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).

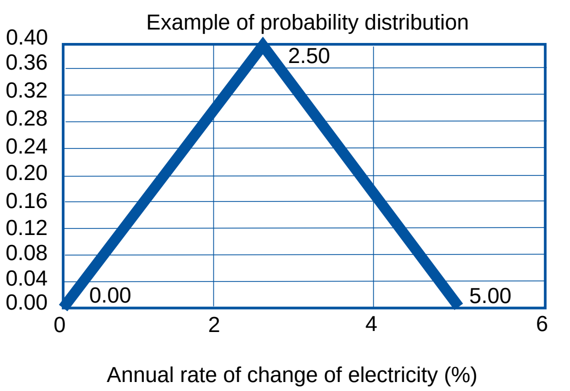
3.1.6 Other evaluation elements

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.

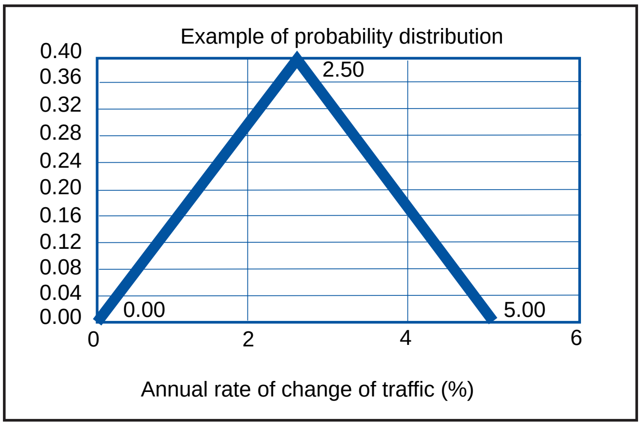
3.3.7 *Sensitivity and risk analyses*

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).

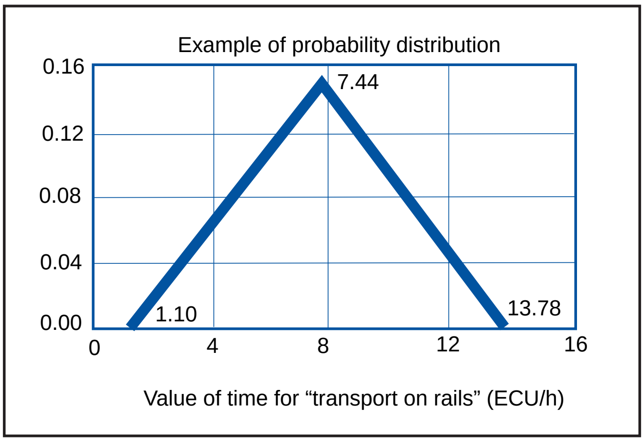
3.4.6 Other evaluation elements

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).

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.

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.

*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.).

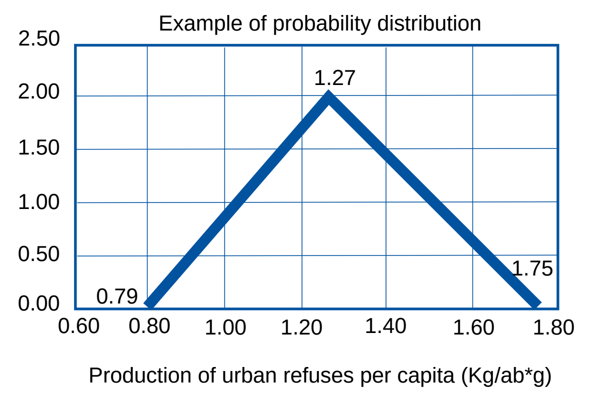
3.8.6 Other evaluation elements

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*

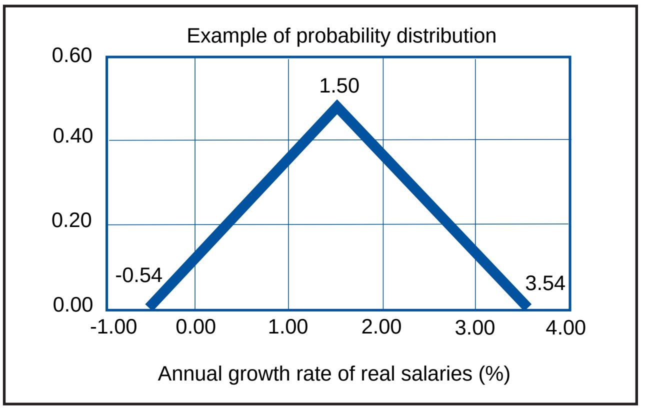
It would be useful to have an independent evaluation from a *panel of qualified experts* of the following elements:

- **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.

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.

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.*

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.).

3.10.6 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

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.

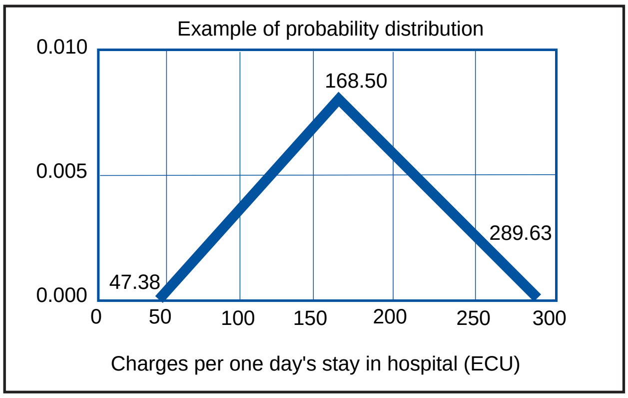
Sometimes in this sector the proposed project may have an intrinsic value for the health system. This should be shown through a panel of independent qualified experts that agreed on the results.

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;

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.

- discharge points for liquid and/or gas waste and a description of treatment plants;
- waste products (type and quantity) and disposal/treatment systems;

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.