiency improvements instead of (or in addition to) new plant construction; etc.

The project examiner should be convinced that an appropriate study of feasibility and option analysis has been carried out by the applicant. If there is not enough evidence of this, he/she may suggest implementing it and reconsidering the project design accordingly.

Appendix A offers a detailed table of contents for a typical **Appraisal Report**, while Section Three offers some useful material concerning major projects in specific sectors of relevance for EU regional policy.

Table of contents of a typical appraisal report

A.1	**Summary**
A.2	**Socio-economic environment**
A.3	**Demand and supply of the project's outputs**
A.4	**Technology options and production plan**
A.5	**Human resources**
A.6	**Location**
A.7	**Implementation**
A.8	**Financial analysis**
A.9	**Socio-economic Cost-Benefit Analysis**
A.10	**Risk analysis**

Feasibility. The financing proposal should be based on appropriate previous feasibility studies. See also Appendix A particularly A.3, A.4, A.5, A.6, A.7.

Appraisal report. For details see Appendix A.

2.4 Financial analysis

✔ **The future of the project should be forecast over its useful life and for a period long enough to understand its likely medium/long term impact.**

✔ **For most infrastructure this time horizon is (indicatively) not less than 20 years; for productive investment, again indicatively, about 10 years. See also chapter 3.**

✔ **Nevertheless, the time horizon should not be so long as to exceed the economically useful life of the project.**

✔ **The project data must contain information about physical inputs and outputs on an annual basis and on financial inflows and outflows.**

✔ **The examiner should check that a consistent financial analysis is available. This implies a forecast of the internal rate of return of the project or of its net present value. It is important that these calculations be supported by a full set of financial projections (income statement, balance sheet, cash flow).**

While CBA goes beyond the consideration of the financial returns of a project, most of the project data on costs and benefits is provided by a fairly detailed financial analysis. This analysis will give the examiner essential information about forecasted inputs and outputs in physical terms, their prices, and the overall timing structure of inflows and outflows. The existence of such data will greatly increase the possibility of appraising the social impact of the project, because it will be possible to use it as a base for appropriate corrections and additions of data for CBA.

First, the future of the project should be forecast for a period appropriate to its economically useful life and long enough to understand its likely medium/long term impact. For infrastructure, a reasonable time horizon is not less than 20 years; for productive investment about 10 years (see Table 3). For the final year, one has to estimate the residual value (e.g. of standing debt, standing assets, such as building and machinery, etc).

Second, the project data must contain information about physical inputs and outputs on an annual basis. Inputs include personnel, raw materials, purchases of energy and any other relevant physical item, investment goods, etc; output will include units of service and/or of product supplied year by year.

Third, one has to select an appropriate unit of account: when values are expressed in ECU, this will be of help to the Commission assessment.

Fourth, prices must be given to each item. The best practice is to consider **current prices** and forecast their different trends. One can work with forecasted **constant prices**, but then one has to adjust for forecasted changes in relative prices. A survey of major project analyses concluded that too often this issue was not studied in depth by the proposers.

Fifth, financial planning should show that the project does not risk running out of money: the timing of the inflow and outflow of funds may be crucial in implementing the project. Proposers should show how, in the project time horizon, sources of financing (including revenues and any kind of cash transfers) will consistently match disbursments year by year. There is ample evidence that quite often project proposers overlook this important analysis.

Finally, the applicant should show the best estimate of the internal financial rate of return **(FRR)** of the project or of its financial net present value **(FNPV).**

Net present value of a project is defined as the difference between the present values of its future cash inflows and outflows. This means that all annual cash flows should be discounted to the start time at a predetermined discount rate.
Internal rate of return. The discount rate at which a stream of costs and benefits has a net present value of zero.
Discount rate. The rate at which future values are discounted to the present. Usually considered roughly equal to the opportunity cost of capital. A clear exposition of the logic of discount rate is in: Bridges G.A., Winpenny J.T, Planning development projects, HMSO, London, 1992.
Constant prices. Prices fixed at a base-year in order to adjust for inflation.
Current prices. Nominal prices as actually observed year by year.

A very low or even negative financial rate of return does not necessarily mean that the project is not in keeping with the objectives of SF. CBA may give a positive socio-economic appraisal of such a project.

The Commission should, in any case, be aware of the net financial burden of the project and should be sure that the project, even assisted by co-financing, does not risk being stopped by lack of cash. At this stage the Commission does not suggest a minimum required financial rate of return, or a financial discount rate for all countries and sectors. International experience and the Commission's own experience with the first and second generation of major projects under SF, however, gives some useful indication.

For productive investments, such as industrial plants, financial rates of return are usually well above 10% (real).

For infrastructure, financial rates of return are usually lower and negative, partly because of the tariff structure of these sectors.

Table 3. Time horizon (years) in the appraisal of a sample of 400 major projects of the 'first generation' and 'second generation' combined

	average time horizon	*number * of projects*
Energy	24.7	9
Water and environment	29.1	47
Transport	26.6	127
Industry	8.8	96
Other services	14.2	10
TOTAL	20.1	289

Source: see Tables 1 and 2.
(*) Projects for which data were available.

Table 4. Expected financial internal rates of return of a sample of 400 major projects of the 'first generation' and 'second generation' combined

	average	*number * of projects*
Energy	7.0	6
Water and environment	-0.1	15
Transport	6.5	55
Industry	19.0	68
Other services	4.2	5
TOTAL	11.5	149

Source: see Tables 1 and 2.
(*) Projects for which data were available.

In any case, financial rates of return should be calculated on total investment, net of tax and subsidies, thus excluding granted funds from financial returns.

2.5 Socio-economic costs

✔ **The project examiner should check if the proposer has considered social costs of the project that may go beyond its money expenditures. These may occur when:**

✔ **actual prices are distorted by monopolies, trade restrictions, etc.**

✔ **wages are not linked to labour productivity**

✔ **taxes or subsidies influence price structure**

✔ **there are externalities**

✔ **there are non-monetary effects, including environmental impacts.**

While the previous steps are necessary and important, in a sense they are just preliminary to the assessment of social benefits and costs. The project examiner is advised to start with a check of how the proposer has treated social costs in his own appraisal.

A negative financial internal rate of return may arise because valuable goods and services such as water or education are not priced or are given low tariffs.The value of benefits to the consumers in such cases may be revealed by the use of accounting prices in the context of economic analysis (§ 2.6)

Price distortions of inputs and of outputs

A general goal of the European Union is to complete its internal market. In spite of decades of efforts and of recent moves in that direction, there are still important price distortions among Member Countries and on the border between the EU and the rest of the world.

Current prices as they emerge from imperfect markets and from public sector pricing policies, may fail to reflect the **opportunity cost** of inputs. In some cases this may be important for the appraisal of major projects, and financial data may thus be misleading as welfare indicators. Examples:

- a land intensive project, e.g. an industrial site, where land is made available free of charge by a public body, while it may otherwise earn rent;
- an agricultural project which depends upon water supply at a very low tariff, heavily subsidized by the public sector;
- an energy intensive project which depends upon the supply of electricity under a regime of regulated tariffs, when these tariffs are different from long run marginal costs.

In some cases prices are regulated by States so as to compensate for perceived market failures and in ways that are consistent with their own policy objectives; e.g., when indirect taxation is used to correct externalities. But in other cases, actual prices are distorted because of monopoly power, of historical reasons, of incomplete information, or other market imperfections.

Whenever some inputs are affected by strong price distortions, the proposer should consider the issue in the project appraisal and use accounting prices that may better reflect the social opportunity costs of the resources. The project examiner needs to carefully assess and consider how the social costs are affected by departures from the following price structures:

marginal cost for internationally non-tradeable goods, such as local transport services

border price for internationally tradeable goods, such as agricultural or manufactured goods.

In fact, there are often good economic arguments for using border prices and/or marginal costs as accounting prices, when actual prices are deemed to diverge widely from social opportunity costs. However this general rule may be checked under the circumstances of the specific project under examination.

✔ Border price. For internationally tradeable goods and services, prices on the international market are usually the appropriate opportunity costs. The particular good can always be sold or purchased at its world price. For marginally imported goods, the accounting price is its CIF (Costs, Insurance, Freight) price; for marginally exported goods, its FOB (Free on Borad) price.

✔ For mostly intra-Community tradeable goods there are not important differences between domestic and border prices. But for some extra-Community tradeables, such as some industrial and agricultural goods, and thus in the appraisal of related major projects, there may be significant price differences.

Opportunity cost. The economic value of an input in the best possible alternative use.

Marginal cost is the increase in total cost when production increases by an additional unit.

Border price. For most EC internal market trade domestic prices do not differ much from border prices. But there may be important differences for extra-Community trade and for some related industrial and agricultural projects.

For a quick and clear introduction to accounting prices, refer to: Saerbeck R., Economic appraisal of projects. *Guidelines for a simplified Cost-Benefit Analysis*, EIB Paper n.15, European Investment Bank, Luxembourg, 1990.

Wage distortions

✔ **In some cases, a crucial input of large projects, particularly of infrastructure, is labour. Current wages may be a distorted social indicator of the opportunity cost of labour because labour markets are imperfect.**

Examples:

- some people, particularly in public sector employment, may receive wages above or below their counterparts in the private sector for similar work;

- in the private sector, costs of labour for the private company may be less than the social opportunity cost because the State gives special subsidies to employment in some areas;

- there may be legislation fixing a minimum legal wage, even if under heavy unemployment there may be people willing to work for less.

The proposer, in such cases, may resort to a correction of nominal wages and to the use of an **accounting wage**.

While the Commission does not recommend a specific accounting wage formula, the proposer needs to be prudent and consistent in his own appraisal of labour social costs. For further reading see Appendix C.

Tax aspects

Market prices include taxes and subsidies, and some transfer payments, that may affect relative prices. While in some cases it would be extremely difficult to estimate net-of-tax prices, some rough, general rules can be laid down to correct such distortions:

- prices of inputs to be considered for CBA should be net of VAT and of other indirect taxes;

- direct taxes should be included in costs: thus one has to consider wages gross of income taxes, and profits gross of corporate taxes;

- pure transfer payments to individuals, such as social security payments, should be omitted;

- in some cases indirect taxes/subsidies are intended as correction of externalities. A typical example are taxes on energy prices to discourage negative environmental externalities. In this case, and in similar ones, it may be justified to include these taxes in project costs, but the appraisal should avoid double counting (e.g. including both energy taxation and estimates of external environmental costs in the appraisal).

Obviously, the treatment of taxation should be less accurate whenever it has minor importance in project appraisal, but overall consistency is required.

External costs

Any social costs that spill over from the project towards other subjects, without compensation, should be accounted for in CBA in addition to its financial costs.

Examples:

- loss of agricultural product because of different use of land;

- additional net costs for local authorities to connect a new plant to existing transport infrastructure;

- increase in sewage costs.

The project examiner should check that these kinds of costs have been identified, quantified, and given a realistic monetary value, if possible. If this is not possible, see next paragraph.

Accounting wage or shadow wage. The highest possible remuneration the labour employed in the project could have earned elsewhere. Because of minimum wage laws, regulations and other rigidities, wages actually paid may not be a correct measure of the real cost of labour. In an economy marked by extensive unemployment or underemployment, the opportunity cost of labour used in the project may be less than actual wage rates.

Consistency implies that the treatment of taxes and incentives should be the same for cost and benefit items within a project, as well as between different projects.

Environmental impact

The Commission systematically requires proposers to provide information on the appraisal of the environmental impact. Application forms for both the Cohesion Fund and the ERDF asked the proposer to specify whether the project pertained to the list in Annex I of the 85/337 Directive or to Annex II of the same, or whether the project was not provided for in the 85/337 Directive. Annex I includes such cases as the construction of motorways, commercial sea ports, plants for eliminating toxic or dangerous waste, integrated chemical plants and other plants or works which have a strong impact on the environment. Annex II includes a large number of industrial, mining and production plants and energy transportation as well as the infrastructure projects not included in Annex I.

An examination of the sectors most involved in the ERDF and Cohesion Fund shows that, in principle, a large number of projects fall within the bounds of Annex I or Annex II. In the first case, the Commission's questionnaire attached to the application form asks proposers to include a non-technical résumé of environmental impact analysis (Eia), the outcome of consultations with the country's environmental authorities and public opinion, possibly in the form of declarations or certificates from the environmental authorities of the member country.

The same documents are also requested for the second case. In the third case (projects not provided for by Directive 85/337) general information is required regarding the environmental compatibility of the project with regard to the landscape, nature, land, water and air, waste products, erosion risks and land stability. Details of plans aimed at softening the impact on the environment were also called for.

The same questionnaire applied to Annex II projects in cases where the national laws did not demand a compulsory study of the environmental impact. In addition, projects not covered by the Directive required a declaration signed by the pertinent authorities to support the questionnaire, and whenever the proposer stated that the project was not governed by the above Directive and not located in an environmentally sensitive area (zones protected by national laws or included in the list where Community legislation applies), the Commission required a 1:100,000 scale (or similar) map of the area and a declaration from the pertinent authorities. In all cases the Commission requested information on the current status of Eia procedures if these had not already been completed.

In the context of major projects appraisal, the environmental impact should be properly described and appraised, possibly with recourse to state of the art qualitative-quantitative methods. Multicriteria analysis is often useful in this framework.

A discussion of the assessment of environmental impact goes beyond the scope of this guide, but CBA and environmental impact analysis raise similar issues. They should be considered in parallel and, whenever possible, should be integrated; this would imply giving, if possible, an accounting conventional value to environmental costs.

Examples:

- the environmental costs of a highway may be approximated by the potential loss of value of properties near it because of increased noise and emissions, degraded landscape;
- the environmental costs of a large polluting plant, e.g. an oil refinery, may be estimated by the potential increase in health expenditures among the residents and workers.

These may be very crude estimates: however they may at least capture the most relevant environmental costs.

When it is eventually impossible to assign money values to environmental costs, this is a case for accompanying CBA with a careful consideration of Eis (Environmental impact statements) and to propose a subjective assessment of their respective results.

Accounting value of public sector owned capital assets

Many projects in the public sector use capital assets and land, which may be state-owned or purchased from the general Government budget.

Capital assets, including land, buildings, machinery and natural resources should be valued at their opportunity cost and not at their historical or official accounting value. This has to be done whenever there are alternative options in the use of an asset, and even if it is already owned by the public sector.

If there is no related **option value**, past expenditures or irrevocable commitments of public funds are not social costs to be considered in the appraisal of new projects.

Option value. The present value of capital assets whenever there are alternative options for their use. This is closely related to the concept of opportunity cost. No option value implies that opportunity cost is egual to zero.

✔ Sometimes valuing external costs and benefits will be difficult, even though identifying them is simple. A project may cause some ecological damages, whose effects, combined with other factors, will take place in the long run, and are difficult to be quantified and valued.

✔ It is worthwile at least listing the unquantifiable externalities, in order to give the decision-maker more elements to make a decision, by weighing up the quantifiable aspects, as expressed in the economic rate of return, against the unquantifiable ones, as expressed in qualitative scores.

2.6 Socio-economic benefits

✔ The project proposer should present social benefits in a measurable form.

✔ The examiner is advised to check for the following issues:

✔ actual output prices may not represent their social value, because of market imperfections

✔ the social benefit of additional employment is in principle the output that it gives rise to: double counting of a benefit should be avoided

✔ external benefits should be given a money value, if possible

✔ if this is difficult or impossible, there should be at least an adequate quantification in physical terms, making possible a qualitative assessment of these benefits.

Price distortions of output

Current prices of output may misrepresent the opportunity cost of the goods or services produced by the major project under examination.

For example:

- a power station under a **monopoly** pricing regime, leading to electricity prices that substantially diverge from long run marginal costs: the economic benefit may be less than the financial benefit

- a new car plant in a country that limits imports of less expensive cars from non-EC countries: here the price of the output may be higher than its social opportunity cost

Option value. The present value of capital assets whenever there are alternative options for their use. This is closely related to the concept of opportunity cost. No option value implies that opportunity cost is egual to zero.

Monopoly. Maximisation of profits by a monopoly leads to prices that are higher than marginal costs. Tariffs of state-owned monopoly entrerprises may occasionally be below marginal costs.

When prices are equal to marginal costs, the consumer pays exactly the cost of production of an additional unit: under some general conditions, this leads to economic efficiency.

- a hospital under a public health service regime: here patients may pay substantially less than the cost of treatment, thus the economic benefits may be higher thar the hospital revenues

In these and similar cases, the project examiner should check if and how the applicant has made the appropriate corrections in order to assess the social benefits of the project.

The following checks may be relevant:

- are prices or tariffs paid by the consumers of the project's services equal to the marginal long-run costs for non-tradeable goods? For examples, are local transport services priced at marginal cost?

- are prices of project outputs for tradeable goods, such as agricultural or manufactured goods, equal to or different from border prices?

Social benefit of additional employment

In the framework of Cost-Benefit Analysis, additional employment is, in the first instance, a social cost. It is the use by the project of labour resources that become thus unavailable for alternative social purposes. The relevant benefit is the additional income generated by job creation, and this is accounted for by the valuation of direct and indirect net output resulting from the project.

It is important to understand that there may be two different, mutually exclusive ways to estimate the social benefit of additional employment:

- as already stated, one can use an accounting wage inferior to the actual wage paid by the project. This is one way to take into account the fact that, under conditions of unemployment, actual wages are higher than the opportunity cost of labour. By reducing labour costs, this accounting procedure increases the social net present value of the project income or its ERR in comparison with its private value;

- alternatively, one can try to estimate the **income multiplier** of output, and the social income of the project will again be more than its private income because of this positive external impact.

Both methods, either subtracting a fraction of labour costs, or adding up some additional output, have their drawbacks and limitations, but under appropriate conditions in principle they are equivalent. In any case:

- they cannot be used simultaneously (double counting!)

- if a major project already has a satisfactory internal rate of return before corrections for employment, it is not necessary to spend much time and effort on this kind of calculation.

However, it is important to consider that in some cases the employment impact of a project may need very careful consideration:

- it is sometimes important to check for employment losses in other sectors as a consequence of the project: gross employment benefits may overestimate the net impact;

- sometimes the project is said to maintain jobs that otherwise would be lost: this may be particularly relevant for the restructurating and modernisation of existing plants. This kind of argument should be supported by an analysis of cost structure and competitiveness with and without project

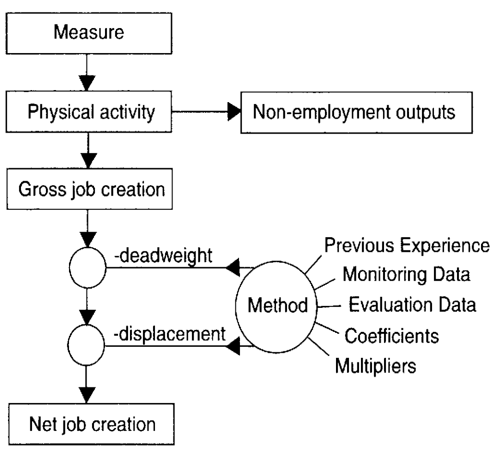
- some objectives of the Structural Funds are concerned with particular employment targets (e.g. youth, long term unemployed) and it may be important to consider the different impacts by target groups.

Income multiplier. Ratio between national income variation and expenditure variation that caused it. The expenditure arising from incomes earned on a project may draw small business and ancillary services into the region. The income of these enterprises will then be earned in the project region and will contribute to increasing the region's income.

Table 5. Average investment cost per permanent employee created by major projects 1993-1999, by sector (current million ECU)

	directly created	*indirectly created*	*total*
Transport	1.0	0.3	0.2
Water and environment	0.3	0.5	0.2
Other services	0.1	0.1	0.1
Industry	0.3	0.2	0.1
Total	0.5	0.2	0.2

Source: see Table 2.



Source: "Counting the Jobs. How to evaluate the employment effects of Structural Fund interventions", European Commission, Directorate General XVI Regional Policy and Cohesion, Coordination and evaluation of operations.

✔ **Investment cost per job created**
The creation of jobs by infrastructure or industrial projects is often a specific target of regional policies. The social benefit of employment is ultimately determined by incomes and economic welfare associated. Average investment cost per permanent job created is a rather crude indicator of cost-effectiveness, and may be used essentially for preliminary comparison among similar projects.

Tax aspects

There are no basic differences in the treatment of taxes, subsidies and transfers in the calculation of benefits as compared with the calculation of costs. See above, § 2.5.

External benefits

Many major projects, particularly in infrastructure, may be beneficial to subjects outside those directly appropriating the social income generated by the project. It is worthwhile checking if and how these aspects have been considered. Examples are:

- advantages in terms of reduction of risk of accidents in a congested area;
- savings in transport time in an interconnected network;
- increase of life expectancy from better health facilities or from reduction of pollutants.

These benefits may accrue not only to the direct users of the product but also to third parties for whom they were not intended. In this case, they must also be accounted for by appropriate evaluation. Other examples of such positive externalities or beneficial spill-overs towards other consumers are the following:

Externality is the positive or negative impact of the project on third parties, without payment or compensation.

- a railway may reduce traffic congestion on a highway;
- a new university may sustain applied research and the future income of employers will be increased by a better educated work-force, etc.

Positive externalities should be given a monetary value, if possible. If not, they should be quantified by non-monetary measures.

Obviously, the same reasoning applies to negative externalities, which are best treated as socio-economic costs, see above § 2.5.

Externality is the positive or negative impact of the project on third parties, without payment or compensation.

2.7 Discounting

✔ **Costs and benefits in monetary terms should be expressed in constant ECU, at the exchange rate of the year of proposal to the Commission.**

✔ **All future social costs and benefits occurring in different years must be discounted to the base year, possibly using a uniform discount rate across sectors and regions.**

✔ **As an alternative, one can calculate the internal economic rate of return.**

All costs and benefits in monetary terms should be expressed in an appropriate unit of account. For the European Union it would be only natural to use ECUs. For Cost-Benefit Analysis, it is important to consider the real economic value of resources deployed in financing large projects. Thus, a first correction is that we need constant ECUs. If possible, we suggest using 1994 as the base-year, it being the start-up of the new round of SF planning. For projects proposed later, the base-year may also be the year when the project is presented to the Commission.

Also, because the Commission's regional policy is interested in the total investment costs, the expenditures by Member States, expressed in local currency, should be converted at an appropriate exchange rate. This may be an average of the actual exchange rate with ECU in the base year.

When expressed in their common unit of account, all social costs and benefits occurring in different years for given projects, should be discounted at a base-year possibly by using a uniform social discount rate across sectors and countries. There are many theoretical and practical ways of estimating this variable.

Most Member States have their own social discount rates for public sector projects. Typically these official discount rates comprise between a maximum 10% rate and a minimum 3% real rate. In this context, a real 5% discount rate may be an appropriate benchmark value: low enough to focus attention on projects not passing the test, but not too far from the average official discount rates. However, the explicit consideration of a social discount rate is necessary only for the calculation of the net present value of the project, while it is not necessary for the calculation of the internal rate of return. The latter is requested, for example, by the application forms for assistance by the ERDF and the Cohesion Fund.

Discount factor

1 ECU invested at 5% yearly rate, will become 1+5% = 1,05 after one year; (1.05)x(1.05) = 1.1025 after two years; (1.05)x(1.05)x(1.05) = 1.157625 after three years, etc. The economic present value of 1 ECU that will be spent or gained two years later is 1/1.1025 = 0.907029; three years later is 1/1.157625 = 0.863838. This is the inverse operation of above.

2.8 Economic rate of return

✔ **After corrections for price distortions and externalities, one has to calculate the economic rate of return (ERR). Equivalently one can calculate the economic net present value (ENPV). In principle any project which shows an ERR less than 5% or a negative ENPV after discounting at the benchmark 5% discount rate, should be carefully redesigned or even rejected.**

✔ **Nevertheless, in some exceptional cases even a negative net present social value may be acceptable if there are substantial non-monetary net benefits: but these must be carefully presented and assessed.**

✔ **In any case, the appraisal should convincingly argue, by structured reasoning, adequately supported by data, that social benefits will exceed social costs.**

Table of discount factors

years	1	2	3	4	5	6	7	8	9	10
$(1+5\%)^{-n}$	.952 381	.907 029	.863 838	.822 702	.783 526	.746 215	.710 681	.676 839	.644 609	.613 913
$(1+10\%)^{-n}$	.909 091	.826 446	.751 315	.683 013	.620 921	.564 474	.513 158	.466 507	.424 098	.385 543

n: number of years

The project examiner may need to examine that the project is able to achieve a range of objectives:

- increase of aggregate real income at Community level;

- reduction of disparities of per capita income among regions;

- reduction of unemployment (if not considered implicitly by accounting wages or by income multipliers);

- reduction of unemployment may be valued over and above the increase in output to which it gives rise (e.g. psychological benefit to people concerned, social benefit from improvement of morale and cohesion of local community, etc.).

The *first* criterion is easily checked by looking at the internal rate of return or at the net present value of the project: if ENPV is positive under reasonable assumptions or if ERR is above 5%, the Community economic welfare will probably be increased by implementing the project. If, on the other hand, ENPV is negative or if ERR is less than 5%, there is no evidence of an increase in real income and there must be other strong arguments if the project is to be accepted (see the following paragraph).

The *second* criterion is more demanding: the project should have a beneficial income impact in the target region, net of leakages and spill-overs to other regions so that it contributes to real convergence. In order to check for this, it may be useful, for example, to **compare** the internal rate of return of different projects in different EU countries and sectors; to look at how imports and exports of the region will be affected by the project; etc. A project with a low economic rate of return and with high import/export ratio will probably give only a modest or even a negligible contribution to real convergence.

Table 6. Expected economic internal rates of return of a sample of 400 major projects of the 'first generation' and 'second generation' combined.

	average rate	*n. of projects* *
Energy	12.9	6
Water and environment	15.8	51
Transport	17.1	152
Industry	18.4	14
Other services	16.3	10
TOTAL	16.8	233

(*) Projects for which data was available.

The *third* criterion gives an additional specific weight to employment but, as previously stated, one has to be careful. If the appraisal of costs considers an accounting wage that is less than the current wage, this difference already captures the multiplier impact of employment, and to consider employment again as a benefit would imply double counting. Any additional weight given to job creation by the project, in excess of either an appropriate accounting wage or of an output multiplier, must be treated as a merit good, see §2.9.

"In practice, many countries have an officially agreed discount rate, which although it may not be theoretically precise does have the advantage that all projects are measured by the same benchmark. So if such an official rate is available, it should always be used. Otherwise an intuitively determined cut-off rate of between 5-10% in real terms is usually adopted. In reality this lack of precision is not a great handicap in appraisal, since the really poor projects would usually have ERRs falling well outside this range" (Saerbeck, 1990).

A Commission internal review of discount rates used in the appraisal of the first generation of major projects under SF confirmed that Member States suggest official real economic discount rates comprised between a minimum of 3% and a maximum 10%, with most official rates falling above 5%.

Comparison. Cost-Benefit Analysis is very much an exercise in detecting relative advantages of a project in comparison with other ones. Its main usefulness lies in that it makes possible a systematic comparison of different projects on the basis of common criteria for the measurement of costs and benefits. It is therefore not the absolute but the relative worth of a project that can be reliably estimated.

2.9 Other evaluation criteria

✔ Non-monetary costs and benefits cannot easily be included in the former analysis. It is not advisable to give a monetary value to goods which generally cannot be given a market value. But the project examiner should assess if:

✔ the forecasts of such non monetary aspects have been given a realistic quantification in the prior appraisal

✔ there is a serious analysis of non-monetary benefits and non-monetary costs, if any

✔ such additional criteria can be given a reasonable policy weight, high enough to eventually reverse the results of both the financial analysis and of the calculation of the economic rate of return.

Suppose a given project shows, at a 5% discount rate, a negative net present value worth 1 million ECU. Thus the proposer forecasts a net social loss of the project in monetary terms. Now the proposer says that, in spite of this, the project should be assisted by SF because it has a "very good" environmental impact, even if it is impossible to give a monetary value to it. The Government may see safe environment as a **merit good**.

Then, one could ask the proposer to make an estimation of environmental benefits in physical terms. Suppose this has been done, and the expectation is that the project will reduce the emission of Z-polluting factors by 10% per year.

Thus one could ask:

a) is this forecast of reduced emission reliable in physical terms?

b) does it make sense that one million ECU is an acceptable "price" for reducing the emissions by 10% (how much is the implicit cost per unit of decreased pollution?)

c) is there any evidence that such a "price" of reduced emission is consistent with the weight that the government of the Member State or the Commission attaches to similar projects?

For instance, one may see whether – regularly or occasionally – Member States have funded similar projects in order to obtain a similar cost/effectiveness ratio. Otherwise, if there is no evidence of consistency, one should enquire why this is proposed for the project under SF assistance.

Cost/effectiveness. The ratio between physical results and costs in money terms incurred in getting these results.

One can substitute reduced emissions with many kinds of other non-monetary benefits and repeat the check, when appropriate. If the benefits are not just non-monetary, but also physically unmeasurable, there is no way of appraising the project.

One should be very careful with proposals where the analysis of non-monetary benefits is vague and merely qualitative.

✔ Distribution objectives

✔ The project may have an important impact on the future income distribution within the region.

✔ If the proposer wants to assign a specific weight to equity objectives, the basic information is a forecast of redistributive effects of the project and a discussion of the desirability of these effects in the context of regional policy.

Merit good. An additional criterion of project evaluation applied when the government has preference for more or less consumption or specific goods, such as, respectively, education and alcohol. Employment and self-reliance are examples of goals whose national importance is not determined only by individuals in their capacity as consumers. The Government may see education as a merit want because it wishes to represent the interests of future generations, even against choices of some parents; Government may see alcohol (or drugs) as a negative merit good, because the majority of voters are morally disturbed by consumption by a minority of consumers; and Government may see employment as a positive merit good, because it regards unemployment per se as a social disease, over and above any monetary compensation for the unemployed.

Cost/effectiveness. The ratio between physical results and costs in money terms incurred in getting these results.

2.10 Sensitivity and risk

✔ **The project examiner should check if risks associated with the project have been assessed by the applicant.**

✔ **This check cannot be done by sensitivity analysis alone, but it implies a certain amount of reasoning, if not of calculations, in terms of probabilities of the main variables affecting the expected outcome of the project.**

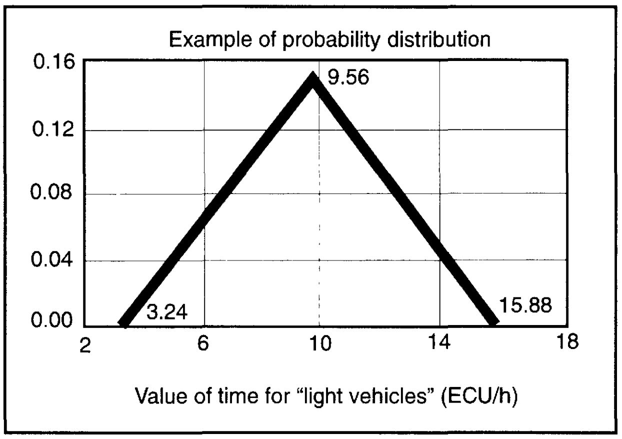
✔ **According to a survey of 400 major projects, the Evaluation Unit, DGXVI, considers that sensitivity analysis and risk were often a weak aspect of ex-ante appraisal by proposers.**

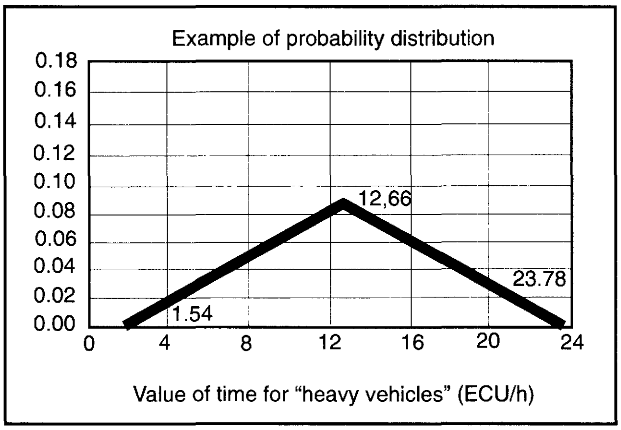
Sensitivity analysis is a deterministic procedure, aimed at understanding which variables influence the ENPV or ERR of the project. Any independent variable for which 1% change results in 1% change or more of ENPV or ERR is certainly a critical one, and needs to be estimated as reliably as possible.

Risk assessment implies assigning probabilities to these critical variables (*see box*) and calculating the **probability distribution of ERR**. There are well-known procedures for doing so, such as the "Montecarlo" technique, and for very large projects it would be desirable to implement them.

Innovative projects may be more risky than traditional ones, and if they have only a 50% probability of success their social net value should be reduced accordingly, i.e. by 50% for a risk- neutral investor. But if innovation is an additional criterion in itself, this must be treated by giving a premium to the merit want "innovation" and not by disregarding the risk.

It is important to understand the trade off between high risk, high maximum social return projects on the one side, and low risk, low maximum social return projects on the others. There is no reason to prescribe risk neutrality. In some cases the examiner or the proposer may deviate from neutrality, and prefer to risk less or more than the expected return: but there should be some clear justification for this preference.





Risk analysis - A study of the odds of the projects earning a satisfactory rate of return and the most likely degree of variability (variance) from the best estimate of the rate of return.

Sensitivity analysis - A study of the impact that changes in crucial estimates concerning costs and benefits would have on the profitability or present value of a project.

Probability distribution. One is often interested to know what the probability is of a project having an economic rate of return less than the minimum required rate.

Section Three

Outlines of project analysis by sector

Overview

The following outlines provide the concepts expressed in the preceding sections, with reference to the main investment sectors supported by EU funds.

The outlines are of a schematic nature and are not comprehensive. Their main purpose is to act as a guide for readers and writers of project proposals, showing, on the one hand, the established methods which should be the basis of a good appraisal and, on the other hand, areas of uncertainty that deserve particular attention.

Obviously, all the general methodological elements mentioned in the previous sections should also be taken into consideration. For example, the analysis of financial flows and of economic costs and benefits, should always be conducted in comparison with a situation without the investment.

The outlines follow a common structure to facilitate the task of the user, and also to encourage standardisation in the procedures for analysis and reporting and to make communications smoother between proposers and evaluators.

In some cases, where possible, value ranges are given for the essential analysis variables which have been taken from previous experience. These value ranges should be considered only as a reference for the analyst and not as target values.

Sectors considered

1. Energy transport and distribution
2. Energy production
3. Roads and highways
4. Surface and underground railways
5. Ports, airports and infrastructure networks
6. Water supply, transport and distribution
7. Sewers and depurators
8. Refuse and waste treatment
9. Training infrastructures
10. Museums and archaeological parks
11. Hospitals and other health infrastructures
12. Forests and parks
13. Telecommunications infrastructures
14. Industrial estates and technological parks
15. Industries and other productive investments

3.1 Energy transport and distribution

3.1.1 Objectives

Measures may include, for example, the construction of a gas pipeline and/or distribution networks for gas in industrial or urban areas, or the construction of power lines and related transformation stations, or networks for local distribution of electricity (e.g. electrification of rural areas).

Objectives may therefore be local development or development on an inter-regional, national or multinational scale.

3.1.2 Identification of the project

When defining the functions of the project, it is useful to state whether the investment refers to infrastructure destined mainly for the transport of energy (electricity, gas or other) on a large scale or distribution to local users (urban, industrial, agricultural). A clear description of the dimension and position of the area potentially served would be helpful, accompanied by an analysis of the market where the product will be placed.

The functional and physical links of the proposed infrastructure with the existing energy system must be clearly explained.

Lastly, a broad description of the engineering features of the infrastructure would be particularly useful:

- basic functional data, such as: transport tension (KV) and transport capacity (MW) for power lines, nominal load (m^3/s) and amount of gas transported annually (millions of m^3) for gas pipelines, number of inhabitants served and power (MW) or average supply per inhabitant (m^3/inhab.per day) for the networks;
- physical features, such as:
    - route and length (Km) of power lines or gas pipelines, attaching pertinent chorographic sketches of an appropriate scale,
    - section of electricity conductors (mm^2) or nominal diameters (mm) of the gas pipelines,

- size (Km^2) of the area served by the networks and their routes (attaching pertinent maps),
- characteristics of the network and location of internal nodes and links with networks and/or pipelines;
- typical sections of the gas pipelines;
- typical construction of power lines;
- building techniques and technical features of the plants for depression and pumping (for gas) or transformation or sectoring stations (for electricity);
- building techniques and technical features of the other service structures;
- significant technical elements, such as important intersections, overcoming large gradients, marine pipelines for gas, remote control and/or telecommunications systems, etc. (attaching data and sketches).

3.1.3 Feasibility and option analyses

The key information is the demand for energy, seasonal and long term trends. Also the demand curve for a tipical day is requested.

The option analysis should include a comparison with:

- the previous situation, without the realisation of the project;
- possible alternatives within the same infrastructure e.g. different technologies for transporting electricity (direct or alternating current, transport tension etc.) or alternative routes for gas pipelines or power lines, different district networks, etc.;
- possible alternatives for satisfying the same demand for energy (e.g. mixed use of gas and electricity instead of just electricity, the construction of a new power station on an island instead of underwater power lines, etc.).

3.1.4 Financial analysis

Forecasts for price dynamics are essential in order to evaluate the investment correctly.
A time horizon of 25-30 years is advisable.

*Financial rate of return**	*Energy transport and distribution*
minimum	- 3.10
maximum	11.00
average	5.12
standard deviation	5.37

* Sample data: 4 major projects out of 7 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.1.5 Economic analysis

Environmental impact and risk assessment are an essential aspect of the appraisal of energy networks.

As far as environmental *externalities* are concerned, in this case it may be useful to take into account the following:

- the possible valorisation of the area served, quantifiable, for example, by the revaluation of real estate and land prices;
- the negative externalities of possible impact on the environment (loss of land, spoiling of scenery, impact in a naturalistic context) and on other infrastructure (e.g. roads);
- the negative externalities due to the opening of building sites, especially for urban networks (negative impact on housing, productive and service functions, on mobility, historical and cultural heritage, on the agricultural framework and on infrastructure, etc.).

*Economic rate of return **	*Energy transport and distribution*
minimum	8.57
maximum	25.00
average	14.19
standard deviation	7.65

* Sample data: 3 major projects out of 7 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

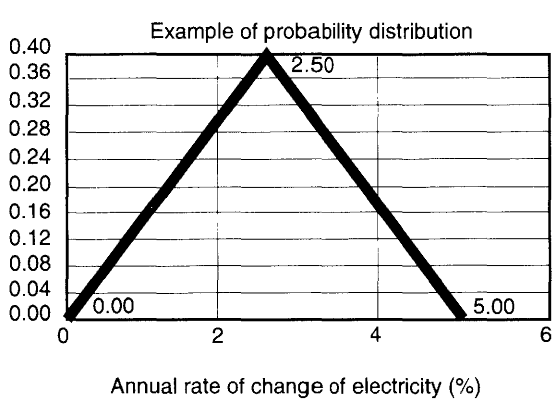
3.1.6 Other evaluation elements

Reference should be made to the corresponding paragraph for the production of energy: see: 3.2.6.

3.1.7 Sensitivity and risk analyses

The critical factors influencing the success of an investment in this sector are the same ones as those described in paragraph 3.2.7. It would be useful if the sensitivity and risk analysis considered at least the following variables:

- cost of the investment,
- demand dynamics (i.e. forecasts of growth rates, of the elasticity of electricity consumption, etc.),
- the dynamics of the sale prices of substitutes electricity or gas.



Further reading: see appendix C.3

3.2 Energy production

3.2.1 Objectives

Included in this sector are crucial investments for economic development because of their wide inter-sectorial links, and for which public involvement is always considerable, even though it may take different forms in different countries.

The actions may be the construction of plants to produce electricity from any source, but also prospecting and drilling natural gas or oil fields, or actions directed at energy saving etc.

Objectives may include local development, but they have an impact on a larger scale (inter-regional, national, multinational, etc.).

Examples of these are:

- increased energy production to cover growing demand;
- reduction of energy imports by substitution with local or renewable sources;
- modernisation of the existing plants for energy production, e.g. for reasons of environmental protection;
- modification of the mix of energy sources, e.g. increasing the share of gas or renewable sources;
- actions supporting energy saving policies.

3.2.2 Identification of the project

When defining the functions of the project, it is advisable to state destination as well as the dimension and location of the potential area served (e.g. research and drilling of a new well field may have as its objective the supply of energy for more than one country, a new power station may serve an entire region, and so on). The projected positioning of the product on the market must be accurately described.

Since we are dealing with rather long cycle investments, the proposer should clearly state the phases; e.g. for a well field the prospecting and research within the target area, initial test drilling, mining and commercial exploitation, closure.

The functional and physical links of the proposed infrastructure to the existing energy system must be clearly explained.

A broad description of the engineering features of the infrastructure would be particularly useful:

- basic functional data, such as: type of plant for producing electricity[1], installed capacity (MWe) and energy produced (TWh/year); annual potential capacity of well fields (millions of barrels/year or millions of m^3/year);
- physical characteristics[2],
- building, technological and processing techniques for the production plants;
- building techniques and technical features of the plants for mining wells, e.g. off-shore platforms, attaching building and functional sketches;
- building techniques and technical features of the other service structures;
- the waste water and fumes treatment systems, with the number and the position of stuks and water discharges;
- significant technical elements, such as the constructions in caverns, dams, special technical solutions for treating refluences, computerised control systems, telecommunications systems, etc.

3.2.3 *Feasibility and option analyses*

The key issue is the demand for energy, seasonal and long term trends and also, for electricity power stations, a typical graph of the daily demand for electricity.

1. In the case of hydroelectric plants (production and/or pumping) linked to aqueducts, one must also bear in mind the observations for the aqueduct sector.

2. For example: area covered by well field (Km^2) and position. In the case of off-shore drilling, it would also be useful to provide local bathymetric profiles; average depth of deposits (m); area occupied (Km^2) by plants (thermo-electricity) and relative storage areas, location of dams, pressure water-pipes and generators for hydro-electric production; area occupied by fields of photovoltaic generators (Km^2) and their location.

The option analysis should include a comparison with:

- the previous situation, without the project;
- possible alternatives within the same infrastructure (e.g. different technologies for production and drilling, different technologies for treating refluences, etc.);
- possible realistic alternatives for producing the energy required (e.g. launching actions and policies aimed at energy saving instead of building a new power station).

3.2.4 *Financial analysis*

Trends in energy demand are strongly linked to the dynamics in other sectors, consequently, in order to make an accurate estimate it is necessary to refer to the development scenarios of the other sectors.

Having said this, it is nevertheless essential that forecasts for price dynamics be made in order to evaluate the investment correctly.

A time horizon of 30-35 years is advisable.

3.2.5 *Economic analysis*

The major problems to be faced are:

- **the monetary value of benefits;**
- **the evaluation of externalities;**
- **the opportunity costs of inputs;**
- **the import substitution impact.**

- The monetary value of benefits. The direct benefits of an energy project may be quantified as the revenue from the sale of energy (at appropriate accounting prices). A realistic evaluation can be made - wherever possible - by estimating the community's *willingness* to pay for energy, by, for example, quantifying the costs the user must incur to acquire energy (e.g. installing and using independent generators, or direct purchasing of combustibles on the market).
- The evaluation of externalities, especially of an environmental nature. The analysis should consider: the cost of the measures necessary to neutralise possible negative effects on the environment (air, water, land) which derive from the implementation of the project; the cost of other

negative externalities which cannot be avoided such as loss of land, spoiling of scenery, etc.

- The identification of the opportunity cost of the various inputs. The economic costs of raw materials used to realise the project should be evaluated by considering the loss to society by the diversion of such raw materials from the best alternative use.

- The value attributed to a greater or lesser dependence on energy from abroad. The evaluation should be conducted by applying appropriate shadow prices[3] to the substituted imported energy; in order to quantify these, it would be advisable to refer to the suggested reading.

*Economic rate of return**	*Energy production*
minimum	8.17
maximum	16.10
average	11.70
standard deviation	3.29

* Sample data: 3 major projects out of 5 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.2.6 Other evaluation elements

Reference should be made to the impact on the environment (visual, noise, pollution, refuse etc.) which, in any case, according to the laws of the majority of Member States, must be a part of the approval procedures.

It would also be useful to evaluate the indirect economic costs, for example those deriving from the use of exhaustible resources, the majority of which are unlikely to have been included in the estimates of the preceding paragraph. One methodological approach which can be suggested is to measure them as standard physical indicators and then to subject the project to an appropriate multi-criteria analysis.

3. If, as often happens, there are strong distortions in the energy market (duties, internal taxes, prices levied, incentives, etc.) it would be wrong to evaluate the value of import substitution using these distorted prices.

3.2.7 Sensitivity and risk analyses

The critical factors influencing the success of an investment in this sector, as already described in the paragraph regarding the financial analysis, are mainly those of the high investment costs and the length of the cycle.

Bearing this in mind, it would be useful if the sensitivity and risk analysis considered at least the following variables:

- cost of the research phase (meaning the prospecting phase for new deposits or research into new technological processes);
- cost of the project realisation phase (site costs);
- demand dynamics (i.e. forecasts of growth rates, of the elasticity of electricity consumption. etc.);
- sales price dynamics for energy produced (or energy products);
- *mix* and dynamics of critical input costs (fuels, etc.).

Further reading: see appendix C.3

3.3 Roads and highways

3.3.1 Objectives

The following alternatives should be considered:

- the construction of the road may be aimed at local development (on a regional or territorial scale, etc.) either because it provides a direct service to productive activities (this is the case, for example, where a road links an industrial area to a port) or because it aims to satisfy the wider transport needs of the local population (included here, for example, are roads for tourism and recreation purposes); in both cases the analysis should show and quantify the local impact;

- the infrastructure is part of road network of a non-local scale (inter-regional, national or international); in this case its construction may create advantages or disadvantages at a local level, but these should in any case be considered in the economic analysis.

Roads which are a component of a wider network should be appraised in the framework of the network.

3.3.2 Identification of the project

A good starting point for briefly, but clearly and unequivocally, identifying the infrastructure is to state its functions, which are coherent with the objectives of the investment. This should be followed by a description of the type of action, that is whether it is a completely new road, or a section of a larger infrastructure, or part of an extension or modification of an existing road (for example the construction of a third lane for a two-lane highway).

This part of the analysis report should at the very least contain the following data:

- length (in Km) and layout of the road, with an attached plan of appropriate scale;

- physical links with other roads and the position of important junctions (exits, links to other infrastructure, etc.);

- technical features and conformation of the road, including examples of one or two typical sections of the carriageway (clearly showing the parts to be constructed);

- important technical elements, such as bridges and tunnels, crossing of other infrastructure, service areas, traffic information and assistance centres, etc.

3.3.3 Feasibility and option analyses

The key issues are the volume of traffic on a daily and seasonal basis.

In this case the pattern of traffic flows to/from the major intersections and the forecast for trends over time constitute the ideal tool for showing the optimisation of the project (number and size of lanes, position and structure of the exits and/or links, etc.), including considerations of the impact on the environment. Any elements of particular technical importance for the project should be included if appropriate (e.g.: sections where there is a considerable difference in height, important tunnels and/or bridges, equipment for traffic information/support, etc.).

The option analysis should include a comparison with:

- **the previous situation, without the realisation of the project;**
- **alternative routes;**
- **possible alternative systems of transport (by rail, sea, etc.).**

3.3.4 Financial analysis

The profitability analysis should be carried out according to standard methods, see above Section 2.4. When appropriate, two different points of view should be considered: i) that of the infrastructure investor and ii) that of the operational management. In the case of toll-free roads, the financial analysis should measure the net cost to be financed publicly and provide significant comparison with other similar investments. In all cases a time horizon of 25-30 years is advisable.

Financial rate of return *	*Roads and highways*
minimum	- 0.60
maximum	10.49
average	3.93
standard deviation	2.79

* Sample data: 12 major projects out of 97 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.3.5 *Economic analysis*

Since the purpose of the economic analysis is to show the increased social benefits, that is the benefits the project brings to the local community, this may be carried out as a single step, as if the proprietary body or licenser and the licensee were one and the same.

In addition to all the parameters of financial analysis, the following costs and benefits should be considered:

- **the time saved**
- **the reduction of number of accidents**
- **the increased cost for the user**
- **externalities**

a) The time saved if compared to a situation without the realisation of the project, to be quantified on the basis of a technical analysis of the travel time; the economic value of time saved is a function of the average economic income of the users; in practice, it can prove useful to subdivide users into categories (for example: individual users or light vehicles, estimating the average number of occupants per vehicle and considering the average income of private citizens; commercial use or heavy vehicles, referring to the average load and the average added value to potential user companies); as an indication, the value of time considered in 27 major projects of the second generation (1994-99) was an average of 9.56 ECU/h (standard deviation s = 2.48 ECU/h) for light vehicles and 12.66 ECU/h (s= 5.56 ECU/h) for heavy vehicles.

b) The reduction in the number of accidents, which should be estimated on the basis of a technical analysis of the road safety features; to give an economic value it is necessary to refer on the one hand (non-fatal accidents) to the total cost of hospital treatment and to the cost of income lost due to possible absence from work and, on the other (fatal accidents) to the value of human life quantified on the basis of average income and life expectancy.

c) The increased cost for the user (for example number of Km travelled), quantifiable in terms of greater consumption of fuel (consumption curves according to speed), tyres, etc., as well as the increased wear and tear on mechanical parts.

d) In addition, it would also be helpful if the proposer appraised, wherever possible, *externalities*, negative ones such as loss of agricultural land, possible relocation of residential, commercial or industrial areas, noise and atmospheric pollution[4] and positive ones, for example possible increase in local earnings due to the setting up of new enterprises (for example motorway services, restaurants, commercial activities, etc.) as a direct result of the existence of the new road[5].

*Economic rate of return**	*Roads and highways*
minimum	5.00
maximum	94.65
average	18.63
standard deviation	13.15

* Sample data: 91 major projects out of 97 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.3.6 *Other evaluation elements*

This section mainly refers to other elements of the impact on the environment (visual, noise, pollution, etc.) which, in any case, according to the laws of the Member States, must be a part of the approval procedures. In the case of modernisation of existing roads, the impact of road works on traffic flows should also be analysed and shown to be kept to a minimum.

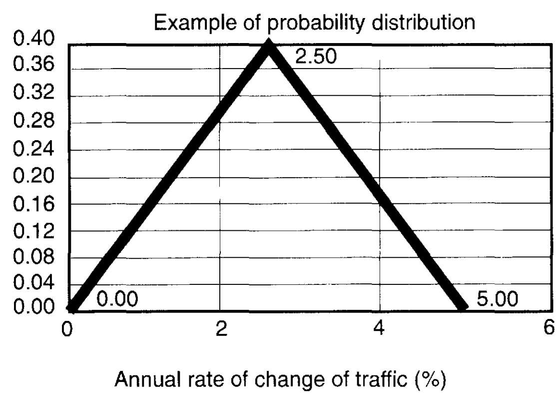
3.3.7 *Sensitivity and risk analyses*

The critical factors that influence the success of an investment in the road transport sector are basically of three types and involve the forecast traffic flows (demand), the lack of elasticity of the investment (excessive capacity is often required in the early stages of the exercise), the determining influence of side activities (for example, the efficiency of a motorway is dependent on a good network of link roads). Bearing this in mind, it would be advisable for the sensitivity and risk analyses to consider at least the following variables:

4. The impact of the latter may be evaluated amongst other things, as the loss in commercial value of real estate in the surrounding area.

5. A word of warning: double counting should be avoided: the possible increase in local income in general is already included in the economic parameters previously analysed.

- the dynamics of toll fees over a period of time;
- the rate of change of traffic over a period of time (see graph below);
- the number of passengers in light vehicles and the loads of heavy vehicles, which influence the time value (see graphs in par. 2.10);
- the value of life and temporary disability.



Further reading: see appendix C.4, C.5

3.4 Surface and underground railways

3.4.1 Objectives

In addition to railways and underground systems, this sector includes projects for other kinds of transport on rails, such as trams, mixed systems, etc.

As was the case with roads, the objectives for projects in this sector may be either of the following alternatives:

- the (railway) infrastructure is an integral part of an inter-regional and/or national network; in this case its realisation may bring about advantages or disadvantages at a local level, which should be considered in the economic analysis;
- the construction of the system is aimed at local development (on a metropolitan or regional scale, etc.) either because it provides a direct service to productive activities (this is the case, for example, of a branch line linked to an industrial area) or because it aims to satisfy the wider transport needs of the local population (included here are underground rail and urban transport systems, trams etc.).

The analysis should show and quantify the net positive impact locally (e.g. reduction of urban road traffic, and pollution in the case of underground transport).

3.4.2 Identification of the project

Here, again, it is also useful to define the functions of the measure, which must be consistent with the objectives of the investment. This should be followed by a description of the type of action, that is whether it is a completely new construction, a section of a larger infrastructure, or part of an extension or modification to an existing construction (for example the laying of a second track or the electrification and/or automation of existing structures). The functional incorporation of the projected infrastructure into the (existing or projected) transport system (whether urban, regional, inter-regional or national) should be made quite clear.

This part of the analysis report should at least contain the following data:

- the total length (in Km) and layout of the structure, with an attached chorographic plan of appropriate scale;
- physical or functional links with other transport structures and the position of important intersections (stations, sidings, intermodal connections, etc.);
- technical features and conformation of the structure, including examples of one or two typical sections and/or sketches;
- other important technical elements, such as tunnels.

3.4.3 *Feasibility and option analyses*

The key issues are the volume of traffic, at least on a daily and seasonal basis. In this case the pattern of traffic flows to/from the major intersections and the forecast for trends over time constitute the ideal tool for showing the optimisation of the project, as do considerations of the impact on the environment. Here any elements of particular technical importance for the project should be included if appropriate (e.g.: embankments, important tunnels and/or bridges, sophisticated safety/automation equipment, etc.).

The option analysis should include a comparison with:

- **the previous situation, without the realisation of the project;**
- **alternative routes;**
- **transport alternative (by road, sea, etc.).**

3.4.4 *Financial analysis*

Here one can follow the outline given for road infrastructure. Note that for railways the managing body and the investor are the same in the majority of cases, but this may more often not be true for local systems (underground or suburban railways, etc.). Furthermore, the use of these structures is rarely free of charge. In order to evaluate temporal trends in demand it may be useful, especially when dealing with local systems, to refer to the forecasts for the population of the area, bearing in mind any town planning projects (relocation of businesses, renovation of historic town centres, etc.).

*Financial rate of return**	*Railways*	*Undergrounds*
minimum	1.63	5.18
maximum	21.50	9.50
average	6.44	7.86
standard deviation	4.26	1.91

* Sample data. Railways: 31 major projects out of 56 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

Undergrounds: 3 major projects out of 6 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.4.5 *Economic analysis*

In addition to all the parameters of financial analysis, here the following costs and benefits should be considered:

- **time saved;**
- **reduction of accidents;**
- **diversion of income;**
- **externalities.**

- The time saved if compared to a situation without the project, to be quantified as suggested for roads; note that due consideration should be given to the time saved as a result of the substitution of other, less efficient means of transport; it may also be useful here to divide users into categories (e.g. passengers and goods); as an indication, the value of time considered in 27 major projects of the second generation (1994-99) was an average of 7.44 ECU/h (σ= 3.17 ECU/h) regardless of the type of user.
- The reduction in the number of accidents should be evaluated in the same way as for roads; this parameter is particularly relevant where modernisation projects are involved.
- The reduced social income due to the decrease in traffic in other existing transport systems which may have been (partially) substituted by the new, more efficient structure.

Again it is useful if *externalities* could be given a money value:

- negative ones such as loss of agricultural land, possible relocation of other infrastructure and/or possible relocation of residential, commercial or industrial areas;
- positive ones, for example the possible increase in local earnings due to the setting up of new enterprises (e.g. restaurants or shops in the new stations);
- certain types of pollution may be reduced in certain areas, whereas at the same time some types of pollution may be increased in other areas[6].

*Economic rate of return**	*Railways*	*Undergrounds*
minimum	2.80	10.09
maximum	55.10	18.90
average	13.83	15.06
standard deviation	8.76	3.23

* Sample data. Railways: 43 major projects out of 56 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

Undergrounds: 4 major projects out of 6 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

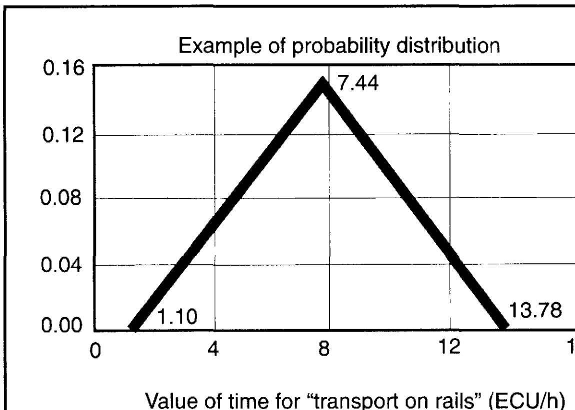
3.4.6 Other evaluation elements

In the case of tram, underground and mixed systems, the impact of construction works on both urban and suburban traffic flows should also be analysed and shown to be kept to a minimum.

3.4.7 Sensitivity and risk analyses

The observations made for roads about the critical factors influencing the success of the investment are equally true for railways. In view of this, it would be advisable for the sensitivity and risk analysis to consider at least the following variables:

- the dynamics of fares and tariffs (passengers and goods) over a period of time;
- the rate of change of traffic over a period of time (see graph in par. 3.3.7);
- the substitution rate of other existing infrastructure;
- the number of passengers or the amount of goods per train, which influences the time value (see graph below);
- the value of life and temporary disability.



Further reading: see appendix C.4, C.6

6. As stated, local systems (underground, trams, mixed-systems) should bring about a net reduction in pollution of all types.

3.5 Ports, airports and infrastructure networks

3.5.1 *Objectives*

These structures act as an interface between national and international transport networks and local systems.

- In general the aims of a project in this sector are to promote local development either because it provides a direct service to productive activities or because it aims to satisfy the wider transport needs of the local population, or to complete and permit maximum utilisation of national/international transport networks. Both aspects should be included in the analysis.

- In some cases (e.g. tourist ports) the aim of local development is by far the most important and consequently the analysis should show and quantify a positive impact locally.

3.5.2 *Identification of the project*

Bearing in mind the wide range of possible alternatives, great attention should be paid to the precise definition of the functions of the project, explaining whether it is a completely new construction, or an extension or modification of an existing structure (for example the automation of traffic and the container park, the extension or improvement of ground services at an airport).

The functional inclusion of the projected infrastructure into the (existing or projected) transport system (regional, national or international) should be made quite clear.

This part of the analysis report should for example contain the following data:

- type and size (range) of the means of transport (aeroplanes, ships, etc.) which will benefit from the structure;

- physical features (with an attached chorographic plan of appropriate scale), such as:

- number and total length (in m) of airport runways,

- number and total length (in m) of piers or quays for ports,

- covered and uncovered storage area (in thousands of m^2) for the intermodal structures (and also for ports if the storage is part of the project);

- physical or functional links with other local transport systems e.g. motorways, roads, railways etc. (it may be useful to attach schematic drawings); for an airport, for example, it would be important to show the links with the cities it is to serve, for a tourist port the links with other tourist structures, and so on;

- technical features and conformation of the major structures, including examples of one or two typical sections or sketches (sections of runways, the structural arrangement of the quays etc.) clearly showing the parts to be constructed;

- building techniques and technical features of buildings and other service structures, with attached plans and sections;

- significant technical elements, such as internal transport, crane systems, equipment for computerised traffic control, automation of goods traffic, etc.

3.5.3 *Feasibility and option analyses*

The points of reference are the volume of passenger and/or goods traffic, based on daily and seasonal trends.

The pattern of traffic flows and the forecast for trends over time constitute essential information for showing the net optimisation of the project.

This section should also include technological solutions adopted for any significant technical problems with the project.

The option analysis should include a comparison with:

- the previous situation, without the realisation of the project,

- possible alternative locations for the same infrastructure,

- possible alternative systems of transport.

3.5.4 *Financial analysis*

The managing body and the investor are the same in many cases, but in the case of tourist ports or intermodal structures, for example, the two may be different, and if so, it is advisable to conduct the analysis from both points of view. In evaluating the financial inflows, in addition to rents, taxes or other forms of payment for the use of the structure, one must also bear in mind the tariffs or sales prices of any possible additional service offered by the management (e.g. water and fuel supply, catering, maintenance and storage services, etc.). For the output, as well as the investment costs[7], depreciation, maintenance[8], technical and administrative personnel costs for the project and additional services and overheads, it is also necessary to bear in mind the purchasing price of the products and services needed for the day to day working of the structure and the additional services.

A time horizon of 30 years is advisable.

*Financial rate of return**	*Airports*	*Ports*
minimum	6.19	3.66
maximum	16.02	15.49
average	10.73	8.49
standard deviation	3.22	4.47

* Sample data. Airports: 5 major projects out of 12 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

Ports: 4 major projects out of 8 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.5.5 *Economic analysis*

The economic analysis may follow the pattern of that for roads, taking into account the comments below.

In addition to all the parameters of financial analysis, the following costs and benefits should be considered:

- **time saved;**
- **variation in rate of accidents;**
- **income lost for traffic diversion;**
- **income increase for trade or tourism;**
- **other externalities.**

a) The time saved if compared to a situation without the realisation of the project, to be quantified as suggested for roads and by dividing users into categories (e.g. passengers and goods); in this case due consideration should also be given to the time saved as a result of the substitution of other, less efficient transport systems (or goods handling), as an indication, the value of time considered in 27 major projects of the second generation (1994-99) was an average of 7.44 ECU/h (σ = 3.17 ECU/h) regardless of the type of user.

b) Possible variation in the rate of accidents[9], especially in modernisation projects; in this case one needs not only to consider the rate for users (passengers, staff, transporters, etc.) but also that for workers on the infrastructure itself.

c) The reduced social income due to the decrease in traffic in other existing transport systems which may have been (partially) substituted by the new, more efficient structure.

d) Income increase for trade or tourism could be estimated by simple multipliers.

e) Again it is useful if *externalities* can be valorised:

- negative ones such as loss of agricultural land, possible relocation of other infrastructure and/or possible relocation of residential, commercial or industrial areas, environmental pollution (acoustic, visual, etc.) and the raw material consumption[10];

7. The investment cost includes e.g. the following: works, expropriation, indemnity and connection expenses, etc, expenses for special machinery and equipment, general expenses. In addition, the cost of extraordinary maintenance may be charged to the investor or to the licensee, according to the contract licence.

8. Ordinary maintenance; for extraordinary maintenance see previous note.

9. The valorisation mat follow the methodology described for roads.

10. The impact of the latter may be valorised by referring to the loss in commercial value of real estate in that particular area.

- positive ones, for example the increased value of land and real estate in the impact zone of a tourist port or the possible increase in local earnings due to the setting up of new enterprises (e.g. hotels, restaurants or shops in the new airport or port), with the warning to avoid doubling;
- additional income arising from trade.

*Economic rate of return**	*Airports*	*Ports*
minimum	1.00	7.46
maximum	36.34	41.00
average	16.90	19.96
standard deviation	9.28	4.15

* Sample data. Airports: 9 major projects out of 12 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

Ports: 5 major projects out of 8 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.5.6 Other evaluation elements

Reference should be made to the impact on the environment (visual, noise, pollution etc.) which, in any case, according to the laws of the Member States, must be a part of the approval procedures.

In the case of new infrastructure or significant extensions, it would also be useful to consider the local impact on the territory, in terms of urban and traffic congestion, etc., showing that this has been kept to a minimum.

3.5.7 Sensitivity and risk analyses

The observations made for roads about the critical factors influencing the success of the investment are equally true for these infrastructure. In view of this, it would be advisable for the sensitivity and risk analysis to consider at least the following variables:

- the rate of change of traffic over a period of time,
- the substitution rate of other existing infrastructure,
- the value of time,
- the value of life and temporary disability.

Further reading: see appendix C.4, C.7, C.8

3.6 Water supply, transport and distribution

3.6.1 Objectives

Investments in this sector are often of a considerable size, for works aimed at the purification, collection and conservation of water resources (dams, intakes of running water, well fields, etc.), large scale transport (lead ins, large aqueducts, etc.), reservoirs and networks for local water distribution. Projects may include plants for raising and producing water (e.g. desalinators for sea water) or for treating it.

In general the aims of the projects in this sector are to promote local development (on a metropolitan or territorial scale, etc.) since they provide a direct service to productive activities (agriculture or industry) and/or because they aim to satisfy the wider water needs of the local population. The analysis should therefore show and quantify a positive impact locally.

Sometimes the project may have non-local objectives, for example on a regional or inter-regional scale; this is the case, for example, of aqueducts for the long-distance transportation of water from relatively rich areas to arid zones. This aspect should be duly considered.

3.6.2 Identification of the project

It is useful to state whether the water resource is destined for irrigation and/or other agricultural purposes, for feeding industrial areas, for the drinking water system for urban centres, or for multiple purposes[11]. It is also useful to distinguish between types of investments, classifying them according to the prevalent functions, e.g. in the following categories: i) completely new aqueducts; ii) modernisation and/or partial replacement of existing aqueducts; iii) works to increase the available water supply; iv) works to guarantee water supply in periods of drought (seasonal, annual)[12]; v) completion of distribution networks; vi) actions to increase management efficiency.

When dealing with extensions or modernisation, the functional linkages of the projected infrastructure into the existing aqueduct system should be clearly shown.

11. If the project involves the production of hydroelectric energy the analysis must also take into account the considerations made for the energy production sector

12. These are "safety" measures, of important strategic value.

This section should at least give the following engineering data:

- basic functional data, such as: the number of inhabitants served, the area irrigated (in hectares), the number and type of productive structure served, the per capita (l/g*inhabitant) or per hectare (l/g*hectare) water supply, data regarding the quality of the water (from laboratory analyses);
- physical features[13];
- physical or functional links between the structures and with other possible plants (it may be helpful to attach technical and schematic drawings);
- technical features and conformation of the major structures, including examples of one or more typical sections or sketches (sections of pipelines, sketches of the control room etc.) clearly showing the parts to be constructed;
- building techniques and technical features of the major plants for drawing, production or purification, attaching detailed functional drawings if necessary;
- building techniques and technical features of buildings and other service structures, with attached plans and sections;
- significant technical elements, such as crossings, tunnels, remote control or computerised service equipment, etc. (including data and drawings).

13. *For example: total length (Km), nominal diameters (mm), nominal rate of flow (l/s) and rises (m) of lead ins (attaching a topographic plan of the layout of an appropriate scale), nominal volume (millions of m^3) and height of dam gates (m), number, length (m) and nominal rate of flow (l/s) for intakes of running water, number, depth (m), diameter (mm), flow drawn (l/s) for well fields, linear development (Km) and characteristic diameters (mm) of the networks, reservoir capacity (m^3), nominal flows (l/s) and rises (m) of drawing plants (attaching blueprints and sections), nominal flow (l/s), production (m^3/g) and power absorbed/consumed (KW or Kcal/h) for drinking water treatment or desalination plants.*

3.6.3 Feasibility and option analyses

The points of reference are the demand for water on the part of the users[14], which may be broken down into components according to the use (demand for drinking water, or for irrigation or industrial purposes, etc.), and the timing of demand (daily, seasonally, etc.). The estimation of the demand curve may be based on data gained from previous experience in the area involved, or on other forecasting methods. This section should also include considerations of the environmental impact, especially for works like dams, large aqueducts, important technological plants, etc. This section should also include technological solutions adopted for any significant technical problems with the project.

The option analysis should include a comparison with:

- the previous situation, without the realisation of the project;
- possible alternatives within the same infrastructure (alternative routes for aqueducts, different building techniques for dams, different positioning and/or process technology for plants etc.);
- improvements in the operation of existing plants and distribution lines;
- possible global alternatives (e.g. a dam instead of a well field, or the re-use in agriculture of suitably treated refluent water).

3.6.4 Financial analysis

The managing body and the investor are the same in many cases, but if they are different (this may happen, for example, with a distribution network built by a public company but managed by private enterprise) it is advisable to bear this in mind and conduct the financial analysis from the point of view of both parties.

14. *It is advisable to refer to **effective demand**, which differs from potential demand because it takes into consideration the effective extension of the service (e.g. in the number of homes linked to the network, the number of public and private activities which actually use the service, etc.).*

The financial revenues generally derive from tariffs applied for the sale of water[15], which must, however, be separated from the sewer and/or depurator fees, if applied. The tariffs or sales prices of possible additional services offered to users (e.g. hooking up, periodic maintenance, etc.) should also be taken into account. The rate of growth in demand can be based on estimates of the demographic dynamics and/or the development prospects (planned or "natural") of economic activities in the affected area (e.g. development of crops, raising of livestock, tourism, particular industrial activities, etc).

For the output, as well as the investment costs, depreciation (or residual value of the investment), maintenance, technical and administrative personnel costs for the project and additional services and overheads, it is also necessary to bear in mind the purchasing price of the products and services needed for the day to day working of the structure and the additional services.

A time horizon of 25- 35 years is advisable.

*Financial rate of return**	*Aqueduct structures*
minimum	- 16.10
maximum	10.36
average	- 1.01
standard deviation	7.64

* Sample data: 10 major projects out of 29 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.6.5 *Economic analysis*

In addition to the elements deriving from the analysis of financial flows, the main social benefits to be introduced in the economic analysis a shadow price for water. This shadow price can be estimated by an accounting price for water on the basis of market prices for alternative services (tank trucks, bottled water) or other methods[16].

Other elements *(externalities)* which should, if possible, be evaluated are:

- the possible valorisation of the area served, quantifiable, for example, by the revaluation of real estate and land prices;
- in the case of artificial lakes, increased income due to the possible setting up of related activities (tourism, fishing, etc.);
- negative externalities of possible impact on the environment (loss of land, impact on landscape, wildlife and on other infrastructure (e.g. roads);
- negative externalities due to the opening of building sites, especially for urban networks (negative impact on housing, productive and service functions, on mobility, historical and cultural heritage, on the agricultural framework and on infrastructure, etc.)

*Economic rate of return**	*Aqueduct structures*
minimum	6.00
maximum	52.50
average	18.92
standard deviation	12.04

* Sample data: 23 major projects out of 29 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.6.6 *Other evaluation elements*

Legislation in the majority of member countries requires the compulsory evaluation of the environmental impact for some water related projects (dams, large aqueducts, etc.), in the approval stages. A quali-quantitative approach can successfully use multi-objective (or multi-criteria) analysis methods.

15. The sales prices of aqueduct services vary greatly from country to country and between different areas of the same country.
16. See reading list in Appendix B for applicable methodologies.

3.6.7 *Sensitivity and risk analyses*

It would be advisable for the sensitivity and risk analysis to consider at least the following variables:

- the cost of the investment;
- the rate of demographic growth of the population (for drinking water purposes);
- the rate of development of crops (for irrigation purposes);
- variations in tariffs over a period of time;
- the dynamics of costs over time of some goods and critical services for certain projects (e.g. the cost of fuel and/or electricity for desalination plants).

Further reading: see appendix C.9

3.7 Sewers and depurators

3.7.1 *Objectives*

Objectives are almost always related to local development and may be considered from a dual point of view: i) these actions are aimed at "closing" the water-cycle for hygienic-sanitary reasons and, as such, may be regarded as part of the integrated water service, ii) they are also measures to safeguard the environment.

The analysis should therefore show a positive local impact from both viewpoints: service to users and environment safeguard.

3.7.2 *Identification of the project*

In order to define the functions of the project, it is useful to state whether the investment is destined to serve a prevalently urban, industrial or agricultural area, or whether the destinations are mixed; furthermore, it may also be helpful to classify the type of investment, according to the major functions, into categories such as i) construction of totally new collecting separation and refluence purification systems, ii) modernisation and/or partial substitution of existing systems, iii) purification systems for existing sewer systems, iv) completion of depurators with tertiary treatment plants to allow for re-use of purified refluences, v) construction of the main sewer to be linked to the existing purification systems, vi) completion of the sewer network, vii) projects to improve efficiency.

For drains, it should be made clear whether these are for dirty water or for rainwater or mixed systems.

It is especially important, when dealing with extensions or modernisation, that the functional linkages of the projected infrastructure into the existing systems should be clearly shown.

This section should at least give the following engineering data:

- basic functional data, such as: the number of inhabitants served, the number and type of productive structures served, the number of equivalent inhabitants, the volume and parameters of possible pollutants in the water to be treated (laboratory analyses) and restrictions to the quality of waste water (legally defined);
- physical features[17];
- physical or functional links between the structures and with other possible pre-existent plants;
- technical features and conformation of the major structures, including examples of one or more typical sections or sketches (sections of collecting drains, waste drains from depurators, inspection wells etc.) clearly showing the parts to be constructed,
- building techniques and technical features of the major drawing plants, screens, etc.;
- building techniques and technical features of the purification and discharge equipment in the final receiving body of water (e.g. underwater pipelines), screens;
- building techniques and technical features of the other service structures, attaching blueprints and sections;

17. For example: total length (Km), nominal diameters (mm), nominal rate of flow (l/s) and rises (m) of principal lead in drains, linear development (Km) and characteristic diameters (mm) of the sewer networks (attaching a blueprint sketch of a suitable scale), nominal volume (millions of m^3) and rises (m) of possible drawing plants (attaching blueprints and sections), nominal flow (l/s), potential (equivalent inhabitants), purifying efficiency of the depurators.

- significant technical elements, such as crossings, tunnels, technical solutions for depurators in areas (e.g. tourist) with considerable variation in needs, remote control or computerised equipment, etc.

3.7.3 *Feasibility and option analyses*

The reference point is the effective demand for water from the users[18], basically equivalent to the amount of waste water to be treated and drained.

The option analysis should include a comparison with:

- **the previous situation, without the realisation of the project;**
- **possible alternatives within the same infrastructure (alternative routes for lead-ins, different positioning and/or process technology for purification plants etc.);**
- **possible alternatives for discharging water in final receiving bodies.**

In addition, if not already required by the project, it is useful to analyse the alternative of re-use of refluent water.

3.7.4 *Financial analysis*

The managing body and the investor are the same in many cases, but if they are different (this may happen, for example, with networks and/or plants built by a public company but managed by private enterprise), it is advisable to bear this in mind and conduct the financial analysis from the point of view of both parties[19].

The financial input generally derives from tariffs applied for the sale of water, and from the sewer and/or depurator fees. Possible reimbursements (or other forms of transfers) for the collection and transport of rainwater should also be considered, if they exist. Also in this case, the tariffs or sales prices of possible additional services offered to users (e.g. hooking up, periodic maintenance, etc.) should be taken into account. The rate of growth in demand can be based on estimates of the demographic dynamics and/or the development prospects, or estimates of economic activities in the affected area (e.g. raising of livestock, tourism, particular industrial activities, etc.). On the other hand, in the case of drainage and purification systems which are used free of charge, the analysis should measure the net cost to public finances (FRR<0) and provide a significant comparison with similar investments

A time horizon of 25- 35 years is advisable

Financial rate of return*	Depurators and drains
minimum	- 12.91
maximum	15.60
average	1.79
standard deviation	9.81

* Sample data: 5 major projects out of 35 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.7.5 *Economic analysis*

In addition to the elements derived from the analysis of financial flows, the main social benefits to be introduced in the economic analysis may be evaluated according to estimates of potential demand for refluent[20] water that the investment will satisfy, on the basis of an accounting price for water[21].

Alternatively, if possible, direct valorisation may be applied to benefits such as:

- illnesses and deaths avoided thanks to an efficient drains service; for value of life see the section on roads;
- damage avoided to land, real estate and other structures due to potential flooding or unregulated rainwater, valorised on the basis of the costs for recovery and maintenance;
- in the case of purified discharges into rivers, lakes and land, the value of the water resources in non-

18. For an estimate see section on water supply, transport and distribution.

19. See section referring to roads, especially with reference to the contract licence.

20. Basically the same as the demand for water.

21. See reading list in Appendix B for applicable methodologies.

polluted collectors, to be estimated according to the method shown for aqueducts.

For the reasons stated in the paragraph regarding objectives, the environmental *externalities* should be quantified in any case, considering the following:

- the change of market value, of real estate and land prices;
- in the case of safeguarding rivers, artificial lakes, and other collecting bodies, the increased income due to the related activities (tourism, fishing, etc.) that may be maintained or set up;
- negative externalities due to the possible impact on the environment[22];
- negative externalities due to the opening of building sites, especially for urban sewer networks (negative impact on housing, productive and service functions, on mobility, historical and cultural heritage, on the agricultural framework and on infrastructure, etc.).

*Economic rate of return**	*Depurators and drains*
minimum	4.10
maximum	66.00
average	13.31
standard deviation	11.46

* Sample data: 28 major projects out of 35 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.7.6 Other evaluation elements

It may be useful to produce a special appraisal of the impact of the proposed system when the location for the investment is a *sensitive area* from the environmental point of view.

22. *Legislation in the majority of Member countries requires the compulsory evaluation of the environmental impact for some projects (depurators), in the approval stages.*

3.7.7 Sensitivity and risk analyses

The critical factors influencing the success of an investment in this sector are the same as those for aqueducts (see pertinent paragraph). In view of this, it would be advisable for the sensitivity and risk analysis to consider at least the following variables:

- the cost of the investment;
- the rate of demographic growth of the population and/or other activities involved;
- the dynamics of water demand and fees in case of re-use of purified water;
- variations in tariffs over a period of time,
- the dynamics of costs over time of some goods and critical services for certain projects (e.g. the cost of chemicals for depurators).

Further reading: see appendix C.10

3.8 Refuse and waste treatment

3.8.1 Objectives

As for sewer/depurator structures, in this sector the objectives are almost always related to local development and may be considered from a dual point of view: i) these actions are aimed at "closing" the production-consumption cycle for goods of a hygienic-sanitary nature and ii) for actions aimed at safeguarding the environment. The analysis should therefore show a positive local impact from both viewpoints.

Investments may be mostly of a productive nature (disposal of waste generated by industry and/or services) or be destined for the disposal needs of the civil population (urban waste). They may also have as objectives the recovery of secondary raw materials or energy.

3.8.2 *Identification of the project*

In order to define the functions of the project, it is useful to state whether the investment is destined to serve a prevalently urban, industrial or agricultural area (e.g. raising livestock), or whether the destinations are mixed and if they include plants for recovery and recycling or energy production[23].

In any case, the functional and physical links of the projected infrastructure to systems for gathering and transporting urban and industrial waste must be made clear, and is usually a critical element of investment. In the case of secondary raw material or energy production, their destinations and possible placing on the market should also be described.

This section should at least give the following engineering data:

- basic functional data, such as: number of inhabitants served, number and type of productive structure served, the type (urban waste, processing waste, harmful waste, toxic waste) and quantity (t/day or t/year) of products to be treated, the type and quantity (t/day or t/year) of the secondary raw materials recovered, the energy produced (Kwh/day or Mwh/year, Kcal/day or Mcal/year);

- physical features, for example: the area occupied by the plant (in thousands of m^2), covered and uncovered storage areas (in thousands of m^2); nominal power absorbed and/or produced (MW);

- building, technological and processing techniques for the treatment plants;

- typical range (chemical type) of the waste to be treated and possible products recovered;

- building techniques and technical features of the other service structures;

- the position and discharge systems for refluent water and fumes;

- significant technical elements, such as technical solutions, remote control or computerised equipment, etc. (including data and drawings).

23. *In these cases it would be advisable to bear in mind the considerations made in the section regarding energy production.*

3.8.3 *Feasibility and option analyses*

The key issue is the effective demand for waste removal on the part of the user. The pattern for refuse flows must be based on the demographic development of the population and on the kind of industrial activities or services to be catered for.

Typical values for per capita waste production, and for the type and quantity of waste produced by many industrial processes and some services, can be found in various publications.

The option analysis should include a comparison with:

- the previous situation, without the realisation of the project,

- possible alternatives within the same infrastructure (e.g. different technologies for thermo-destruction, different storage systems, etc.),

- possible alternative treatment (e.g. the construction of a landfill instead of thermo-destruction plant or vice-versa, etc.).

In addition, if not required by the project, it is still useful to analyse the alternative of recovering and recycling secondary raw materials and/or the use of waste for energy.

3.8.4 *Financial analysis*

Wherever the manager and the investor are separate bodies, it is advisable to bear this in mind and produce two financial analyses from the two viewpoints.

The financial revenue of the manager is usually given by the prices for treatment (normally extremely variable according to the type of waste). One must also bear in mind the possible sale of products recovered and/or energy produced, if any. The growth rate in demand can be based on estimates of the demographic dynamics and/or prospects for the development of economic activities in the area.

The financial analysis measures the net cost to public finance and provides a significant comparison with other similar projects, even if the waste treatment is intended to be offered free of charge (FRR<0).

For the output, in addition to other investment costs[24], depreciation (or residual value of the investment), maintenance[25], technical and administrative personnel costs for the project and additional services and overheads, it is also necessary to bear in mind the purchasing price of the products and services needed for the day to day working of the plants.

A time horizon of 15-20 years is advisable.

3.8.5 *Economic analysis*

For this sector, the methodology for estimating social benefits is quite controversial and may entail some conceptual difficulties.

One practical approach is to consider, along with the analysis of financial flows, the value of sanitary and environmental benefits, such as:

- illnesses and deaths avoided thanks to an efficient waste disposal service; for valorisation see the section on roads;

- damage avoided to land and water (surface and sub-stratum); the former can be valorised on the basis of the costs of de-polluting and recovery[26], and the latter in the same way as aqueduct systems, bearing in mind, however, the portion of water resources safeguarded which can really be utilised.

The suggested approach perhaps underestimates some of the benefits, like, for example, the reduced pollution in the air.

For the reasons stated in the paragraph regarding objectives, the environmental *externalities* should be quantified in any case, considering the following:

- the possible valorisation of the area served by the treatment plant, quantifiable, for example, by the revaluation of real estate and land prices;

- negative externalities due to the possible impact on the local environment[27] of the construction and running of the infrastructure (loss of land, impact on landscape, spoiling of scenery, pollution of the air by odours and/or fumes, impact in a naturalistic context etc.).

3.8.6 *Other evaluation elements*

In these project analyses multicriteria evaluation may be useful.

3.8.7 *Sensitivity and risk analyses*

The critical factors influencing the success of an investment in this sector are the same as those for aqueducts (see pertinent paragraph) and sewers/ depurators. In view of this, it would be advisable for the sensitivity and risk analyses to consider at least the following variables:

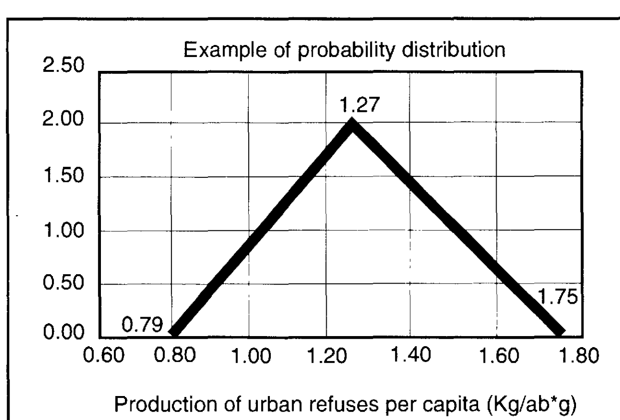
- the cost of the investment;

- the rate of demographic growth of the population and/or other activities involved;

- the quantity of refuse produced (see attached graph for urban refuse);

- variations in the sales price of recovered products (if applicable);

- the dynamics of costs over time of some goods and critical services for certain projects (e.g. the cost of electricity and/or fuel).



Further reading: see appendix C.10

24. *The investment cost includes the following: technical works, expropriation, indemnity and connection expenses, etc, expenses for special machinery and equipment, general expenses. In addition, the cost of extraordinary maintenance may be charged to the investor or to the manager, according to the contract licence.*
25. *Ordinary maintenance; for extraordinary maintenance see previous note.*
26. *There are many examples of these types of actions carried out in many countries, including EU member states, to which one may refer.*

27. *Legislation in the majority of member countries requires the compulsory evaluation of the environmental impact for some infrastructure (incinerators, etc.), in the approval stages.*

3.9 Training Infrastructure

3.9.1 *Objectives*

The objectives of projects concerning training infrastructure are always linked to satisfying needs on a local scale, but often have a wider social impact: a higher level of instruction would appear to determine a higher per capita GDP, better hygiene standards, increased political awareness etc. Furthermore, instruction may be seen as a worthy cultural asset in itself.

Projects may refer to basic education, or to vocational training, higher levels (universities, business schools, etc.).

On the other hand, actions may be aimed at making the geographic distribution of school services more homogeneous (this is the case for projects in rural or isolated areas, etc.) or they may be directed at eliminating discrimination between social classes, genders or even at improving opportunities for the disabled.

Lastly, in some cases the projects may be linked to particular needs for specialisation in certain productive areas and/or to improving the positioning of young people on the labour market.

3.9.2 *Identification of the project*

The identification of the project stems from the precise determination of the training functions which the structure fulfils and must be coherent with the programmed objectives.

It would therefore be advisable to give the following basic data: geographic location (attaching suitable maps), level and type of educational activity, number of pupils, geographic catchment area of pupils, associated services (libraries, sports-recreational activities, reception facilities, canteens, etc.). It would also be useful to see a summary of the proposed training plan over a number of years (number and type of courses, length, number and type of subjects taught, duration and timing of pedagogical and related activities, didactic methods, diplomas and other qualifications obtainable, etc.).

The engineering data for the structure should include:

- covered area (m^2) and uncovered equipped area (m^2);
- data and typical construction designs for buildings intended for pedagogical purposes (classrooms) and for related activities (laboratories, libraries, etc.);
- functional data and sketches for service structures (management, offices, gymnasiums, stadiums, guest-quarters, canteens, etc.);
- functional sketches and layout of the major technological equipment (internal networks, central heating, electrical and communications systems, etc.);
- internal viability systems (and possible car parks) and links with local communication routes;
- significant technical elements, such as particularly important architectonic constructions, laboratory or complex calculating equipment, etc.

3.9.3 *Feasibility and option analyses*

The key issues for educational projects are the demographic and labour market trends, which determine the potential number of pupils and the opportunities available to them, subsequent to their training, to improve their position on the labour market.

The description should include:

- demographic trends disaggregated by age range and by geographic area (for investments covering more than one area),
- rate of enrolment, attendance and completion of studies[28],
- employment forecasts for various sectors, including forecasts of the organisational changes within the various productive segments[29].

28. This information will be even more useful if broken down into sex, social class and geographic area.

29. It is important to forecast the growth of new professions and the decline of others.

In order to analyse the options it would be helpful if not only the previous situation without the realisation of the project, but also different locations and different layouts for the same infrastructure were studied.

3.9.4 *Financial analysis*

The revenues are the school fees and/or annual subscriptions if charged. The prices of possible paid auxiliary services should also be taken into account. For the same reasons mentioned for other sectors, a financial analysis is useful even if the services are totally free of charge and the financial profitability rate is therefore negative.

The major cost item in this case is the cost of the personnel necessary to run the structure, which should be carefully estimated in the long term, rather than considering only the personnel costs related to construction.

Often the body bearing the investment costs is separate from the one that will bear the running costs; for this reason, as we have stated for other sectors, it may help to clarify the matter if the analysis of financial flows is conducted from both viewpoints.

A time horizon of 15-20 years is advisable for these investments.

*Financial rate of return**	*Schools, universities, etc.*
minimum	- 1.88
maximum	20.00
average	7.01
standard deviation	9.23

* Sample data: 4 major projects out of 16 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.9.5 *Economic analysis*

The following variables may be a starting point for the identification of the benefits:

- effective enrolment rates compared to potential ones;
- the share of students repeating the year;
- the percentage of pupils who complete the whole training course;
- the average attendance rate per pupil;
- the achievement of pre-established, measurable learning standards;
- the quality of pedagogical material;
- the suitability of equipment and its rate of use;
- the level of preparation and the commitment of the teaching staff, based on objective examination,;
- the fungibility of the pedagogical content in as many and varied contexts as possible.

The benefits are represented by the number (or percentage) of pupils who have found (or who are expected to find) productive employment and who, without this specific training, would have been unemployed or under-employed. Forecasts for this variable can be based on the long term studies carried out in other countries.

If the prominent or sole objective of the investment is to improve the opportunities of potential pupils on the labour market, the benefits may be quantified and valorised by the expected increased income of the pupils due to the training received (avoided under-employment, better positioning on the market)[30].

Social costs may be evaluated on the basis of the loss to society due to the deviation of factors from their best alternative use[31].

30. An alternative method, theoretically valid for all cases, is to refer to the willingness to pay, valorisable as the average fees students would have to pay to take similar private courses. Great care should be taken when following this method due to possible distortionary effects: e.g. there may be a difference in quality between the training offered by the investment and what is already available privately, or there may be differing degrees of risk aversion according to income levels, and so forth. Wider discussion of the subject can be found in the suggested readings.

31. For example, the social opportunity cost of teaching and other staff is equivalent to the product of these people in alternative occupations (quantifiable as the average market salaries for people of a similar training). That of the pupils, which should not be forgotten, is based on the estimated product of young people outside the education system, on the marginal basis that the project in question does not affect salaries.

Finally, since these are infrastructure projects, it would be useful to include other *externalities* such as loss of land, and other raw materials, possible mobility or construction congestion brought about by the installation of the infrastructure and so on; if they can be predicted, one should also consider the increase in incomes due to other possible induced activities, which are directly related to the presence of the new scholastic structure (commercial activities, restaurants, recreational activities, etc.).

*Economic rate of return**	*Schools, universities, etc.*
minimum	3.35
maximum	47.52
average	17.53
standard deviation	14.20

* Sample data: 6 major projects out of 16 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.9.6 Other evaluation elements

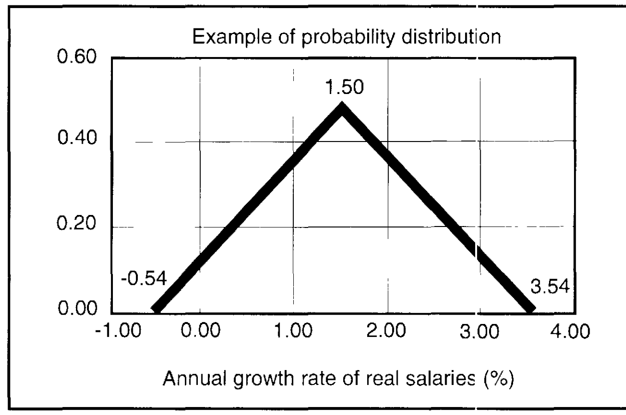
It would be useful to have an independent evaluation from a *panel of qualified experts* of the following elements:

- **the ability of the educational investment to meet the proposed objectives and social needs,**
- **the suitability of the type of training programmes realisable through the structure.**

3.9.7 Sensitivity and risk analysis

The following parameters should be covered in the sensitivity and risk analysis:

- rate of growth of the population (per age range) in the catchment area;
- rate of growth of salaries for teaching and non-teaching staff (see example shown in the graph below);
- the actual enrolment rate;
- the rate of employment of pupils who have completed their studies.



Further reading: see appendix C.11

3.10 Museums and archaeological parks

3.10.1 Objectives

The investments included in this sector generally have local objectives both because they are linked mainly to the development of the tourism/culture sector (e.g. the creation of an archaeological park) and because they aim to satisfy the more general cultural and entertainment needs of the population (e.g. the construction or restoration of a theatre).

Projects in this sector may have a more general value of a cultural nature, which transcends the local environment and may, in some cases, be the predominant factor. In order to evaluate the investment correctly, it would be helpful to state clearly the type of objective established for each project.

3.10.2 Identification of the project

In keeping with the objectives, it is necessary to identify the project by stating the type of infrastructure affected by the action: museums (archaeological, art galleries, conservatories, mixed, scientific, technical, etc.), historical monuments or buildings, archaeological parks, industrial archaeology, theatres (for plays, operas, etc.), open-air theatres, etc. It is also useful to state whether the project is to create a new structure, or to renovate or extend an existing structure.

It is often quite important to list the services the structure will offer, whether main or subsidiary (restoration of works of art, research centres, information services, internal transport, *catering* services for visitors and so on). In addition, a summary of the cultural and/or artistic programmes planned for the medium term should be included.

From the engineering point of view it would be helpful to include:

- basic data, primarily the number of expected users (per day, season, year, etc.) and the maximum capacity of the structure;
- physical features, such as:
  - covered and showroom areas (m^2) for museums and historical monuments or buildings,
  - total area of parks or archaeological areas (m^2),
  - surface area (m^2), number of seats, usable area (m^3) for theatres;
- architectural characteristics, construction, and *layout* of museums, historical monuments or buildings or theatres, attaching sketches and data, and clearly showing, if necessary, the parts to be constructed or modified;
- building techniques, technical features and *layout* of buildings or parts thereof dedicated to additional services, as described above;
- process features and *layout* of the plants and of the major systems (air-conditioning, lighting, communications, etc.);
- viability and access systems (plus possible car parks) and links with the local communications routes;
- significant technical elements, such as particularly exacting architectonic constructions, experimental or significant restoration technologies, communication/information systems for users or for the public etc. (supplying drawings and data).

3.10.3 Feasibility and option analyses

The major reference point for the optimisation of the project is the potential flow of users to the structure, broken down according to type.

In the case of actions directed at restoring or recovering existing historical buildings it would be useful to show all of the aspects, including technological ones, which demonstrate its feasibility.

The option analysis may, for example, consider the following alternatives:

- the previous situation, without the realisation of the project;
- variations in structural arrangement or layout of the infrastructure;
- possible alternative locations for new constructions of museums, theatres etc.;
- possible alternative technology and methods of restoration/recovery for existing buildings;
- alternative choices of infrastructure within the context of those already existent in the area (e.g. one could consider establishing a museum of technology instead of recovering a historical industrial structure, etc.).

3.10.4 Financial analysis

Very often in this sector the investor and the management body are different parties; should this be case the analysis ought to be conducted from both viewpoints, remembering to state clearly any possible transfers between the two.

As was the case with educational infrastructure, also here running costs in the project time horizon are larger than investment costs, especially those of personnel and maintenance (which may for some structures be predominant cost item in the medium-long term) and this raises similar evaluation issues.

The revenues derive from the admission fees, which often cover only a fraction of the real costs; other inflows may come from the sales of collateral services and related commercial activities (*catering*, art publications, network services, *gadgets*, etc.) if they are under the same management.

Here it would be advisable to use a time horizon of 15-20 years.

Subject to a careful examination of the concrete feasibility and volume of demand, one should also consider the increase in incomes in the tourism sector (linked to both the increased flow and longer average length stay of tourists) induced by the wider range of cultural-recreational services offered by the new structure, and the additional increase in income due to other possible induced activities, which are directly related to the presence of the new structure (commercial activities, restaurants, recreational activities, etc.).

3.10.5 Economic analysis

As with educational infrastructure, the main difficulty with the economic analysis is the ability to identify, quantify and valorise social benefits due to the generic and/or uncertain definition of the objectives, which obviously have a direct influence on the identification and measurement of the benefits themselves.

An admittedly incomplete evaluation of the benefits may be based on the willingness to pay for the service on the part of the public[32], for museums, archaeological parks etc. For example, for some projects this would appear to be in the region of ECU 5/visitor. For other methods refer to the suggested reading.

As with the previous sector, the social costs may be evaluated on the basis of the loss to society due to the diversion of factors from their best alternative use. For example, the social opportunity cost of the staff employed to run the structure is equivalent to the product of these people in alternative occupations (quantifiable as the average market salaries for people of a similar training).

Lastly, since these are infrastructure projects, it would be useful to include other *externalities* such as loss of land and other raw materials, possible mobility or construction congestion brought about by the installation of the infrastructure and so on.

3.10.6 Other evaluation elements

Here it is mainly a case of referring to the intrinsic cultural value of the project. Thus it would be useful to give a clear cultural and artistic profile of at least the medium-term programmes the infrastructure intends to realise, stating also whether there are any particularly important historical or artistic works of art.

In any case the decisive element is the independent experts' opinion of the programme, which should be shown by appropriate evidence.

3.10.7 Sensitivity and risk analyses

The major elements of risk are, on the one hand, the high personnel and maintenance costs which are difficult to predict in the long-term, and, on the other, the uncertainties in evaluating the long term demand and dynamics of admission fees. In view of this, it would be advisable for the sensitivity and risk analysis to consider at least the following variables:

- the cost of the investment;
- the rate of growth of staff salaries;
- the rate of growth of effective demand (number of visitors per year);
- the admission fees.

In addition, with regard to maintenance, it would be advisable to analyse the risks related to possible damage, regardless of the cause (technical, natural, man induced).

Further reading: see appendix C.12

32. *It does not seem correct to include the indirect costs of the visitor (journey, food, lodging etc.) to the value attributed to the* ***willingess to pay****, unless one can demonstrate that for the project in question, those expenses must be attributed exclusively to the desire to visit the structure or see the particular show and not to other recreational activities e.g. Toursim.*

3.11 Hospitals and other health infrastructures

3.11.1 Objectives

Even if the objectives of a specific action are often of a local nature, these should always be related to and fitted into the framework of the planning objectives of the health sector as a whole, both in order to optimise the allocation of resources among different health programmes and to choose between projects and alternatives. Without adequately defining the fundamental objectives of the health policy, the analysis of single projects has a limited value.

The objectives may include the prevention and/or treatment of numerous pathologies.

These may also refer to different ranges of the population, according to age (children's or geriatric hospitals, etc.), gender (support structures for childbirth, andrology, etc.), professional conditions (traumatology centres for industrial accidents, sports or military hospitals, etc.).

A quantitative definition of the objectives could be given by the increased life expectancy[33]. Whenever statistics are available regarding the risks associated with various pathologies and epidemic and demographic data it will be possible to provide a more disaggregated and manageable quantification of the objectives.

3.11.2 Identification of the project

In keeping with the objectives of the investment, it is fundamental for the project analysis to clearly define the functions of the proposed infrastructure and in particular the group of pathologies involved, the range of the population, the diagnostic functions, the short or long term treatment/recovery, reception facilities and connected services and so on.

The engineering characteristics should include the following data:

- basic data, such as: the average and maximum numbers of users per day, month, year; a list of the departments for assistance and prevention, treatment and diagnosis; for a hospital the number of beds in each ward;

- physical data such as the surface area and covered area (m^2), usable space (m^3), number of treatment rooms, wards, prevention and/or diagnostic consulting rooms, existence and size of outpatients department;

- the functional arrangement of internal/external areas (layout), including viability between the various buildings and within them, under both normal and emergency conditions;

- technical features of the principal equipment and machinery for diagnosis and/or treatment (e.g. X-ray, scans, nuclear medicine, endoscopes etc.);

- layout of the auxiliary plants and of the major systems (electricity, lighting, water, refuse and possible incinerators, fire-fighting equipment, air-conditioning, gas distribution, remote monitoring, communications, etc.);

- architectural characteristics, construction, and *layout* of buildings or parts thereof dedicated to auxiliary structures;

- viability and access systems (plus possible car parks) and links with the local communications routes, with possible privileged access for the casualty department, attaching appropriate blueprints;

- significant technical elements, such as particularly exacting architectonic constructions, special or experimental treatment or diagnosis machinery.

33. These are very rough indications. Obviously, in addition to the quantity there is also the quality of life: some indexes have been proposed which take this into account (Q.A.L.Y.), further details can be found in the publications suggested in the reading list.

3.11.3 Feasibility and option analysis

The patient flows and their trends over time can be determined on the basis of demographic data and their respective *trends*. It is also necessary to give epidemiological and morbidity data for the pathologies involved[34].

The option analysis should include:

- a comparison with the situation in the catchment area without the realisation of the project;
- possible alternative locations for the same health structure;
- possible alternative medical-technological solutions (different treatment systems, different diagnosis technologies, etc.);
- possible general alternatives with the same socio-sanitary objectives (e.g. building an outpatients department instead of wards in a hospital).

3.11.4 Financial analysis

Often the body bearing the investment costs is separate from the one that will bear the running costs; for this reason it may help to clarify the matter if the analysis of financial flows is conducted from both viewpoints, taking into careful consideration the structure of co-financing (if existent) and the repayment mechanisms.

The revenue is usually the fees for hospital stays (e.g. the number of days the patient spends in hospital), diagnosis and treatment which are paid separately and additional services (single rooms, etc.), if they exist. For the same reasons already given for other sectors, the financial analysis is useful even if the services are totally free of charge and the financial profitability rate is therefore negative.

In the long term the greatest cost items are almost always personnel costs and the costs of medicines and other materials and *out-sourced* medical services necessary to run the structure, which should be accurately estimated.

For these investments it would be advisable to consider a time horizon of at least 20 years.

3.11.5 Economic analysis

The key benefits are:

- **future saving in health costs;**
- **avoided loss in income;**
- **reduction in suffering.**

- The future saving in health costs, directly proportional to the decrease in the number of people affected and/or the lesser degree of gravity of the illness thanks to the implementation of the project (reduced outpatient and home assistance costs for those who avoided catching the illness, lower hospital and convalescence costs for those who have been treated more effectively).
- The avoided loss in production, due to the lower number of working days lost by the patient and his family.
- The increase in the welfare or the reduction in suffering on the part of the patients and their families, identifiable as the number of deaths avoided, the increased life expectancy of the patient and the improved quality of life for the patient and his family as a result of the illness avoided or the more effective treatment administered.

Benefits may be given a money value by two methods, the first of which *(willingness to pay)* recurs to the market prices of the service[35].

*Economic rate of return**	*Hospitals*
minimum	10.00
maximum	23.10
average	14.57
standard deviation	6.03

* Sample data: 3 major projects out of 5 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

34. If no specific data is available for the catchment area in question, it would not be wrong to use data referring to socially similar areas.

35. This method may, for example, be applied in the case of an odontology clinic, as these services are generally offered by both the public and the private sectors.

Alternatively the quantification and valorisation of the costs saved can be conducted using standard methods, whereas that for the welfare benefits one can refer to the indices for increased life expectancy, suitably adjusted by the quality (e.g. *Quality Adjusted Life Years*) which can be valorised according to the principle of lost income or to similar actuarial criteria.

3.11.6 Other evaluation elements

In addition to the considerations made in the paragraph referring to the option analysis, and because of the stated uncertainties and difficulties in making a quantitative analysis of the benefits, one can say that it may be helpful to evaluate the benefits in terms of simple physical indicators e.g. an analysis of the cost-effectiveness which are more readily quantifiable.

Useful cost-effectiveness is largely used in the health sector and offers comparable data.

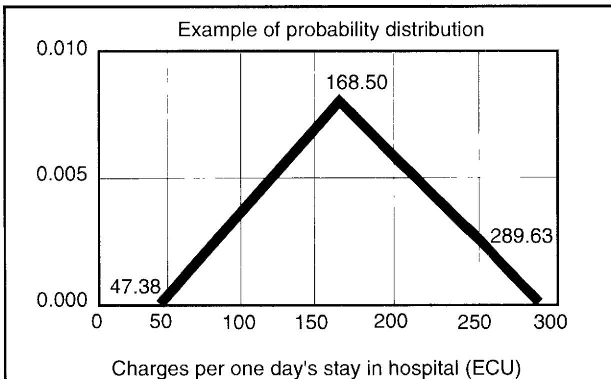
Sometimes in this sector the proposed project may have an intrinsic value for the health system. This should be shown through a panel of independent qualified experts that agreed on the results.

3.11.7 Sensitivity and risk analyses

The principal elements influencing the success of a project in the health sector are of three types: i) the availability and reliability of epidemiological data for the catchment area, ii) the risks incurred by administering (new) diagnostic, preventative or therapeutic treatment, etc., iii) the difficulty in correctly evaluating trends in the costs of personnel, medicines etc. in the long term.

In view of all that has been said, it would be useful if the sensitivity and risk analysis included at least the following variables:

- the cost of the investment;
- the percentage incidence of pertinent morbidity, disaggregated by pathological type, age range, sex, profession, etc.;
- tariffs for health services and their dynamics in time;
- dynamics in time of personnel costs;
- dynamics in time of the costs of medicines, products and critical services;
- the value and dynamics of the risks involved in carrying out diagnoses or treatment.



Further reading: see appendix C.13

3.12 Forests and parks

3.12.1 Objectives

Forestry projects can have different primary objectives, such as:

- projects aimed at increasing the production of wood or cork for commercial or energy purposes;
- projects aimed at increasing the production of non-wood products[36];
- projects of an environmental character, such as establishing parks and protected areas, actions for the prevention of erosion, control of water, environmental protection (naturalistic, improvement of scenery, vision and noise screens, etc.);
- projects for promoting tourist-recreational activities[37];

36. Such as truffles and mushrooms, fruits of the forest (strawberries, bilberries, raspberries, blackberries, aromatic and/or medicinal herbs, etc.), game, bee-keeping, and others.
37. Such as bird watching, photographic safaris, camping, horse riding, trekking, etc.

All investments in forestry bring about multiple effects, the table below gives some examples.

Effects/benefits	Type of investment A	B	C	D	E
Land protection	⇧	⊠ ↑	↑ ⊠	↑ ⊠	⊠ ↑
Water regulation	⇧	⊠	↑	↑ ⊠	⊠ ↑
Improvement of the countryside	↑ ⊠	↑ ⊠ ↓	↑ ⊠	↑ ⊠	⊠
Environmental protection	↑	⊠ ↓	⊠ ↑	⊠ ↓	⊠ ↑
Species conservation	↑	⊠ ↓	↑ ⊠	⊠	⊠ ↑
Improvement of quality of air and climate	⊠	⊠	↑	⊠	⊠
Increased production of wood, cork or other products	⊠	↑	⇧	↓ ⊠	⊠ ↑
Increased tourist-recreational activities	⊠	↑	⊠	⇧	↑ ⊠
Improvement in the local economy	⊠ ↑	↑ ⊠	↑ ⇧	↑ ⇧	↑ ⊠
Improvement in the general economy	⊠	↑ ⊠	↑	⊠	⊠

A: Control, regulation and protection of bodies of water; protection from erosion
B: Infrastructure (tracks, footpaths, fire-fighting, nurseries, etc.)
C: Direct productive valorisation (wood, cork, mushrooms, nuts, etc.)
D: Indirect productive valorisation (tourism, recreation)
E: Organisational activities (studies and inventories, cartography, etc.)
Note: ⇧ = very positive effect, ↑ = positive effect, ⊠ = no effect, ↓ = negative effect

3.12.2 Identification of the project

Due to the wide ranging scope of possible projects in the parks and forests sector, it would be helpful if the projects were identified according to a scheme of typologies, like for example those given in the table above.

It would be useful to supply the following data:

- geographic position, altitude (m. above s.l.) and surface area (hectares or Km^2);
- detailed description of projected operations, the extent (number of trees to be removed or planted, etc.) and methodologies (chosen species, type of cultivation, etc.), time period (years), form of management, type of treatment and execution period;
- surface area (m^2) and gradients (m) of the slopes to be consolidated;
- number and length (Km) of the water flows to put into regime;
- number, length (Km) or surface area (m^2) and type for access routes and for parking or *picnic* areas;
- maps showing position and description of biotypes and other interesting natural phenomena (waterfalls, caves, springs, etc.);
- number, position, surface area (m^2) and *layout* of service buildings, such as visitor centres, lodgings, canteens, observation posts, warehouses, sawmills, etc.;
- number, position, surface area (m^2) and capacity of possible tourist reception structures, such as hotels, refuges, restaurants, etc.;
- access routes and links with the local and regional road networks;
- description of and data for important interventions, such as the re-introduction of rare or extinct species, remote fire prevention surveillance systems, communication and information networks, etc.

3.12.3 *Feasibility and option analyses*

The reference points for optimisation are the functions of the project itself. For example, for projects for wood (or cork) arboriculture, the reference point is the demand for the type of wood (or cork) to be produced, in addition, if this is the case, to the objective of substituting imports. When projects are of a prevalently tourist-recreational nature, it is obviously necessary to refer to the forecast trends for tourist flows, including their seasonal trends etc. Note, however, that since the objectives are so interdependent, it would be useful if all projects included an impact analysis showing the sustainability of the proposed project also from an environmental point of view, even if this is not its major scope. One possible method is to establish a series of physical indicators for each effect and then conduct a multi-criteria analysis.

With regard to the alternatives, it would be helpful to analyse the following:

- comparison with the situation without the realisation of the project;
- different areas of intervention within the same forestry district;
- different methodologies for amelioration, reforestation and cultivation;
- cultivation of alternative species, compatible with the chosen area (e.g. eucalyptus plantations instead of poplars for the production of cellulose pulp);
- different perimeters and zoning of the parks;
- different routes or typologies for footpaths, tracks and equipped areas;
- different positioning of entrances, *visitor centres*, car parks, camp sites, etc. for projects for equipped parks and forestry areas;
- different destination (e.g. agricultural and not forestal) for the areas to be reforested, for example, within a park.

3.12.4 *Financial analysis*

The financial analysis may be carried out using standard methods, with the warning that whenever the investor and manager are not the same party, the analysis be carried out from both viewpoints, taking into account any possible licensing fees as input for the former and output for the latter. Also in this case, the financial analysis is useful even if the project gives rise to opportunities and services which are totally free of charge.

Often the largest cost items, and consequently those to be considered most carefully, are those for personnel and maintenance (ordinary and extraordinary).

A time horizon of 25-35 years can be considered appropriate[38], but in some cases of forestry interventions the horizon may be opportunely extended.

Available literature shows that interventions in this sector have rather low FRR values, which rarely exceed 5%.

3.12.5 *Economic analysis*

One can consult the table above to identify the benefits, while to quantify and valorise them the following considerations should be made:

- In the case of forestry production, reference can be made to the forecasts for effective demand and consequently to the economic activities related to the utilisation and transformation of wood; the valorisation can be based on the added value of woodland companies and related industries.
- Similar observations can be made for non-wood products.
- The tourist-recreational benefits can be quantified and valorised using the visitors' "willingness to pay" method or by a quantitative estimation of the tourist product realised, evaluated at market prices, net of distortions. If predictable, one should also add the increased income for the tourism sector and related activities in the areas adjacent to or linked with the park or forest involved. Studies

38. The lowest values should be applied to tourist-recreational interventions and to those of a short cycle (e.g. forest fruits, etc.).

show values of between ECU 1 and ECU 7.5 per visitor, based on factors such as the environmental attraction and the standard of tourist reception facilities in the area.

- The benefits arising from hydro-geological protection can be evaluated on the basis of the costs due to flooding, landslides etc., which will be avoided thanks to the project and, if demonstrable, the higher added value of woodland production compared to a situation without the intervention.

- The benefits arising from the improvement of the countryside and environmental protection can be evaluated on the basis of the greater "willingness to pay"[39] or the higher income from tourist activities compared to a situation without the intervention.

3.12.6 Other evaluation elements

Whenever the proposed project contains any elements which are of naturalistic, environmental or scientific importance in themselves (e.g. the protection of threatened species), this should be confirmed by a panel of qualified independent sector experts.

3.12.7 Sensitivity and risk analyses

It is advisable to analyse the following variables:

- trend in tourist flows;

- cost trends for some critical factors, such as personnel;

- the value and the dynamics of the risks related to possible damage, regardless, of the cause (natural, human error, technical).

Further reading: see appendix C.14

39. See previous note.

3.13 Telecommunications infrastructure

3.13.1 Objectives

Investments in this sector are crucial for economic development on both a national and an international scale due to the wide reaching inter-sectorial effects of improved efficiency in communications and the development of on-line services. These systems satisfy a range of communications needs (telephones, telefax, data transmission, TV, multimedia transmission, cryptographic transmissions, etc.), whether local or generalised, not only of the productive, commercial and service sectors, but also of the civil sector. Here it is worth mentioning that the communications system, which uses increasingly more varied[40], powerful and extensive link up networks, has a considerable influence even in the more general fields of civil development, such as training, youth education, culture, pastimes, politics and so on.

Even though the telecommunications sector is always in the forefront of public policies in European Union Member States, the evaluation of the projects can be complicated by an imperfect definition of the objectives, often due to the speed and intensity of change - sometimes extremely turbulent[41].

If, for the purposes of the present guide, we limit ourselves to infrastructure interventions, the objectives may be for local development (although these always have a value on a larger scale); some examples of which may be:

- local cabling or relay systems to extend services to areas not covered;

40.The predominant trend in the sector is to offer superior services. In order to do so, service providers rely on increasingly more convenient connection systems, such as optic fibres, co-axial cables, telephonic bights, via air through relay stations, satellites, etc.

41.The most important trends are not only the privatisation of public telephone companies, but also the attempt to mitigate the monopolistic situation which often still exists, in two ways: the liberalisation of licences to a number of operators in the same area - also with alternative networks (horizontal disaggregation) and the separation of those who manage the networks from those who offer the link up services and from the providers of these added value services and so on (vertical disaggregation).

- cabling a city, metropolitan or industrial areas, etc. to provide faster, more powerful networks which will enable the development of new local services (e.g. the so-called "wide band") networks;

- the construction or modernisation of units for band switching with wider networks (this type of project is often linked to the previous type);

- the laying of cables, construction of relay or satellite stations to link isolated areas (mountainous areas, islands, etc.).

Some types of project with objectives of a non-local scale are:

- the development of international communications systems, to increase the capacity, power and speed (e.g. launching telecommunications satellites, building satellite radio stations, laying long distance cables underwater, etc.);

- increasing the capacity, power and speed of inter-regional communications networks;

- the technological updating of the network to enable connection with new services (e.g. multimedia services, portable telephones, cable television, civic networks, virtual museums, etc.).

3.13.2 Identification of the project

The identification of the project should begin with its pertinence to one of the above described objectives - local or non-local. Not only the type of project, but also the list of functions (infrastructure, links) and services should be described.

In all cases it is useful to identify the potential catchment area the project is designed to serve, and to provide an analysis of the potential market.

Taking into account what was stated in the previous paragraph and considering the scarce initial elasticity of this type of investment, it would appear to be essential to have a clear idea of the following two aspects, which are strongly inter-related:

- the organisation of the intervention management, including any possible division into sectors,

- the realisation programme for the project itself and the proposed plan for penetrating the catchment area with the services offered by the new structure.

In all cases, the functional and physical links between the projected infrastructure and the existing telecommunications system should be made clear.

A broad description of the engineering features of the infrastructure will also be extremely useful:

- basic functional data, such as: type of communications infrastructure, traffic volume and type, maximum communication speed (baud), type of commutation, communication protocol, frequency bands (GHz) and power (kW), electronic technologies for commutation/ connection, etc.;

- physical data such as the length of cables (Km) and area covered by the network (Km^2), the number and position of commutation/connection nodes, the number and position of radio stations and the area covered (Km^2);

- data, building techniques and technical features of networks;

- data, building techniques and technical features, layout of commutation/connection centres or radio stations, attaching plans;

- data, building techniques and technical features, layout of auxiliary plants e.g. electricity supply, lighting, remote control;

- covered area (m^2) and schematic layout of possible buildings and other service structures, attaching blueprints and sections;

- significant technical elements, such as satellite transmission/reception systems, underwater cables.

3.13.3 Feasibility and option analyses

The key points for optimisation of the project are the volume of traffic, and the daily, weekly and seasonal trends. For these projects one should bear in mind that the optimum capacity must be a reasonable compromise between the highest peak levels of traffic and that which the system can handle.

The study of possible alternative technologies should show the total feasibility of the services, old and new, that the network plans to offer within the chosen catchment area.

In view of this, the option analyses should include a comparison with:

- the previous situation, without the realisation of the project;
- possible alternatives within the same infrastructure (e.g. different types of cables, different transmission protocols, different commutation /connection technologies etc.);
- alternative locations or radio stations;
- possible global alternatives for the projected infrastructure, which can offer similar services such as a satellite transmission or mixed network (air-cable) rather than optic fibre cables.

3.13.4 Financial analysis

Wherever the owner of the infrastructure and the licensee are separate, it is advisable to bear this in mind and produce two financial analyses from the two viewpoints.

It is essential to predict price dynamics in order to correctly evaluate the investment. In many cases, as with telephony, the existence of government controlled tariffs may help in forecasting these.

In addition to the sales tariffs for services, the revenue should also include rents for additional services, if under the same management.

Estimating the output should not prove difficult if the previously given outlines are followed.

A time horizon of at least 10 years is advisable, except for cabled networks and long distance cables for which the horizon should be extended to 20 years.

3.13.5 Economic analysis

One possible method of direct quantification of the users benefits, is based on the following:

- The time saved for each communication (waiting time, transmission time, etc.), quantifiable by unit according to type of service (e.g. commercial telephone call, transmission of a text, transmission of a data file, transmission of graphics and so on); for valorisation purposes the users may be divided into categories, for example in the civil sector reference can be made to the average income of citizens, and in the company sector to the average added value.
- The new additional services which would be impossible without the project. In some cases the preceding method can be applied for their quantification and valorisation (e.g. on line anagraphic services could lead to almost a 100% saving in the time taken to request and obtain certificates), in other cases one can estimate the willingness to pay for the service on the part of the public, quantifying the costs the user would incur to obtain certain types of data (e.g. purchasing specialist publications).

3.13.6 Other evaluation elements

Here one should refer to the development of the new telematic and multimedia services. In this respect it could be helpful to subject the project to a flexibility examination, to see how capable it is, in technological and construction terms, of satisfying the wider needs stemming from future development.

3.13.7 Sensitivity and risk analyses

The critical factors influencing the success of an investment in this sector are mainly those of forecasting the demand and sometimes of the high investment costs (e.g. for satellite systems). Another element of uncertainty is the rapid technological evolution of the sector which could mean that the investment is totally or partly obsolete long before expected ex-ante.

In view of this, it would be useful if the sensitivity and risk analyses considered at least the following variables:

- investment costs, including those for technological development;
- forecast for substitution cycles (ageing, technical obsolescence) of the equipment installed;
- demand dynamics (i.e. forecast growth rates for the population and businesses);
- dynamics of the sales prices for services.

Further reading: see appendix C.15

3.14 Industrial estates and technological parks

3.14.1 Objectives

The objective of projects in this sector is to encourage the setting up of businesses in certain areas, by making a specific location more convenient (industrial areas, craftsmen's areas) and this is often accompanied by the supply of real services at advantageous conditions, again for the purpose of favouring the launching of new companies or to prevent existing ones from collapsing. The proposer may find it useful to bear in mind the following categories of objectives:

- creation of basic infrastructure for establishing industrial estates, commercial and service areas;
- creation of basic infrastructure for the planned relocation of productive plants from excessively congested or polluted areas;
- creation of centres supplying real services to companies in a specific area (accounting, financial information, marketing, training, industrial organisation, technological innovation and/or transfer, etc.);
- creation of centres promoting the setting up of new companies and supporting existing ones (technological parks, business innovation centres, etc.);
- a mix of the above, often aimed at supporting companies in one particular industrial segment (industrial district).

3.14.2 Identification of the project

The proposed projects must fit in with one of the above objectives, making reference to the more general actions of incentives to production in which it is involved.

For a better understanding of the scope and nature of the project it is necessary to identify the catchment area, that is the geographic area, the size of target companies (e.g. craftsmen, SME's, medium and large companies, etc.) and the productive segments involved.

It would be useful to give basic data, such as the number, size and type of companies involved, the type of real services to be provided, the type of scientific/ technological laboratories, if present, and so on.

It would be useful to provide at least the following engineering data:

- location and surface (Km^2) of the equipped area and the breakdown into plots;
- number and covered area (m^2) of warehouses, stores, office blocks, exhibition spaces, etc.;
- internal viability and mobility (roads and railways) and their links with external systems; features of possible ports, heliports, etc.;
- internal networks and systems, e.g. aqueducts, drains, depurators, electricity, lighting, telecommunications systems, security, etc., attaching data and layout;
- number of, and area covered by, public buildings (real services, laboratories, logistics, canteens, telecommunications centres, etc.);
- significant technical elements, such as specialised laboratories, multimedia service centres, etc.

3.14.3 Feasibility and option analyses

The feasibility study should cover a number of aspects. The first group of parameters is obviously the estimated demand from existing companies to relocate in the catchment area and the birth rate of new companies. In cases where real services are offered one must also take into account the demand for these and their dynamics over time. Lastly, environmental elements should also be considered, which, at least in some cases, may be of decisive importance for the location and size of the infrastructure project.

It would be useful in the option analysis to consider:

- **a comparison with the previous situation, without the realisation of the project,**
- **different alternative locations,**
- **different alternatives in the number and type of services,**
- **global alternatives, e.g. increased funding direct to companies for the same end (moving premises, purchase of real services, technological innovation, new production lines or newly constituted companies, etc.)**

3.14.4 Financial analysis

The analysis of financial flows does not present any particular difficulties in this sector, as long as the investor and manager of the project are clearly identified.

The revenue for the manager is the rent or licensing costs of land and warehouses and, if they exist, the sales prices of services (water, electricity, drains and purification, storage, logistics, etc.) and of real services. The output should also include the costs of goods and services necessary for the running of the infrastructure and the production of real services. The financial analysis provides information fundamental to the evaluation of the project, even in cases where the services are offered totally or partially free of charge (FRR<0).

In this case a time horizon of at least 20 years is advisable.

*Financial rate of return**	*Infrastructure to support production*
minimum	2.30
maximum	16.87
average	10.49
standard deviation	5.28

* Sample data: 4 major projects out of 14 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.14.5 Economic analysis

In addition to the elements of financial analysis (internal effects), the social benefits of projects in this sector can be explained by the external effects on the productive system, such as better positioning on the market for existing companies, a diffusion of entrepreneurial knowledge and skills among the beneficiary companies, and externally, the retraining of personnel, the effects of various productive factors on employment and incomes, the birth of new productive companies, the birth of new private service companies, etc.

The effects mentioned (with the exception, in some cases, of employment) are not immediately or easily quantifiable.

An approach that may sometimes be adopted is that of subdividing the potential beneficiary companies of the catchment area by size and sector of activity. For each class it is then possible to evaluate the benefit, with reference, for example, to increased added value thanks to the more advantageous location (e.g. savings in transport costs, greater penetration of a previously difficult to reach market, effect of possible promotional activities in the new exhibition areas, lower costs for basic services, etc.), or the availability of real services (e.g. better positioning due to the marketing service, better penetration and cost-saving with telemarketing, technological improvements or new production technologies, improved professional level thanks to training, etc.).

The economic costs of raw materials and the land used in the realisation of the project should be evaluated according to the loss to society by the diversion of these from an alternative better use. Personnel costs should be evaluated in a similar manner.

Environmental costs should also be quantified (land, water and air pollution, spoiling of the visual impact, noise, refuse, etc.) as should any possible urban and transport congestion caused by the realisation of the infrastructure. Note, however, that since the impacts considered will increase in the area surrounding the new infrastructure, they should decrease in the rest of the catchment area, the global effect - which is what should be considered in the analysis - may be for the better or for the worse (e.g. systems for controlling refluences may be more effective, etc.).

*Financial rate of return**	*Infrastructure to support production*
minimum	9.10
maximum	36.00
average	18.89
standard deviation	6.91

* Sample data: 12 major projects out of 14 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.14.6 Other evaluation elements

Bearing in mind the difficulties described in the previous paragraph, it may be helpful to provide a different evaluation of the benefits of the project.

For example, the social costs may be measured by the physical indicators directly or indirectly linked to them and cost/effectiveness ratio may be computed.

The other element which must always be considered is the impact on the environment.

3.14.7 Sensitivity and risk analysis

The greatest risks to the success of this type of investment are the relative initial rigidity, and the difficulty in forecasting the real rate of penetration in the catchment area, from the point of view of both the relocation of companies[42] and, even more importantly, the development of new businesses.

It would be advisable for the sensitivity and risk analysis to consider at least the following variables:

- the cost of the investment;
- the rate of installations in the area;
- the cost of some critical input (labour, out-sourced goods and services for the production of real services);
- if they have been quantified, the birth and early mortality rate of new businesses.

Further reading: see appendix C.16

3.15 Industries and other productive investments

3.15.1 Objectives

These types of intervention may be classified into the following categories:

- projects aimed at encouraging the industrialisation of all sectors in areas that are relatively backward in this respect;
- strategically important, capital intensive projects (e.g. certain segments of the energy sector);
- projects aimed at encouraging technological development in specific sectors or at applying new, more promising technologies which require a high initial investment (e.g. applying new materials to the transport industry, developing electric superconductors, applying technologies for the use of renewable energy, etc.);
- projects aimed at creating alternative employment in areas where there has been a decline in the existing productive fabric;
- projects aimed at encouraging the installation and development of new companies, both craftsmen and SME's (new enterprises).

42. *In some cases the relocation of industries has been accelerated by opportune territorial planning policies.*

3.15.2 Identification of the project

The starting point is the clear identification of the objectives of the proposed project, and its placement in one of the above mentioned categories.

Then, in the case of projects which request financing in favour of existing companies[43], it is useful to give a detailed description (e.g. quantity and type of new machinery or equipment, surface area and *layout* of new warehouses, plans for reorganisation and training of the workforce, etc.).

In all cases, whether dealing with existing or new companies, this should be followed by an accurate description of the company (or group of companies) which will benefit from the intervention:

- a list of the categories of goods or services produced by the company before the intervention and those predicted as a result;
- a list of the annual quantities of production input in terms of raw materials, semi-finished articles, services, workforce (disaggregated according to category and specialisation), etc. both before and after the intervention;
- the turnover, gross operating margin, gross and net profit, *cash-flow,* debt ratio and other balance sheet indicators, both before and after the intervention;
- a description of the market covered by the company and its positioning before and after the intervention (e.g. giving quotas per product and geographic area and their respective dynamics);
- company structure (functions, departments, procedures, quality systems, information systems, etc.) before and after the intervention;
- a description of the production and auxiliary machinery and equipment;
- a description of the company buildings and related areas;
- discharge points for liquid and/or gas waste and a description of treatment plants;
- waste products (type and quantity) and disposal/treatment systems;

43. *Obviously when the project involves building and launching a new production plant, the description of the beneficiary company will be the same as the project itself.*

3.15.3 Feasibility and option analyses

The parameters on which to base the optimisation of the project are obviously specific to each project, and are closely dependent on factors such as the sector in which the company operates, the type of product, the production technologies employed. Consequently, it is not possible to give any general indications, but it is a good idea if the elements which demonstrate the feasibility and optimisation of the project are clearly stated, case by case.

The same is true for the option analysis, although here we can suggest some variables which should be studied, such as:

- alternative methods of financing (e.g. financing the interest account instead of the capital account, financing a *leasing* contract, or other methods of financing);
- technical or technological alternatives to the proposed project;
- if possible, the global alternatives (e.g. supplying low-cost real services to beneficiaries).

3.15.4 Financial analysis

The financial analysis of projects with capital account or interest account incentives can be carried out using standard methodologies taking into account the incremental cash flow for the beneficiary company. The financial profitability of the investment is measured by comparing the cash flows produced by the company (or group of companies) as a result of the investment, with those it would have generated without the concessions (i.e. without the project)[44].

44. *The incremental cash flows coincide tout-court with total flows in the case of newly constituted companies. It should be emphasised that, in any case, it is necessary to consider two possible alternatives i.e. one where the company would have still made the investment (e.g. it would have purchased the machinery) at a higher investment cost, and the other where the company would have been unable to purchase the machinery without the financial concessions.*

On this basis, the financial analysis of the investment may be carried out by evaluating the various cost and revenue items according to market prices, and discounting the cash flows.

The time horizon, which depends on the type and sector of investment, should be of around 10 years.

*Financial rate of return**	*Industry*
minimum	5.50
maximum	70.00
average	19.59
standard deviation	14.45

* Sample data: 64 major projects out of 107 in the sector included in the sample of 400 projects combined (see Tables 1 and 2).

3.15.5 Economic analysis

The validity of the incentives is not only measured by considering the increased added value of beneficiary companies (financial analysis), but, wherever quantifiable, by considering all the ensuing social costs and benefits.

As a result, in addition to the elements deriving from the analysis of financial flows, it is necessary to take into account the *externalities*, such as:

- the benefit due to the increased income caused by the increase in business or by the creation of new sector companies (producing goods and services) stimulated by the beneficiary company or group of companies;

- the economic costs of raw materials and the land used in the realisation of the project should be evaluated according to the loss to society by the diversion of these from the best alternative use;

- the environmental costs (land, water and air pollution, spoiling of the visual impact, noise, refuse, etc.) should for the most part be evaluated on the basis of the costs (at distortion corrected market prices) of the actions necessary to eliminate the effects of pollution or by other methods suggested in previous outlines.

- the cost of any possible urban and transport congestion caused by the installation of new companies or the increased activity of existing companies, estimable in terms of longer transport times (goods and passengers) on the communications routes involved[45] and the possible depreciation in value of adjacent real estate and land.

3.15.6 Other evaluation elements

Projects in the industrial sector generally have considerable environmental impact and for this reason it is useful if this aspect is thoroughly examined, showing clearly all of the steps and technological devices used to reduce them.

Furthermore, considering the difficulties in quantifying and valorising all of the social benefits, for the purpose of a more complete evaluation of the project it would be useful to make a careful appraisal of these, even if only in terms of physical indicators, so that the direct and indirect effects may be measured.

These should include the effects on employment, bearing in mind that maintaining or developing employment is a central objective in many incentive programmes for the productive sector.

3.15.7 Sensitivity and risk analysis

The risks to be considered are specific to each type of intervention (new companies, modernisation or expansion of existing companies) for every productive segment (mature or pioneer segments, strong or weak competitiveness, processes with a considerable or negligible impact on the environment, etc.). It is therefore necessary for the proposer to make an analysis of the specific risks and correlate them to the above parameters.

In general we suggest that the sensitivity and risk analysis consider the following variables:

- **the cost of the investment, for projects with a high technological risk;**
- **the growth rate in demand for the goods and services produced for the specific market;**
- **the cost of critical input;**
- **the price of the output.**

Further reading: see appendix C.16

45. *For the quantification and valorisation of these effects, see the section on roads.*

Appendices

A. Outline of an Appraisal Report

This Section offers a detailed, even if only indicative, outline of a typical Appraisal Report for a large project. Under SF Regulations, Member States are responsible for producing their prior appraisal and they are free to follow any suitable procedure of analysis. Nevertheless, in some cases it may be useful to refer to the following outline as a check-list, both for experts working under the responsibility of Member States and for project examiners working for the Commission. Though there is no particular need to follow this format, it may be an advantage if applicants deliver Appraisal Reports that cover the relevant items suggested below. These Appraisal Reports may be attached to the application forms for assistance or delivered to the Commission in any other appropriate way.

A.1 Summary

In the first chapter of the report, a short presentation of the objectives of the promoters, the characteristics of the project and the main results of the analysis is required.

1.1 Project promoters and the authority responsible for the proposal to the European Commission

1.2 Object of the analysis

1.2.1. Name of the project

1.2.2. Summary description of the project

1.2.2.1. Sector (railway, highway, power station, environment project, etc)

1.2.2.2 Location

1.2.2.3 Impact area (regional, interregional, national, international)

1.3 Objectives of the Promoters

1.4 Previous experiences with similar projects

1.5 Summary description of the present Appraisal Report

1.5.1 Authors of the present Report (Consultants, Government Bodies, etc)

1.5.2 Delimitation of the scope of the Report. Linkages with other projects. Specification of functional components into which the project has been divided. Independent components of the project which can be developed in sequence.

1.5.3. Methodology of the present project analysis

1.6 Indication of the main results of the analysis

1.6.1 Financial returns

1.6.2 Economic returns

1.6.3 Employment impact

1.6.4 Environmental impact

1.6.5 Other outcomes

A.2 Socio-economic environment

The Report should present the essential socio-economic environment of the project and of the sector it refers to. In this presentation the main institutional aspects are to be included.

2.1 Main relevant aspects of the socio-economic environment

2.1.1 Territorial and environmental aspects

2.1.2 Demographical aspects

2.1.3 Socio-cultural aspects

2.1.4 Economic aspects

2.2. Institutional and political aspects

2.2.1 General policy framework. Consistency of the project with the objectives of plans and programmes from the different national and local authorities: Community support framework; Operative Programme; Regional development plans; Sector plans on a national level; Sector Regional Plans; Other EC policies and programmes

2.2.2 Source of finance (specify if loans or grants); EC instruments (ERDF, EIB, CF, ESF, etc); National authorities (Central Government, Regions, others); Private

2.2.3 Financial coverage by the above mentioned sources (discussion of implementation issues, timing, etc)

2.2.4 Procedures and administrative constraints; authorities involved in the decision making process on the project, with an identification of specific roles: different land planning constraints (town-planning, hydro-geological, state-owned, military, etc.); authorizations/permits at local level; specific requirements for concessions and incentives

2.2.5 Timing for: obtaining authorizations/ permits; concessions/ incentives to be paid; others

A.3 Demand and supply of the project's outputs

The project is aimed at producing public or private goods and services, allocated either by market or non-market transactions. In any case, these outputs have to be identified and demand for them measured. Other producers have to be indicated and their reactions foreseen.

3.1 Forecast of the potential demand

3.1.1 Needs that the project may satisfy in a given time horizon (to be maintained for the whole Report)

3.1.2. Current and future demand trends (local, regional, national)

3.1.3 Demand segmentation by kinds of consumers

3.1.4 Purchasing or distribution processes

3.1.5 Specific market research studies: results

3.2 Competition

3.2.1. Characteristics of regional/ national offer of similar outputs

3.2.2 Structure of competition, if existing or foreseeable

3.2.3 Factors of success (prices, quality, timing)

3.3. Proposed Sstrategy

3.3.1 Products

3.3.2 Prices

3.3.3 Promotion

3.3.4 Distribution

3.3.5 Marketing

3.4 Forecasts of rate of utilized capacity

3.4.1 Sales forecast for the project

3.4.2 Market shares, coverage of needs share

3.4.3 Forecasting assumptions and techniques

A.4 Technology options and production plan

Production of both tangible and intangible goods and/or services requires the appraisal of technological options and the selection of the best combination of factors of production. Analyse briefly options and efficient solutions by using, whenever possible, the sector experts' assessments.

4.1 Description of the relevant technological alternatives

4.3 Selection of the appropriate technology

4.4 Buildings and plants

4.5 Physical inputs

4.6 Required personnel

4.7 Energy requirement

4.8 Technology suppliers

4.9 Investment costs

4.9.1 Planning and know-how

4.9.2 Buildings

4.9.3 Machinery

4.10 Production plan for the project's time horizon

4.11 Joint supply of products

4.12 Production organization

A.5 Human Resources

In public infrastructure projects, as in most private projects, the human factor is the key one. The analyst must be very careful about forecasts concerning human resources available.

5.1 Organization chart

5.2 Staff list and wage parameters

5.2.1 Managers

5.2.2 Office workers

5.2.3 Technicians

5.2.4 Workmen

5.3 Services contracted out

5.3.1 Administrative

5.3.2 Technical

5.3.3 Others

5.4 Recruiting procedures

5.5 Training procedures

5.6 Annual costs (both before and after start-up)

A.6 Location

The choice of location and a suitable site selection are dependent on many factors: the proximity of demand (centres of consumption), the availability of managerial staff and skilled labour, Government regulations and restrictions (political-administrative constraints), the availability of incentives and concessions (public or institutional finance linked to location, etc.).

The selection of a site among different alternatives must be accompanied by an evaluation of the impact on the environment.

6.1 Optimum location requirements

6.2 Available alternatives

6.3 Site selection and characteristics

6.3.1 Climatic conditions, environmental aspects (if relevant)

6.3.2 Site or land

6.3.3 Transport and communications

6.3.4 Water and electricity supplies

6.3.5 Waste disposal

6.3.6 Government regulations

6.3.7 Local authorities' policies

6.3.8 Description of selected site (details in Appendices)

6.4 Cost of land and site preparation

6.5 Availability of the site

Some of the following questions may be important. Is the project realization dependent on that particular site? Is the area available to the promoter? Can the area be acquired on the market? At what price? Should it be acquired through expropriation? At what price? Is the site-use considered by the project acceptable to the planning authorities?

6.6 Infrastructural requirements

List of the main infrastructural requirements the project needs as external provisions, such as: connecting roads; public transport; water network; electricity network; methane gas network; drainage system; liquid urban waste disposal; solid urban waste disposal; special waste disposal; toxic waste disposal.

Can the project adequately solve all the infrastructural needs mentioned above? If not: which are to be provided by other bodies? with which technical characteristics? with which additional financial burden (for the project)?

A.7 Implementation

The analysis of the realization and of the timing will be brief, unless time uncertainty and risk are critical factors. It may be summarized by appropriate diagrams.

7.1 Analysis of the construction/start-up time (project cycle)

7.1.1 Selection of the project management team

7.1.2 Definition of the information system

7.1.3 Negotiations for the acquisition of know-how and machinery

7.1.4 Detailed planning of buildings and contracts

7.1.5 Negotiations for financing

7.1.6 Acquisition of land and concessions

7.1.7 Organizational build-up

7.1.8 Recruitment of staff

7.1.9 Recruitment and training of personnel

7.1.10 Supply agreements

7.1.11 Distribution agreements

7.2 Bar-chart planning for the main phases (Pert or similar for more complex projects)

7.3 Main timing data to consider in the financial analysis

A.8 Financial analysis

Even in public projects, balance between financial inflows and outflows must be obtained for each year, otherwise the project may become short of cash.

Moreover, one is interested to know the overall financial return of the project (or its overall financial net loss).

8.0 Basic assumptions for the financial analysis

8.0.1 Planning horizon (e.g. 10, 20, 50 years)

8.0.2 Pricing of project inputs and outputs (e.g. constant prices in ECU 1994)

8.0.3 Financial real discount rate (5% as a benchmark for real opportunity cost of capital in the long term)

8.1 Fixed investments

8.2 Pre-production expenditures

8.3 Working capital

8.4 Total investments

8.5 Operating revenues and expenses

8.6 Sources of finance

8.7 Financial planning (a table with in flows and out flows year by year)

8.8 Statements of assets and liabilities

8.9 Profit and loss account

8.10 Determination of net cash flow

8.10.1 Net Flows to calculate the return on the total investment (project investments as a whole)

8.10.2 Net Flows to calculate the return of the equity/grant capital (public or private)

8.11 Net present value / Internal rate of return

A.9 Socio-economic Cost-Benefit Analysis

The analysis may be widened beyond the limited set of official socio-economic objectives (see 9.5, below) if there are other objectives which are important for the promoters and for the European Commission.

9.1 Unit of account and discounting for Cost-Benefit Analysis (constant ECUs 1994, 5% normal social discount rate, 3% minimum social discount rate, other assumptions if any)

9.2 Social cost analysis

9.2.1 Price distortions of inputs

9.2.2 Wage distortions

9.2.3 Tax aspects

9.2.4 External costs

9.2.5 Non-monetary costs, including environmental aspects

9.3 Social benefit analysis

9.3.1 Price distortions of outputs

9.3.2 Social benefit of additional employment

9.3.3 Tax aspects

9.3.4 External benefits

9.3.5 Non-monetary benefits, including environmental aspects

9.4 Economic rate of return or present net social value of the project in monetary terms

9.5 Additional evaluation criteria (if relevant)

9.5.1 Presentation of results in terms of the general objectives of EU policies

9.5.2 Increase in EU's social income

9.5.3 Reduction in disparities among GDP per capita among EC regions

9.5.4 Increase in employment

9.5.5 Better environment quality

9.5.6 Other objectives of the Commission, National, Regional authorities

A.10 Risk analysis

The analysis must indicate the uncertainty sources and test the strength of its conclusions. An appropriate software can be useful for the sensitivity and probability analyses.

10.1 Determination of the critical variables with the help of sensitivity analysis (percentage change of objectives by percentage change of each individual independent variable)

10.1.1 Demand/Supply variables

10.1.2 Input variables

10.1.3 Human Resources

10.1.4 Time and implementation variables

10.1.5 Financial variables

10.1.6 Economic variables

10.2 Simulation of pessimistic and optimistic scenarios

10.3 Probability analysis (e.g. with Montecarlo techniques)

10.4 Expected value of NPV or IRR and its distribution

B. Glossary

Accounting prices - Equilibrium prices that are generally different from actual market prices and from regulated tariffs. They should be used in project appraisal to reflect better the real costs of inputs to society, and the real benefits of the outputs, than actual prices do. Often used as a synonym of shadow prices.

Constant prices - Prices related to a base year in order to exclude inflation from economic data.

Cost-Benefit Analysis - A procedure for evaluating the desirability of a project by weighting benefits against costs. CBA usually implies the use of accounting prices. Results may be expressed in many ways, including internal rate of return, net present value and benefit cost ratio.

Cost/effectiveness - The ratio between physical results and costs in money terms incurred in getting these results.

Current prices - Prices as actually observed at a given time.

Discount rate - The rate at which future values are discounted to the present. Financial discount rate and economic rate may differ, in the same way that market prices may differ from accounting prices.

Discounting - The process of adjusting the future value of a cost or benefit to the present by a discount rate, i.e. by multiplying the future value by a coefficient that decreases with time.

Distortion - A mechanism that generates a gap between the opportunity cost of a good and its actual price, e.g. monopoly pricing, externalities, indirect taxes, duties, regulated tariffs, etc.

Economic rate of return (ERR) - The socio-economic profitability of a project. It may be different from financial rate of return (FRR), because of price distortion. ERR implies the use of accounting prices and the calculation of the discount rate that makes project benefits equal to present costs, i.e. makes economic net present value (ENPV) equal to zero.

Elasticity - The ratio of the percentage by which one variable changes, given a 1 per cent change in another.

Financial rate of return (FRR) - The financial profitability of a project, see internal rate of return. Not to be confused with financial ratios such as return on sales (ROS) or return on investment (ROI).

Gross domestic product (GDP) - The total product or value added within the physical borders of the country. It includes production based on foreign-owned resources, even though part of the income earned by these factors of production is transferred abroad as factor service income payments.

Income multiplier - Ratio between national income variation and the expenditure variation that caused it.

Internal rate of return - The discount rate at which a stream of costs and benefits has a net present value of zero. Financial rate of return (FRR), when values are estimated at actual prices. Economic rate of return, (ERR) when values are estimated at accounting prices.

Merit good - An additional criterion of project appraisal applied when the government has a preference for more or less consumption of particular goods, such as education and alcohol respectively.

Multicriteria evaluation - An evaluation methodology that considers many objectives by the attribution of a weight to each measurable objective.

Net present value (NPV) - The net value or net benefit of a project when all costs and benefits have been discounted to the present at the discount rate. ENPV, economic net present value. FNPV, financial net present value.

Net social income - The net increase in income inputted to the project, on the basis of accounting prices - equivalent to the net present value.

Nominal prices - Current prices - these of course include the effects of inflation and are to be contrasted to constant or real prices.

Nominal wages - Wages that include the effects of inflation, also current wages.

Non-tradeable goods - Goods that cannot be exported or imported, e.g. local services.

Opportunity costs - The value of a resource in its best alternative use.

Option value - The present value of a capital asset in the best alternative use, opportunity cost of a capital asset.

Real convergence - Reduction of disparities of per capita income and economic welfare among regions.

Real rates - Rates deflated to exclude the change in the general or consumption price level.

Residual value - The net present value of assets at the final year of the period selected for evaluation analysis.

Risk analysis - A study of the odds of the project's earning a satisfactory rate of return and the most likely degree of variability from the best estimate of the rate of return.

Sensitivity analysis - A study of the impact that pre-assigned changes in variables affecting costs and/or benefits would have on the ERR or FRR.

Shadow prices - see accounting prices.

Social discount rate - Social discount rate is to be contrasted to financial discount rate. It attemps to reflect the social view on how the future should be valued against the present.

Socio-economic costs or benefits - Opportunity costs or benefits for the economy as a whole. They may differ from private costs to the extent that actual prices differ from accounting prices.

Standard deviation - It is a measure of the spread of data about their mean (m) and an essential part of many statistical tests. The standard deviation depends on calculating the average distance that the observation (x) is from the mean.

$$\sqrt{\frac{\Sigma(x-\mu)^2}{N}}$$

Tradeable goods - Goods that can be traded internationally in the absence of restrictive trade policies.

Unit of account - The measure that makes it possible to add and subtract unlike items. ECU may be the unit of account for the appraisal of EC financed projects.

Willingness to pay - What consumers are willing to pay for a good. If a consumer's willingness to pay for a good exceeds its price, the consumer enjoys a rent (consumer surplus).

C. Reference by main sectors

The following reading list is extremely selective. It comprises a limited number of reference manuals or other published material which are of particular interest for applied work in the public sector. In many cases, the cited texts show substantial differences of methodology and definitions. Nevertheless, the list may help the user of the present guide to become aware of the variety of existing literature and of relevant experience, and to understand the quality of project analysis that the Commission aims to stimulate under the reformed Structural Funds. References to published materials in English and in French only have been included.

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