EVATREN

IMPROVED DECISION-AID METHODS AND TOOLS TO SUPPORT EVALUATION OF INVESTMENT FOR TRANSPORT AND ENERGY NETWORKS IN EUROPE

SIXTH FRAMEWORK PROGRAMME

PRIORITY 8.1Policy-oriented research

Deliverable 5

Guidelines for ex-ante and ex-post evaluation

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Executive summary

The present Deliverable provides Guidelines for methodological improvements for ex-ante and ex-post evaluation of complex projects that are considered strategic in the development of trans-European energy and transport networks. These guidelines are the results of a refinement process which started from the detailed analysis of 11 European case studies.

Solutions identified in the analysis were the basis for the re-examination of the case studies in order to verify their effectiveness in increasing the capability of the projects in achieving their identified goals. The most effective ones were then presented and discussed with experts and stakeholders in a two days workshop on November 2008.

The Guidelines have two main objectives:

- To point out major themes of relevance concerning the project evaluation process from the EU point of view and
- To improve the contribution of ex-post evaluation to the overall assessment process.

The main recommendations for the improvement of the methodology for ex-ante and ex-post evaluation of large infrastructure projects in the energy and transport sectors are summarised in the following 10 points.

1. **Consider the whole project cycle**. The “project cycle” has different stages, from preliminary appraisal to ex-post evaluation. In the appraisal stage, we recommend an approach, comprehensive and adapted to the level of debates and analyses that takes place at different stages, with more global assessment in the beginning and more complete and more detailed assessment at the end, including economic review. In this comprehensive approach, the ex-post evaluation should enable the ex-ante evaluation procedure to be fine tuned through an ongoing feedback process between the operating results of existing infrastructures and the assumptions used to evaluate new capital expenditure decisions.

2. **Adopt a dynamic approach to ex-ante appraisal**. The time dimension of the decision process must be integrated, managed and controlled. Consequently, appraisal cannot be made once and for all, but must adapt to such different stages, with more detailed analysis when the project is defined. This asks for the establishment of a clear design of the decision making process for large infrastructure projects of EU interest.

3. **Use a progressive approach to environmental analysis**. The capability of Environmental Impact Assessment (EIA), when carried out at the very beginning of the project appraisal, to influence the project technical solutions adopted in order to minimise the environmental costs to society, as well as to organise the public debate around the project and contribute to reach the consensus should be extended also to the whole assessment procedure.

4. **Perform quantitative risk analysis**. A quantitative risk modelling a subsequent plan for risk management and mitigation are of paramount importance for improving the performance of large infrastructure projects. Since the definition of probability distribution is the cornerstone of a meaningful risk analysis and, at the same time, is often the most challenging task, it is worth exploring possibilities to address this issue. Reference forecasting is suggested as an important tool for generating sound probability distributions.

5. **Monitor project development**. In the progressive approach recommended along the whole project cycle, the continuous project monitoring represents the starting point for a successful project cycle approach. The monitoring process should look at all factors that may potentially affect the project feasibility. This means that the checklist of the "monitoring" system that must be put in place should include not only investment costs, but also the socio economic context, the transport context, the expected impact as regards transport evolution of demand, supply and environmental impact of the project.

6. **Adopt risk management and mitigation strategies**. Scope of the "risk management and mitigation" is to identify possible strategic answers to the more critical items identified through the risk analysis. We recommend risk planning to identify how the various risks can be managed and by whom.

7. **Systematically perform ex-post evaluation**. We recommend a systematic use of ex-post evaluation. The ex-post evaluation increases transparency by giving evidence to the effectiveness of the investments in relation to the reached financial, economic, environmental and social objectives; provides elements to improve the ex-ante assessments of future interventions; collects relevant information about past projects to be used as reference class forecasting; and finally, by giving publicity to the real achievements of the projects, provides incentives for better and more accurate ex-ante analysis. Concerning ex-post evaluation we recommend the following: start the planning of the evaluation process at the stage of the project design together with the definition of the analytical framework; maintain all the project documentation available; identify the "after-without" the scheme to be compared with the "after" opening; identify and quantify the discrepancies between the ex-ante appraisal and the ex-post results and assess as far as possible what caused the discrepancies, distinguishing between endogenous or exogenous factors. Concerning costs evaluation and undue optimism, a specific requirement of ex-post evaluations should be to investigate the methods used to obtain costs and the reasons behind the divergences between expected and actual costs.

8. **Use harmonised models and data**. Different transport infrastructure projects should be made comparable on the basis of the same assumptions at least from the point of view of international flows. Given the relevance of demand forecast, we recommend to define a common platform for the modelling tools supporting projects demand projections. A second area of harmonization is the availability of databases. Data plays a key role for projects appraisal as well for models. With an harmonised database, the evaluation framework at European level could be considerably reinforced and become a common reference framework for partner countries.

9. **Make maximum use of evaluation results**. First of all, we recommend that presentation and dissemination of the evaluation's outcomes are as wide as possible, for two main reasons: (i.) democracy, and (ii.) by giving publicity to the real achievements of the projects, incentives for better and more accurate ex-ante analysis are provided. Secondly, we recommend (i.) to use lessons that appear to follow from comparisons of projects outturns with forecasts to really enable the ex-ante evaluation procedure to be fine tuned through an ongoing feedback process; (ii.) to build up a database on costs and demand deviations to indicate how they varies in systematic ways across different types of schemes; (iii.) to use data from past to inform future estimates (e.g. reference forecasting) and (iv.) to use past experience to derive the statistical distribution of parameter values as an important input to the risk analysis.

10. **Establish a EC dedicated team**. We recommend the identification of a dedicated team in charge of collecting and capitalise ex-ante projects documentation, provide harmonised inputs for projects appraisal, collect information on projects monitoring and ex-post evaluation, establish minimum requirements for projects assessment and evaluation, and disseminate results. The dedicated team should have a progressive approach, starting from providing data already available, collecting information on past experience and promote project implementation monitoring.

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1 Introduction

1.1 The EVA-TREN project

EVA-TREN is a research project supported by the European Commission and developed within the VI Framework Programme. The project aims at improving the ex-ante appraisal practices for the assessment of large energy and transport infrastructures projects through the ex-post analysis of several case studies.

The question to which the EVA-TREN project is expected to answer regards the effectiveness of the current assessment tools and practices in dealing with complexity of problems addressed. As a matter of fact, evaluation tools should be planning instruments useful to establish a dialogue with the other projects phases and, at the same time, to manage the several dimensions involved in the policy decision support. The approach followed by the project could be summed up as follows:

1. identification of the most critical aspects concerning the implementation of large infrastructure projects;

2. supporting the developments of tools, indicators and operational parameters for the assessment of sustainable transport and energy network;

3. suggesting good practices to the policy makers.

1.2 Aims of the guidelines

The present Deliverable provides guidelines for methodological improvements for ex-ante and ex-post evaluation of complex projects that are considered strategic in the development of trans-European transport and energy networks. TEN projects are typically the results of rather lengthy process that involves various administrative levels, as well as political institutions, consultants, contractors in the private sectors and different stakeholders. As a result, the decision process takes place during a period of time which is, for most of the projects, a “very long” one. Objectives might change during this period, and the time dimension of the decision process must be integrated and managed because it might distort the evaluation results and the information associated to each step of the process. This process is usually complex, and what happens during this front-end phase is essential for the project success.

The guidelines recognise that the evaluation of a project is never conducted once for ever, but rather has to be considered as an evolutional process that encompasses the project life, from the initial concept to the operational phase. As a consequence, the main focus of the guidelines is not on the technical and methodological issues, although these are a prerequisite of the recommendations, but on the interactions between ex-ante appraisal, monitoring and ex-post analyses, including the decision-making and the policy dimensions.

The recommendations contained in this deliverable derive mainly from the results of work packages 2 and 3, as summarised in the two deliverables D.2.2 "Case studies for ex-post evaluation" and D.3.2 "Methodological developments". These are therefore largely based on the outcome of the ex-ante evaluation vs. ex-post evidence of the eleven EVA-TREN case studies, listed in table 1.1, combined with the results of other recent similar studies.

Table 1. 1 EVATREN energy and transport infrastructure investments case studies

Case study	Transport mode / energy sector	Country
Madrid-Sevilla AVE	High Speed Rail	Spain
Eurotunnel	Rail	France-UK
Magdeburg Waterways Cross	Inland navigation	Germany
ICE Frankfurt-Cologne	High Speed Rail	Germany
Lyon Marseilles TGV	High Speed Rail	France
Malpensa 2000 airport	Air	Italy
Paris Lille TGV	High Speed Rail	France
Baltic Sea Motorway	Road	Benelux-Germany-Poland
Oresund fixed link	Road and rail	Denmark-Sweden
CH-IT electricity cross border connection	Energy	Switzerland-Italy
Iberian Electricity Network interconnection	Energy	Spain-Portugal

The eleven case studies first helped in identifying a framework of the most critical aspects of the conventional approaches, and at the same time, by classifying the different types of discrepancies according to their ultimate cause, allowed identifying the steps forward to perform a more effective assessment. Case studies were thus examples of the type and nature of difficulties encountered in the ex-ante appraisal.

Case studies were firstly analysed, according to a "vertical analysis" following to a common template, Then, the case studies were scrutinised along with an "horizontal analysis" more oriented toward EU needs to improve evaluation methods of large infrastructure projects of EU interest. In this second step, the analysis was therefore of different nature with respect to the previous vertical one, which was conducted within a predominantly national framework, even though related to an international context, since most of projects considered were or "became" (in the case of the oldest ones) part of TEN networks. The outcome mainly consisted in pointing out major themes of relevance concerning the evaluation process from the EU point of view, with particular attention to the positive contribution of ex-post evaluation to the overall assessment process.

1.3 From ex-ante appraisal to ex-post evaluation

The decision making process for large infrastructure investments clearly involves different steps, from prior general investigations to the definitive evaluation, including design of the infrastructure. The traditional project appraisal approach proceeds from very general to very specific assessment: for instance, the local environmental assessment is likely to be detailed in last stages only, when local impact can be known with precision. The major inconvenience of this approach is that at the first stages of the process, the environmental aspect is very general and that at the later stages the

economical assessment is not sufficiently reviewed. The result is that the project that has been appraised is not the one that is going to be realised and, what is more important, the appraisal has not been used to select the best layout.

An appraisal approach that aims to really support the decision making process must adapt to the different stages with more detailed analysis when the project has been defined. This implies the consideration of all general and local options of the project from early planning stages on. Furthermore a continuous monitoring of project impacts and success with learning form past experiences will contribute to improve the selection and management of future large investment projects. This asks for the need to consider the whole decision process including project monitoring and ex-post evaluation as a continuous process with different stages. In this comprehensive approach, the ex-post evaluation should enable the ex-ante evaluation procedure to be fine-tuned through an ongoing feedback process between the operating results of existing infrastructures and the assumptions used to evaluate new capital expenditure decisions.

This “project cycle” has different stages, from preliminary appraisal to ex-post evaluation, each stage links with the preceding one and links forward to the next one. Stages should be integrated into the project cycle so that the main issues are monitored systematically, thus enabling a better project selection. This requires that interrelations between ex-post and ex-ante evaluation are taken into account since the beginning of the project appraisal in order to make the whole process more accurate. A first definition of the information required for ex-post evaluation must be prepared during ex-ante appraisal; this does not prevent collection of other types of information which might appear also relevant at a later stage, with, for example, an important change in the transport context of the project which was not expected but must be included in the process.

A clarification about the term *evaluation* is necessary, since the term is often used at the place of *appraisal* or vice versa. Appraisal occurs when a scheme is (ex-ante) assessed with forward-looking purposes; evaluation is, conversely, a retrospective analysis of a specific scheme on a specific point of time. In practice the ex-post evaluation is similar in techniques to the appraisal, although it obviously uses historic rather than forecast data. It should be conducted in the same manner as an economic appraisal and it should apply almost identical procedures. It focuses on conducting a cost benefit analysis in the knowledge of what actually occurred rather than what is forecast to happen.

The time dimension is important in the project cycle from ex-ante assessment to ex-post evaluation. The whole process must develop in a smooth way since changes of objectives or contestations, which are legitimate, might influence ex-ante and ex-post results. Possible changes and implementation problems must also be considered in the evaluation process definition. The time necessary for decision making processes cannot just be considered as a “delay”.

Finally, conservation of data and information of a project history as well as transparency are important steps toward progressive approach to project appraisal and evaluation. Keeping memory of the project appraisal and monitoring is a pre-requisite for ex-post evaluation. A weak point of the evaluation process pointed in the case studies is the frequent changes over time of the institution or organisation in charge of evaluation, within or outside Ministries. This will imply in particular that there is no “memory” of the evaluation process which makes it very difficult for ex post evaluation. The efficiency of the ex-post evaluation system is directly related to the content and clarity of the information provided by the ex-ante appraisal and the monitoring system. Furthermore, the relevant project documentation must be made available to the public. A smooth evaluation process requires a

transparency and the capability of integrating positions of different stakeholders who can be "partners" of the decision process. This means planning of concerted phases with public and private authorities.

1.4 Content of the deliverable

The Deliverable is structured following the steps of a project cycle that starts with the ex-ante appraisal and the monitoring of the project implementation, looking afterwards at the ex-post evaluation and at the feedbacks with the ex-ante. Recommendations are given in an operational progressive perspective and, whenever possible, the different steps and recommendations are supported by examples of best practices.

Chapter two deals with some limited improvement in the ex-ante appraisal and chapter three underlines the importance of projects monitoring and particularly the need of keeping memory of the project history and the issue of transparency.

The fourth chapter focuses on the ex-post evaluation. In particular, the experience completed in the ex-post analysis of case studies is presented in the form of guidelines for ex-post evaluations. The inputs needed from the ex-ante appraisal are also highlighted and recommendations in the field of harmonisation in core database and common modelling platform are provided. Some remarks are made also concerning the policy dimension, infrastructure investments take place in a given policy context, which influences the impact of investment. A smooth evaluation process will be a transparent process, which integrates positions of different stakeholders who can be "partners" of the decision process and eventually co finance the project. The importance of social acceptance in the definition and implementation of projects is also considered. The use of the evaluation results, and the interaction with the risk, which is of paramount importance for the improvement of ex-ante evaluation and for a useful contribution of the ex-post analysis, are also discussed.

The contribution of a EC dedicated team in supporting the capability of the projects in achieving their identified goals is the objective of the fifth chapter. The team will play as an interface between the EC and the project promoters and developers, providing data and information to support the project appraisal and collecting projects results. The main tasks of the team therefore should include: made available relevant database; provide guidelines and tools for a common modelling platform; define checklist; establish appraisal steps; follow project monitoring and evaluation and guarantee public access to information.

The issue of having a common approach for transport and energy large infrastructure projects is addressed in the sixth chapter, where differences and similarities of the two sectors are briefly discussed.

Lastly, the recommendations for methodological improvements for ex-ante and ex-post evaluation of complex energy and transport projects are presented in chapter seven. References are provided in the eighth chapter.

2. Ex-ante analysis of large transport and energy infrastructure projects

2.1 A dynamic approach to ex-ante appraisal

The decision making process of large infrastructure projects takes place during a period of time which is, as shown by most of the projects considered, a “very long” period of time: for major transport infrastructures it is quite often a period which extends over 10, 15, 20 years and even more. Objectives might change during this period of time and the time dimension of the decision process must be integrated, managed and controlled because it might distort the evaluation results and the information associated to each step of the process. Consequently, appraisal cannot be made once and for all but must adapt to such different stages, with more detailed analysis when the project is defined, including the links with local and interregional networks.

In reality there are, most of the time, several ex-ante appraisals, and it is sometimes difficult to know what is the document, which should be taken as reference as the ex-ante appraisal on which the decision has been taken. In most case studies it was indeed difficult to date the conclusion of ex-ante appraisal. The most frequent situation is when ex-ante appraisal has been made many years before the final decision is taken: this means that a rapid updating has to be made which is not always public or which is just summarised in few simple figures.

A clear structure of the decision making process for large infrastructure projects of EU interest is extremely helpful in clarifying where go/no go decisions are needed. This asks for the establishment of a distinct set of milestones more than strict and comprehensive regulatory design.

A dynamic use of ex-ante appraisal, carried out with different levels of detail each time the project is subject to modifications and adjustments, can represent an extremely useful approach to highlight the essentials matters and to ensure an adequate basis for decisions in the course of the process shaping period.

Different steps are defined in the ex-ante appraisal, and at each step should correspond to a specific analysis to be adapted to the level of maturity of the project

- Preliminary analyses with global exploration of the impact of the project including expected environmental impact (see next paragraph)
- More detailed analyses when the project is more mature and the spatial location more precise. At this stage, a concerted process with stakeholders must take place.
- Detailed ex-ante appraisal including official documents required by legislation or regulation in order to satisfy legal aspects of evaluation (EIA, reference to planning documents, agreed reference values for unit costs.)

Within that framework, possible impact on expected outputs of changes of objectives can be highlighted and delays in decision process and implementation will be considered part of the process together with the analysis of the positive or negative impacts on the expected outcome of the project.

Furthermore such an approach, once adapted to the level of debates and analyses that takes place at different stages can be extremely useful in minimising the reintroduction of contestation of the project on new grounds. Decisions are clearly path dependent, and assessing conflicts continuously throughout a decision making process could contribute to resolve potential conflicts before they become actual conflicts.

2.2 A progressive approach to environmental analysis

Environmental complaints during the implementation phase are quite often one of the causes of construction time delays and cost overruns. The positioning of the environmental appraisal procedure in the decision-making process shapes both the strategies of the actors involved and the solutions they reach. The sooner the appraisal procedure is confronted with interests and logics of action from the environmental perspective, the higher the possibility to construct a common political ground.

The capability of Environmental Impact Analysis (EIA), when carried out at the very beginning of the project appraisal, to influence the project technical solutions adopted to minimise the environmental costs to society, as well as to organise the public debate around the project and contribute to reach the consensus should be extended also to the whole assessment procedure.

Environmental issues must also be enforced because, despite the formal recognition of their importance, they are still playing a marginal role, with no real influence in the decision whether or not the project should be implemented.

A similar approach as the one proposed for the ex-ante appraisal is suggested also for the Environmental analysis, starting from a preliminary analysis, not particularly detailed aimed at identifying the main environmental impacts of the projects, to end up with a full EIA at the end of the appraisal project.

By (i) proceeding in parallel with a dynamic ex-ante appraisal and a progressive environmental analysis, (ii) reappraising the project each time it is modified in order to mitigate environmental impacts, and (iii) re running the environmental analysis each time the project is adjusted a positive dialogue might be guaranteed between environmental and social issues. Through these analyses done in successive stages, the project design that contributes most to the objectives may be selected.

The feasibility of this approach requires that the analysis is designed in a progressive way, providing at each different stage of the decision making process the necessary results without consuming excessive time and resources.

2.3 Quantitative risk analysis

The evaluation process necessarily entails a forecasting exercise: assumption on costs, benefits and effects has to be done before they are realized. Large infrastructure investments are inherently risky due the long planning horizon and complex interfaces. Furthermore these types of investment are necessarily based on uncertain future events involving explicit or implicit probability judgement and probability based assessment. The systematic use of quantitative risk approach, together with risk management and mitigation are of paramount importance in improving the performance of large infrastructure projects.

The quantitative risk assessment involves the selection of the variables to which the project design is most sensitive, the assignment of a probability distribution to the selected variables and then determines the effect of varying simultaneously the variables on the project performance indicators (NPV - IRR).

The sensitivity testing allows identifying those “critical” variables or parameters, which, positively or negatively, influence more the project results. The selection of critical variables depends at least partially on the specific project. Past similar projects dossiers can provide useful basis of information. The following table summarises usually influential factors in transport and energy project.

Table 2. 1 Influential factors for risk analysis in transport and energy projects

Categories	Examples of variables
Price dynamics	Rate of inflation, growth rate of energy prices, changes in prices of goods and services
Demand data	Population growth rate, GDP growth rates, motorization, value of time, volume of through traffic, energy demand, pricing policies, emerging competing services, change in behaviour
Investment costs	Duration of the construction site (delays in realisation), cost of land, cost of other inputs, cost of environmental impacts mitigation, demand by new technologies and standards
Operating costs	Prices of the goods and services used, hourly cost of personnel, price of electricity, gas, and other fuels, consumption of energy and other goods and services, number of people employed
Prices of outputs	Tariffs, sales prices of products
Accounting prices (costs and benefits)	Coefficients for converting market prices, value of time, cost of deaths avoided, valorisation of externalities
Others	Changes in policy priorities and objectives, market structures, (international) agreements. Force majeure (catastrophes, sabotage, bankruptcy

Source: elaboration from the DG REGIO Guide to cost benefits analysis

As a general rule, the parameters considered should always be independent variables. It can be useful to separate the risk components which are subject to the management control from those which could not be controlled.

A probability distribution should then be assigned to the critical variables, identified through sensitivity and scenario analyses The probability distribution for each variable may be derived from different sources, such as experimental data, literature, consultation of experts.

Since the definition of probability distribution is the cornerstone of a meaningful risk analysis and, at the same time, is often the most challenging task, it is worth exploring possibilities to address this issue. Reference forecasting (see paragraph 3.3.2) is suggested as an important tool for generating sound probability distributions.

The quantitative risk assessment involves varying simultaneously all the relevant variables. Many procedures could be used for doing that although Monte Carlo method is currently the most frequently used[1]. Sensitivity tests analysing the influence of each single variable on the project's financial and economic performance can provide important information. However, it is recommended that also the interaction effects among relevant parameters be tested through scenario analysis, where more parameters are varied simultaneously.

The main result of the risk analysis is the probability distribution or cumulated probability of the NPV or the IRR[2] in the resulting interval of values.

[1] Monte Carlo simulation is based on generating large amounts of random numbers based on a statistical model.

[2] Project performance indicators: NPV Net Present Value, the difference between the discounted total social benefits and costs, IRR Internal Rate of Return, the rate that produces a zero value for the NPV.

3. The importance of project monitoring

3.1 The project monitoring process

In the progressive approach recommended along the whole project cycle, the monitoring of project implementation plays a relevant role. The monitoring process should look at all factors that may potentially affect the project feasibility, bearing in mind that the implementation of large infrastructure project may last several years, during which many things may happen. This means that the checklist of the "monitoring" should include not only investment costs, but also the socio economic context, the transport context, the expected impact as regards transport evolution of demand, supply and environmental impact of the project.

In principle, the information required for the project monitoring must be derived from the ex-ante appraisal; this does not prevent collection of other types of information which might appear relevant at a later stage.

3.2 Monitoring the project costs

In order to avoid costs overruns and to compare ex-ante and ex-post situations, monitoring and collection of relevant data is of particular importance. Case studies show that cost overruns are not uncommon (see also Flyvbjerg et al. 2002) and literature suggests the following causes for cost overruns: project typology (roads, railroads, technology used); region; project size; length of the implementation period; several categories of uncertainties; changes in project specifications; strategic behaviour (resulting in too low cost forecasts) of actors supporting the construction of the project.

In the case where the differences between the plan and the actual work performance are large, actions are required to bring the actual performance on course with the desired state of the plan. Large differences may require a revision of the model of future work to ensure that it is realistic.

The control cycle involves three stages:

- Measuring the state of the system.
- Comparing these measurements with the desired state of the system.
- Taking corrective action to minimise some losses.

Time lags have been shown to degrade performance. Flyvbjerg concludes that the length of the implementation period is relevant: the longer the implementation period, the larger the cost overrun (Flyvbjerg et al. 2004).

Project monitoring provides quantitative information on which control actions may be based. Whatever the cause of the discrepancy between actual and expected output, monitoring will help in identifying possible ways to reduce the overall discrepancy and reduce the risk of cost escalations due to changes in project specifications. Projects with good monitoring might be better managed,

resulting in lower-than-average cost escalations (data availability itself increases the likelihood of good management).

3.3 Monitoring the demand

With reference to the demand, rather than comparing the actual and the expected outcome, the monitoring should consider those factors having an impact on the expected demand. This requires controlling both (i) the trends of socio economic variables affecting demand development, like GDP growth, and (ii) the modification in the transport context, i.e. what is going on the competing modes and/or routes as well as in the policies field (regulation, pricing etc.). Such determinants indirectly impact on the project characteristics and can therefore contribute to a change in project specifications.

All technical decisions leave some degree of flexibility, on order to better adapt to unexpected changes in actual demand. This is particularly true for large infrastructure projects made of different stretches. The actual demand on the stretches firstly open to the public might provide extremely useful information on how to "readjust" the technical characteristics of the remaining part of the infrastructure still under construction.

3.4 Monitoring the decision making process

Project monitoring should also look at the decision making process, particularly at the relationship with the stakeholders, including those who are not in favour of the project. In such cases, monitoring the stakeholder's attitudes toward changes in the project characteristics might be extremely useful in order to fine-tune the project with the intention of increasing acceptability and reducing the risk of delays. Before a project owner decides to proceed and build a project, every effort should be made to conduct preparation, planning, etc., in such ways that those problems which may otherwise resurface as delays during the implementation stage are negotiated and eliminated.

3.5 Risk management and mitigation

"Risk mitigation" objective is to identify possible strategic answers to the more critical items identified through the monitoring and risk analysis. The main questions that a risk mitigation and management plan should give answer are:

- what are the possible options?
- what are the tradeoffs in terms of costs, benefits and risk among the different options considered?
- what are the impacts of the actual decision on future options?

Given a clear understanding of the risks, their magnitude, and the options for response, an understanding of project risk will emerge. This understanding will include where, when, and to what extent exposure will be anticipated. and will allow for thoughtful risk planning.

The purpose of the risk management plan is to identify how the various risks made visible by the risk analysis can be managed and by whom. In practice, risk planning requires first of all to develop

and document an organized, comprehensive and interactive risk management strategy describing processes to assess identify, analyze and mitigate the risk associated with a project. Possible options to be considered include:

- more flexible or standardised design (avoiding irreversible decisions),
- better contractual arrangements (transferring risk),
- taking precautionary actions (mitigation), by reducing the probability or consequences of a risk event to an acceptable threshold,
- making the risk takers and those responsible explicit.

4 The role of the ex-post evaluation

4.1 The objectives of ex-post evaluation

The ex-post evaluation has the following primarily goals:

- increase transparency by giving evidence, given the amount of public money involved, to the effectiveness of the investments in relation to the reached financial, economic, environmental and social objectives (accountability);

- measure the effectiveness: the actual impacts are compared with the forecasted ones or the achievements are compared with initial objectives in order to give a measure of the utility of the project;

- provide elements to improve the ex-ante assessments of future interventions: ex-post evaluation based on the reassessment of ex-ante appraisal is extremely informative and useful for understanding whether the conceptual forecasting model adopted before project implementation was adequate to support the investment decision. Furthermore it allows understanding where the efforts in improving the quality of project appraisals should be addressed.;

- collect relevant information about past projects to be used as reference class forecasting (see paragraph 3.3.2);

- provide incentives for better and more accurate ex-ante analysis by giving publicity to the real achievements of the projects.

Ex-post evaluation is not about discovering “deviations” per se. As an example, the fact that traffic demand forecast was wrong can depend upon a number of factors and the reasons for the outturn being better or worse than expected might be attributable to external factors, such as the “state of the world”, the forecasting assumptions, the inherent design of the project, the management of the same project etc.

The understanding of the causes behind the deviations is the real target of the ex-post evaluation. Indeed, what can be learnt from ex-post evaluation greatly depends upon possible separability of impacts of unexpected changes in truly exogenous and partly endogenous variables. With reference to a typical exogenous factor like GDP, the logic sequence might be the following. Demand of transport was assumed to be correlated with GDP growth. Was the elasticity to GDP estimated in a convincing, fairly standard way? Was GDP growth forecast based on realistic/widely accepted sources? If not, the ex-post discovers something that could be learnt ex-ante by an independent review of the appraisal report. If yes, i.e. GDP growth and elasticity were estimated in a professional way, unexpected shocks were within a reasonable probability range, or rather extreme? Clearly the lessons to be learnt here are different. The GDP growth forecast was right, but the

appraisal did not consider the implications of relatively limited adverse variations; or - perhaps - rightly avoided to consider extreme events.

Prices, productivity, some type of costs, etc. are fully or partly endogenous. Here the forecasting errors can be either of the same type as before (weak empirical models, etc.) or of a quite different type: overlooking factors that have led the managers to inefficient decisions. This type of error is more related to project design, asymmetric information, moral hazard, and in general incentive issues. Thus, discovering that there was a cost over-run in a transport project says nothing per se. Was this the consequence of an unexpected increase in the price of an energy input, or the consequence of delays caused by mismanagement of the time plan of the project ? Again, what we can learn is very different and is linked to the origin of the investment cost overrun.

Box 4. 1 The ex-post evaluation in France

Since the promulgation of the LOTI (Loi d'Orientation sur les Transports Intérieurs) transport law in 1982, the socio economic evaluation, ex-ante and ex-post evaluation is an obligation for large infrastructure project of national interest in France.

Ex-ante evaluation was already a usual practice within the planning process for road master plans and in particular for motorways construction following a common cost benefit methodology regularly improved by the Transport Department. But there were, at that time, only few projects for rail or inland waterways except for the development of HST lines, which became a policy priority after the opening of the Paris - Lyon line at the beginning of the eighties. No directive was issued for such projects and the socio economic evaluation process, always based on cost benefit analysis, was depending upon the methodology adopted by "ad hoc" commissions set up for specific projects. The objective of the LOTI was to harmonise the evaluation process taking into account all modes, and to have ex-ante and ex-post evaluations as legal obligation.

Considering the life cycle of a project, the ex-post evaluation became indeed a reality at the end of the nineties. The projects which were already parts of a transport planning process (a 5 years process at that time) were not submitted to this new legal obligation. Originally the ex-post evaluation obligation was 10 years after the implementation of the project and appeared more difficult to achieve in the case of rail projects than for the completion of the motorways network, probably due to the higher acceptability of the motorway as a toll to improve regional accessibility - except for sensitive areas where intense debates also took place.

The experience in France is particularly useful although it can be still considered as a learning process: the two last ex-post evaluation reports have been published in 2008 for the Rhone Alps HST, going around Lyon, and the Mediterranean HST between Valence, Nîmes and Marseilles which was an EVA TREN case study. RFF (French Rail Infrastructure Manager) was in charge of producing the evaluations which have been discussed by the Conseil General de l'Environnement et du Developpement Durable (CGEDD) in the ministry, an advisory body which has already played an important horizontal role within the ministry, and was recently granted enlarged competencies in the energy and environmental domains (formerly Conseil General des Ponts et Chaussées). The reasons for discussion with CGEDD were indeed to harmonise and constantly improve the methodology of ex-post evaluation. The context for ex-ante and ex-post evaluations has indeed very much changed in France over the past 25 years:

The planning process for transport, at the level of central administration, has been abandoned and replaced by a more decentralised process of concertation with regions: the so-called "Schema de Service", which also stressed that the final objective of the transport policy is the provision of adapted services, regions have taken a more important role in the choice and financing of large national projects.

Consultation obligations with the public have been extended, with obligation of public debate at an early stage of the decision process.

New environmental laws for protection of environment have been passed, as well as new obligations in urban planning which must be taken into account within the evaluation process.

Therefore the ex-post evaluation becomes more important in order to point what are the differences between projected and observed results, not only to analyse if the initial objectives of the policy have been reached but also to assess if the quality of information provided to the public before was satisfactory.

This shows clearly that ex-post evaluation is indeed a long, complex, learning process, which must also reinforce the "confidence relations" between the decision makers and the population. The last "Avis" (Advice) of the CGEDD (July 2008) is then particularly interesting to analyse in order to show what progresses have been made in the light of the publication of these last ex-post evaluation reports: two provided by RFF concerning the two lines mentioned before which are closely interrelated (Rhone-Alps and Mediterranean new lines[3], and a report provided by SNCF concerning the new stations of Mediterranean HST, showing how the problem of new stations becomes important in the evaluation process and in discussion with region; this is also a new point to emphasize the projections of traffic, in relation or competition with other modes, putting forward measures of accessibility within the modelling process.

Therefore the context has also very much changed since the initial legal obligation taking into account the separation between transport operators and infrastructure managers with expectation of new entrants, as well as growing influence of discussions with public, and environmental impact assessments.

4.2 The formalisation of ex-post evaluation steps

The path of a correct ex-post assessment can be summarised as follows. For each step, challenges are manifold as briefly outlined below.

4.2.1 Planning

The planning of the evaluation process needs to start at the project design stage. This step is crucial, because it enables to collect the information needed for the analysis of both the "before" and "after" implementation. In order to provide feedbacks for the improvement of the ex-ante techniques performance, ex-ante appraisal should be well documented: the decision making process is most of the time very long so that afterwards it is difficult to point out which is the ex-ante analysis that was supposed to support the decision. When the project documentation is not available or incomplete, the lack of official documentation of ex-ante assessment results and in general of planning documents makes it difficult to apply sound ex-post analysis.

Given the amount of public money involved normally in the appraisal of projects, the provision of the relevant documentation should be considered as part of the project activities.

4.1.1.1 Identification of the project boundaries

This step involves the clear identification of the project boundaries, main objectives and targets.

- Project boundaries should include space and intermodal dimension (all networks where the effects of the new infrastructure are expected to be realised should be taken into consideration), as well as pricing of substitutes and complementary goods.

[3] Their current denomination in official documents is also LN4 and LN5 pointing out how such project takes place within a more global programme, which is very important as regards "option analysis".

- Project objectives should be consistent with the ones included in the EU policy or programme priorities.

4.1.1.2 The analytical framework

The analytical framework for an evaluation needs to be set up at an early stage, as this is then used to define the data collection activities. The most important questions to answer are:

- Is the evaluation limited to outturns, or is it to extend to processes?
- How many "after" periods are to be explored?
- Will statistical analysis suffice for the evaluation, or are new modelling/forecasting tools required?

The definition of the analytical framework produces specific requirements for the data collection activities: data directly related to the estimation of the counterfactual (see 4.1.4), data targeted at observing trends, etc.

4.2.2 Measure of the project outcome

Collect ex-post information about projects performances is in general costly, so that it is important to concentrate on the main indicators and to use standard approaches. There is a danger that some of the important impacts of a project may not be covered by the stated objectives (for example, the impacts on other modes of transport or on other countries). These issues should be considered in the evaluation, if they are material.

In addition to data collection, which is the main source for cost, demand and construction times, experts interviews could be useful to investigate on the possible cause of discrepancies between ex-ante and ex-post results.

4.2.3 Comparison of the project outcomes with the expected outputs

Ex-post evaluation implies comparing the observed outcomes with those expected in the appraisal stage. A key issue is here the understanding that "deviation from initial forecast" is in fact a irrelevant concept. The outcome of an infrastructure project will never be exactly as projected in advance, as there are only very limited chances that the future can be accurately predicted. Thus, it is not sufficient to identify and quantify the discrepancies between the ex-ante appraisal and the ex-post results, rather to assess as far as possible what caused such discrepancies.

Even in those cases where no critical differences emerge, it is not possible to automatically conclude that the ex-ante appraisal methodologies were adequate and that no mistakes were done, since it may occur that exogenous factors which were not considered in the appraisal stage may have generated outcomes similar to those expected (see for example, the demand forecasts for the Malpensa airport, which were overestimated in the appraisal stage, and that, after the liberalisation of air transport, have become lower that the effective demand following the airport opening).

4.2.4 The counterfactual

In order to evaluate the project validity (accountability reasons), ex-post evaluation involves comparing the observed outputs and outcomes with a Reference Case. The analysis needs to look at the "after" opening situation against "after-without" the scheme, which is called the counterfactual situation.

The "after-without" case may be represented by the looking-forward situation, as forecasted at the time that the project was approved (the Reference Solution of the ex-ante appraisal). However, if there is a considerable difference between the forecasts made for the scheme and the observed outturn, this also casts doubt on the validity of the Reference Solution and hence their use for estimating the counterfactual: the "after-without" situation is not observable and it may be not the same as the "before" situation. With large transport projects, the construction and settling down periods can extend over a number of years, and much can happen in that period.

In addition, the comparison ex-post and ex-ante will only be of value if the specification of the project context analysis was sufficiently comprehensive. This is the case where the Reference Solution did not include some projects that were implemented, or - on the contrary - some of the planned projects of the Reference Solution were actually not implemented. In these circumstances, the applicability of the Reference Solution to identify the counterfactual can be improved through re-running the model(s) used in the appraisal stage with updated data on the basis of observed trends (GDP, evolution of transport costs/price of different modes in competition, etc.), and updated transport networks, that better reflect the outturn in the "after" period.

4.2.5 Identify endogenous or exogenous factors

The identification of the counterfactual involves investigate the effects which may be attributable to a project, i.e. the effects that without the project would not have occurred, or would not have occurred at the same level. Some insight into the sorts of changes that have occurred and how they have impacted on transport demand can be gained from data on comparable areas outside the direct influence of the project. This should be supplemented by qualitative research such as in depth interviews with stakeholders and relevant professionals to understand and explain the observed changes.

The key point is whether the deviation is because of endogenous or exogenous factors. While the latter are hardly predictable and outside the control of the project management, the former might be included in the ex-ante analysis to reduce the related risks. Only a careful distinction between forecasting errors in exogenous versus endogenous stochastic variables, and between the latter and the changes in planning parameter applied in the economic analysis, can offer a meaningful ex-post evaluation.

4.2.6 Costs evaluation

Costs evaluation is a critical stage of any major project owing to undue optimism. An approach that might be taken to investigate the process of costing a major project could involve asking whether

the costs were compared with other similar investments, or use was made of published unit cost or an explicit allowance was made for optimism bias, etc.

Thus a specific requirement of ex-post evaluations should be to investigate the methods used to obtain costs and the reasons behind the divergences between expected and actual costs. The main factors to be considered are: delays in the implementation, changes in the project specifications and design, changes in currency rates, geological risk, changes in quantity and prices, changes in safety requirements, changes in environmental requirements, technological risks. It would be also useful to recall that project appraisal provides the starting point for applications for scheme funding, but there is generally a need for iteration as the funding bodies will naturally raise issues about aspects of the appraisal.

In order to progressively improve the cost estimate, it might be extremely useful to develop country based database where information would be classified according to several relevant dimensions like the type of project, its size, the region etc.

4.2.7 Process evaluation

Process evaluation looks at the reasons behind the difference between the observed outcomes and those expected in the appraisal stage from the decision-making process point of view. It involves the examination of aspects of the development and implementation of the project and focus on the strengths and weaknesses of procedures and how they were implemented. This might cover any of the main activities involved in developing the scheme, from objective setting through design to implementation; or it could look at the effectiveness of consultation processes in the finalisation of the design - and/or how decisions were made on capital procurement. As with project outcomes and costs evaluation, process evaluation may consider a wide range of areas or be targeted at a limited number of particular issue.

Process evaluation would identify problems arising from adopting “solution-specific” objectives rather than “pure” objectives and would also look at the role played by the environmental impact analysis, whether it played or not a proactive part in the project development process, at funding problems as well as stakeholder and public consultation.

4.2.8 Measure the effectiveness of the investment

One of the main objectives of the ex-post evaluation is to give a measure of the project net impact on economic welfare on the basis of the observed outcome and outturns. The analysis needs to look at the “after” opening situation against the counterfactual situation. Once identified the counterfactual and calculated the actual project outcome and costs the evaluation should be conducted in the same manner as the ex-ante economic appraisal and should apply almost identical procedures. The result will be the calculation of the actual economic performance indicators IRR and NPV, to be compared with the expected ones.

Box 4. 2 The New Alpine Transversals (NEA)

History: Traffic flows from Northern Europe to and from Italy across the Alps constitute the strongest freight transport corridor in Europe. In front of their strong growth, the ecological sensitivity of the Alpine nature and traditionally important role of environment protection policy in Switzerland has lead to the decision to construct the Alpine base tunnels.(NEAT). After a first agreement by public vote in 1992 and a later re-dimensioning, the final agreement to the project in its present form was taken in 1998 by public vote. The NEAT project is embedded in a series of measures to maintain the high share of rail transport in cross alpine freight traffic, which was at 68% in 1999. These are the BAHN 2000 project for improving capacity of the entire rail network and the connection of Switzerland to the European high speed rail network.

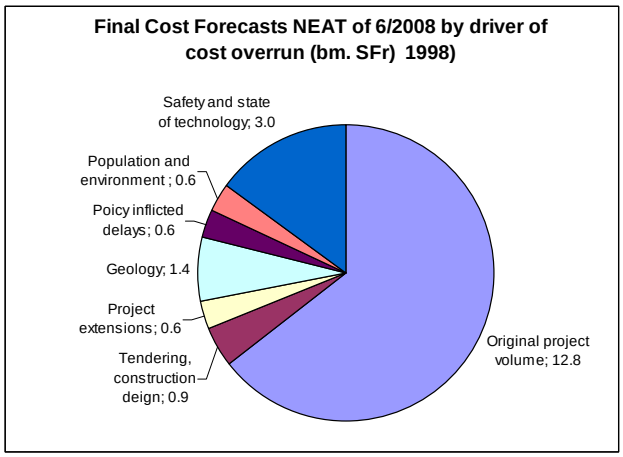
Policy background: On the political side the project has been accompanied by the Transit Agreement between Switzerland and the EU of 1992 and the Bilateral Land Transport Agreement of 1998. The latter has foreseen a stepwise relaxation of the Swiss 28t-limit for trucks to the European Standard of 40t. To balance out this enormous productivity increase for road transport the introduction of a heavy vehicle fee (HVF) on the entire Swiss road network was decided, where the revenues are earmarked to finance the NEAT project.

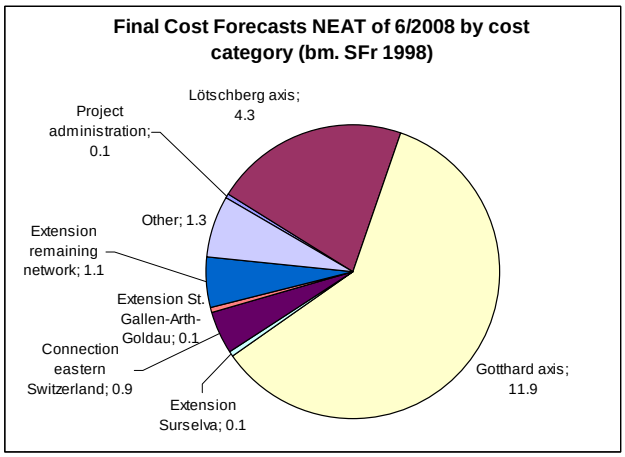
Project specification: The NEAT project consists of two main routes, Gotthard (57 km plus Ceneri base tunnel) and Lötschberg (34.6 km), for which base tunnels are constructed in north-south direction. While the Lötschberg axes is operational since December 2007, the Gotthard axes is expected to be finalised in 2017. If fully completed the Gotthard axes will reduce the travel time from Zurich to Milan from 3:40h to 2:10h.

Ex-ante appraisal: Before the project start several feasibility studies have been conducted by the Swiss federal government and the Swiss Federal Railways (SBB). The SBB economic study clearly came to the recommendation that two tunnels would not pay off, even within a very long concession period. Nevertheless, due to the political constellations and the decision power of the Swiss cantons only one base tunnel would not have been possible.

Continuous monitoring: Given the requirements in the bilateral land transport agreement, the public transport financing act (FinÖV) and the NEAT controlling order (NCW) both, the transport demand development and the financial performance of the project are continuously monitored. The financial status, including cost development and final cost forecasts, are made publicly available through the website of the Swiss Office for Transport (www.bav.admin.ch). It is, however, important to mention, that this open culture of communication is the result of several past experiences. In 1976 the construction of the Furka-Tunnel has eaten up the entire budget after only 50 % of construction works have been finalised. Based on this experience the construction of the Vereina-Tunnel in 1991 was accomplished by a stringent and open cost controlling procedure. The positive experiences together with the extremely high risks and costs of the NEAT and the associated long construction time encouraged the installation of a similar controlling system. The national prestige character of the project and its link to international agreements has supported this decision.

Financial figures are expressed in prices of 1998. All inflation related increases are detected by the official NEAT price index-and are financed by the Swiss parliament on top of the general loan for the project. Since 1998 the original load of 12.8 bn SFr. was continuously extended to the current final cost estimate of 19.8 bn. SFr. I.e. even when disregarding price changes the project is at a cost overrun of 55 %. Across all partial projects this is mainly due to safety and state of technology (25 %) and geology (11 %). Among the single projects the Gotthard axes is by far the most important cost block (estimated final costs 11.9 bn. SFr), followed by Lötschberg (4.2 bn. SFr.). The figure below presents the current cost structure and cost deviation analysis.





The transport performance is measured by the continuous Cross Alpine Freight Traffic survey (CAFT) every three years. The results are published by the Swiss office for Statistics (www.bfs.admin.ch). According to the Swiss Traffic Shift Act a maximum of 650'000 HGVs are allowed to cross the Alps – currently the number is 1263. The finalisation of the Gotthard is expected to substantially help meeting the envisaged goal.

The ex-post assessment for the Lötschberg axis is currently conducted since it is under commercial operation since December 2007. Details about this are not available so far.

4.3 Inputs from the ex-ante – the need for harmonisation

4.3.1 A common modelling platform

Given the relevance of demand forecast, the project appraisals would probably take advantages by relying - at least for some general aspects - on a common strategic forecasting tool. If the same modelling tool is used to provide demand projections for alternative projects, the comparability of results is much higher, even though it should be taken into account that many other parameters used in the applications of the same model can diverge.

However, modelling tools often benefit from being built and calibrated for a specific application, geographical context (country, region, etc.) and/or around a particular policy problem (pricing, investment, regulation, new technology, etc.). Therefore claiming that one specific model is always preferable in any context would certainly be unfair. Furthermore, demand forecast for transport infrastructures offers often the opportunity for methodological improvements and the selection of a specific model could impede more sophisticated applications and slow down progresses.

It seems more preferable from a methodological point of view, and also more realistic, to improve demand forecasts by defining a common platform for the modelling tools supporting projects demand projections.

The main pillars of the common modelling platform for demand forecasting could be the following:

- *Appropriate scale*. The models should handle all relevant demand in geographical terms, which means taking into account the traffic in the region(s) where the project is located but also the international flows (often accounting for a significant share of expected demand).

Additionally, a correct geographic scale is needed to simulate appropriately alternative routes that demand could choose. If this condition is not met, demand forecasts can be either underestimated because some demand is missing, or overestimated, because alternatives are not considered.

- *Multimodality*. In many circumstances, demand can choose between alternative transport modes and therefore competition from each available alternative have to be considered. The models should simulate all relevant modes available to transport demand potentially attracted by the new infrastructure. All modes and intermodal solutions should be considered at the same time, according to the concept of "trans-European intermodal network". This requisite is especially important because the market response of competing services (e.g. reductions of tariffs) has been often a major cause of overestimation of demand.

- *Segmentation*: the models should distinguish basic segmentation of market for demand/supply confrontation. Segmentation is often a matter of data and can be actually be difficult to identify many segments, however at least a basic distinction between business and non-business or low value goods and high value goods is recommended. Furthermore, all relevant demand segments should be enabled to react appropriately on the policy initiative to be tested by the model. I.e. none of these segments should be encoded as a fixed load in the network links.

- *Consistency* between modelling parameters and evaluation parameters; models should be calibrated for a recent base year, with updated parameters (e.g. operating costs, tariffs, etc.) and, above all, the parameters should be consistent with those used in the economic valuation of the project. For instance, value of travel time is generally used in cost-benefit analysis to estimate project benefits, while within transport models value of travel time is widely used in route choice and mode choice algorithms. If values used in the models are different from those used in the evaluation, the coherence of the analysis is weakened.

Lastly, models outputs should be sufficiently disaggregated in order to allow the assessment of the project contribution to the different objectives. For many EU projects the European initiative must be combined with national and regional objectives. The expected outputs might encompass impacts on international, national and regional traffic, expected services performances (time, cost, tariff and eventually quality of services), environmental impacts divided into local and global impact, etc.

4.3.2 Common database

A second area of harmonization is the availability of a common database. Data plays a key role for projects appraisal as well for models from several points of views. First of all, the quality of data greatly affects the overall quality of the modelling and the appraisal. Even very advanced and sophisticated algorithms can fail to provide reliable results when input data is poor. Second, given the relevance of data on modelling and appraisal results, estimates built on different datasets can be hardly comparable. Independent demand estimations can differ significantly to each other just because the starting data is not the same. Third, data collection is often quite a time-consuming task, especially when sources are not known in advance. With a harmonised database, the evaluation

framework at European level could be considerably reinforced and the database could become a common reference framework for partner countries.

The main components of the common database are listed here below:

- *Socio-economic scenarios*. All project projections rely on socio economic scenarios, and thus the provision of a reference data set for base year as well as for medium and long term horizons will improve both the ex-ante appraisal and the ex-post evaluation. Case studies have shown how it is indeed difficult to trace back the underlying socio economic, reference hypotheses. The example to be followed in this domain is the DG TREN energy forecasts document that provides socio economic reference projections per country and economic sectors, which could be also used for transport.

- *Long distance flows*. Nowadays information on international flows is limited after elimination of border within EU. Transport network models use a large amount of data and most of it necessarily concerns local conditions. However, models supporting the assessment of large projects also need data at a larger scale (i.e. national, international): this kind of data is the one whose availability could be more helpful. In particular, a key input for demand projections is the amount of long distance traffic, especially international flows, since this share of demand is often significant for large projects. This means current and projected matrices of trips/tonnes moving between European regions. If a reference source for this kind of information were available, one important driver of demand forecasts would be under control, either because an accepted source is used or because deviations from such source could be detected.

- *Common reference scenario for long distance demand projections at the EU level*. Evaluation studies generally produce their specific forecasts based on ad-hoc analyses and modelling applications. While for local traffic, forecasts are generally built on the availability of specific information on regional development, population growth, etc.. for long distance and international traffic estimates are often derived from external sources, mainly EU scale models and studies. The identification of reference projections for the evolution of transport demand at the European level could improve demand forecasts from several points of views. It would provide an accepted scenario at least for international transport demand trend, and furthermore, would take into account key exogenous elements at the strategic level: European Transport Policy, infrastructure development, energy price, cost of competing modes, etc. All these elements are often quite uncertain and significantly contribute to the overall uncertainty of demand forecasts.

- *GIS network reference*. GIS information is a domain where important improvements have taken place and should be better used for transport modelling at a time when transport information is regressing in many domains and for O/D flows in particular. Reliable network attributes such as speed, density, and eventually capacity stemming from physical characteristics, are essential for evaluation of transport needs. Such attributes are rarely checked in the network description and generate differences in evaluation results and appraisal of needs.

4.3.3 A common policy context

The evaluation of infrastructure investments will depend on the specific policy context (which cannot be limited to the policies directly related to the project) and on the particular assumptions made about cost evolution of different modes. As shown by the cases studies, the policy context influences the impact of the investment and sometimes specific measures are even implemented in order to increase the expected impact. Therefore in order to reduce uncertainties, the actual and future project context must be clearly defined in a common reference scenario. A first step in this direction is the definition of policy objectives and measures.

Policy objectives and measures

Policy objectives are often formulated in qualitative terms that need to be translated in quantitative terms whenever possible. Efforts have been made in this direction with the White Paper where a list of policy measures has been detailed and segmented in different types of measures. However it is always difficult to assign a quantitative objective to a single policy measure, considering that they are normally not independent one from the others. A systemic approach can therefore help in clarifying the interrelations between policy objectives and the functioning of the systems. This requires a definition of a check list of policy measures and objectives and a framework of the interactions between these objectives and measures. This will help to show policy measures/objectives which:

- complement or reinforce each other;
- contradict each other: for example environmental objectives might go against an economic objective of performance and such contradiction will not only be solved with reference to global assessment of socio economic impact for the society.

In other words, the check list must reflect the understanding of the functioning of the system, and as far as possible allow to assign precise indicators for impact assessment. A good example can be provided by the ASSESS project, the mid-term assessment of the White Paper.

A common policy reference scenario

The definition of quantitative objectives requires the definition of a transport reference scenario, in order to benchmark the policy objectives. The definition of a European reference scenario should explicitly include assumptions on the European policy environment: EU directives will be more and more influencing for national transport regulations. This is particularly clear when looking back at what happened in the past 15 years for all modes of transport.

The regulatory context needs to be more carefully considered: competition between modes and routes as well as evolution of transport prices and costs are all factors that can significantly affect the demand development. It is today clearly accepted by European countries that the EU puts in place initiatives for transport regulation in order to guarantee free access and avoid competition distortions, which are basic market principle of EU. Furthermore, the EU area of intervention is presently extended also to infrastructure charging and environmental protection. The European initiative is consequently predominant for interregional and long distance transport. A better

knowledge of the evolution through time of the policy context will then certainly help in improving traffic forecast.

Stakeholders involvement and social acceptability

For many European projects, particularly large strategic investments which encompass large geographic areas, the European initiative must be combined with national and regional objectives.

This requires both to keep stakeholders, citizens and general public informed since the early stage of the project about the expected outcomes and take into consideration costs and benefits for different groups. Providing well organised information may help in overcoming some of the difficulties and promote public involvement. The lack of public involvement tends to polarise the debate, groups that are left without information tend to shoot down the project. Participation can bring local knowledge that can improve the design and appraisal of options, as well as help identifying mitigation measures to better address people's real concern.

The decision making process can be improved through the formulation of outputs indicators for different families of stakeholders, as for instance the SE Matrix suggested by *RAILPAG* (EIB, 2005).

4.4 Use of evaluation results

4.4.1 Dissemination

Ex-post evaluation is of primary relevance, since it demonstrates how well a scheme has delivered its expectations and the main reasons for significant deviations. If a project has fallen materially short of expectations it is important for this to be made clear, with an indication of what went wrong in terms of, for example, flawed forecasting, unforeseeable external events, or weaknesses in design.

This should be made clear to the general public and not only to the policymakers, for two main reasons:

1. democracy: reporting what "tells a story", why and where the project fell short of or exceeded expectations;

2. education: by giving publicity to the real achievements of the projects, incentives for better and more accurate ex-ante analysis are provided.

In order to achieve these objectives it is crucial that presentation and dissemination of the evaluation's outcomes are as wide as possible. It is important to ensure and to communicate that ex-post assessments are not an instrument to blame the responsible planning authority, but to create a decision basis for similar future projects.

4.4.2 Feedbacks to risk analysis

As it has been stressed, ex-post evaluation cannot be dissociated from ex-ante evaluation improvements. These are two facets of the same decision process, which aims at being consistent from economic, social and political point of view. Systematic ex-post evaluation is a critical learning devise and a prerequisite for building capacity and skills to improve the selection and management of future large investment projects.

The scope for systematic use of transport project evaluation and the data it provides is, among others, to provide a pool of information on the lessons that appear to follow from comparisons of projects outturns with forecasts, and the possible explanations for the differences. These may help to improve the understanding of appraisal generally, and of modelling and forecasting in particular.

Furthermore, ex-post evaluation data should feed into future decision making, in order to really enable the ex-ante evaluation procedure to be fine tuned through an ongoing feedback process between the operating results of existing infrastructures and the assumptions used to evaluate new capital expenditure decisions.

The basic evaluation required for accountability purposes may incorporate enough data on costs and demand deviations to build up a database to indicate how they varies in systematic ways across different types of schemes. Besides helping to make more realistic estimates in the future (e.g. reference forecasting) and therefore improve the ex-ante appraisal, ex-post evaluation can also be extremely useful to take corrective actions and to build confidence in the appraisal process.

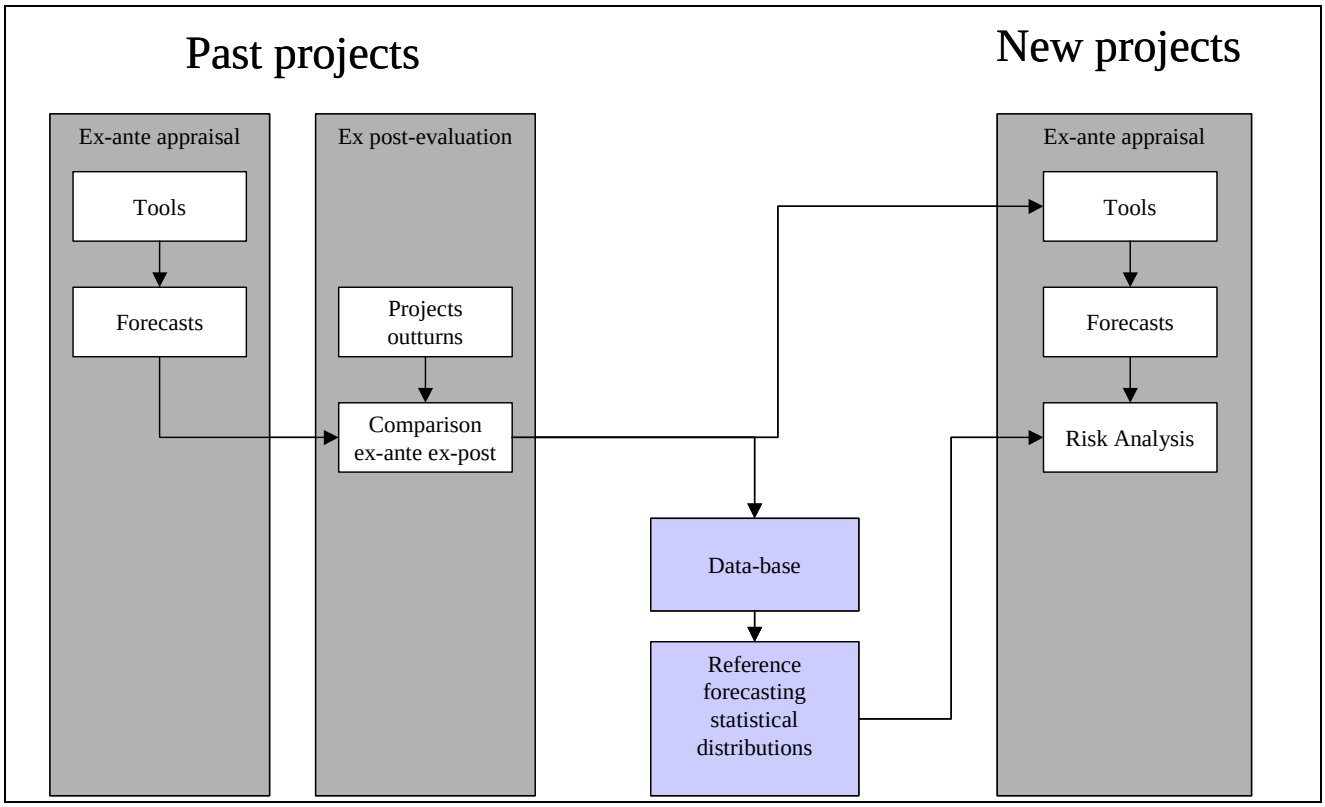
4.3.2.1 Reference forecasting

Risk analysis raises the question of where to look for relevant distributions of parameter values. One possible approach is the so-called “Reference Forecasting”. i.e. taking an ‘outside view’ of the project by placing it in a statistical distribution of outcomes from a class of similar projects. In this perspective, the introduction of systematic ex-post evaluation can be extremely helpful in creating a set of credible data on type and size of discrepancies between ex-ante estimates and ex-post results. Data from past or similar projects elsewhere can inform future estimates and suggest best available approaches on demand forecast, costs etc. And the set of collected data will constitute an important input to the risk analysis, helping in establishing probability distribution for selected variables.

When the idea to use past experience to derive the distribution of parameter values is accepted, Reference Forecasting is a methodological approach proposed to do this in a systematic way. It requires the following three steps:

- the identification of a relevant reference class of past projects, sufficiently broad to be statistically meaningful without becoming too generic;
- the determination of a probability distribution of the outcomes for the selected reference class of project;
- a comparison of the specific project with the reference class distribution and a derivation of the “most likely” outcome.

Figure 4. 1 Reference forecasting



5 The contribution of a EC supporting team

5.1 The specific tasks of the supporting team

The progressive approach outlined in the previous chapters will highly benefit from the support of a EC dedicated team that will be in charge of collecting and capitalise ex-ante projects documentation, provide harmonised inputs for projects appraisal, collect information on projects monitoring and ex-post evaluation. The team will act as an interface between academic studies, research projects and practice of project appraisal as well as a centre of diffusion of results and documents to the public.

The process of collecting data and information from both inside the EC and the institution and organisation in charge for project appraisal and evaluation outside the EC should be designed as an incremental activity that will grow through time together with the collection of information, documents and data. The mission of the unit should be to identify and disseminate the lessons learned from experience and frame recommendations drawn from evaluation findings.

The specific tasks of the team include:

- *Collect and capitalise project documentation*. A weak point of the evaluation process pointed in the case studies is the frequent changes over time of the institution or organisation in charge of evaluation, within or outside ministries. This implies that there is no “memory” of the appraisal process, which among other things makes it very difficult to perform ex-post evaluation. An important task of the team would be to define and check the documents which characterise the different steps of ex-ante appraisal and ex-post evaluation, capitalise such documents and guarantee public access to the information.

- *Provide harmonised inputs*. The team could provide to the relevant database, starting with the information already available at the EC on actual and forecast socio economic indicators, outcomes from the models like long distance traffic, reference scenarios for EU policies and investments etc. As far as modelling is concerned, the team could concentrate expertise on modelling with the support of a scientific committee from academic world. Another area where the team could play a role is in supporting the ex-post evaluation by providing tools and approaches which can help in minimising the evaluation costs.

- *Construct a data base on past projects*. A great help to increase the information available on past projects would come from the construction of a database where data on all projects submitted to EC approval is stored and updated. In such a database, information would be classified according to several relevant dimensions like the type of project, its size, the region etc. For instance, in the light of the critical role played by the assumptions regarding the project costs, it would be very useful to collect data on single cost components, their ex-ante assumptions and their (ex-post) actual values. A statistical analysis carried out on this information could investigate the role of single elements on the discrepancies found on total project costs, e.g. additional expenditure for environmental mitigation, delay in the

construction, etc. For each element (concerning costs as well as other key parameters affecting demand appraisal like fares), the statistical distribution of the discrepancies could be estimated and made available as benchmark for future assessments[4]. Of course, such a database should be continuously updated with elementary data and therefore also statistical distributions should be periodically revised. Furthermore, the results of the ex-post evaluation of large infrastructure projects within the EC domain could be combined with other existing sources of information on projects performance.

- *Establish minimum requirements.* While the team should support the decentralised project assessment and evaluation one of its tasks that can be also establish some minimum requirements for projects entering into the TEN pipelines. Being part of the large infrastructure investments in Trans-European Networks is granting a project with two types of advantages: the first one is financial and the second deals with the strategic objectives of the TEN's, being part of them de facto implies attaching an extra- priority to the projects and could help in getting the project started.

- *Disseminate results.* The supporting team would eventually collect the project relevant documentation from the overall project cycle and made it available to other projects, stakeholders and concerned groups.

The team should have a progressive approach, starting from providing data already available, and collecting information on past experience. Its capability to support the project appraisal will be built on the accumulated experience and information and data collected. It is important for the acceptance of the supporting team to ensure and to communicate that ex-post assessments are not an instrument to blame the responsible planning authority, but to create a decision basis for similar future projects. In particular, the supporting team should analyse cost or performance deviations by different classes of reasons varying by the level of control the planning unit could have had.

A preliminary list of minimum requirements of projects for being part of the TEN's pipeline should at least include:

- full availability of projects relevant documentation;
- compliance of modelling tools applied for demand forecast with the established requirements,
- benchmark of costs and benefits against reference class forecasting;
- comprehensive project appraisal including all the relevant steps (economic, financial, environmental and risk analysis);
- project should undergo public hearings to allow stakeholders and concerned groups to voice criticism and support;
- project monitoring and plan for independent ex-post evaluation.

[4] It's worth noting that detailed information on cost components could also be used to estimate average costs that could work as reference for a first analysis of the reliability of the costs used in the assessment of new projects. When large differences with respect to the average arise, solid justifications could be asked.

6. Energy and transport projects: differences and similarities

6.1 Comparing energy and transport projects

The major difference between transport and energy, and in particular the electricity transmission sector, is the fact that the electricity network is of supranational nature. The European electricity network has currently a structure which is very similar as two decades ago, because of the few investments realised in network expansion in the last 20 years. However, the network utilisation is very different and leads nowadays to very important (potential) congestions, especially in specific areas of France, Germany, Italy and Switzerland. In the last ten years, a decrease of cross-border net transfer capacities was observed, especially between Switzerland and France, and between Switzerland and Germany. This can be explained by a stricter adherence to the n-1 security criteria rules and by a high increase of national and international electricity traffic. The electricity grid situation is characterised by a high volatility of electricity exchanges.

In the field of project evaluation, a major difference with the transport sector is the difficulty of assessing the increase of demand and the benefits of network operators. While analysing similarities and disparities in the energy and transport sectors, a first set of project assessment items (see following table) can be identified and discussed.

Table 6. 1 Comparative overview of main characteristics of transport and energy projects

Sector	Transport	Energy
Supply	Many, heterogeneous	Few, homogeneous
Demand	Many, heterogeneous	Many, homogeneous
Funding	Public	Private
Alternatives	Many	Few
Expected indirect benefits	High	Low

The table above includes the structure of supply and demand, the usual source type for funding large infrastructure projects, the abundance of project alternatives and the expected indirect benefits of projects in the sector considered. As an example, the energy supply is characterised by a small number of actors in comparison with the transport sector where several modes exist. This is the case especially in the electricity transmission sector, where the supply is very homogenous, constituted by a single electricity network owned and operated by a few number of actors.

This homogeneity is also found on the overall energy demand side, but is combined with the higher number of actors representing the energy consumers (industries, tertiary sector, residential sectors,

agriculture, etc.). As a result, transport projects face higher uncertainty and risks that the ex-ante project evaluation should take into account.

On the funding side, the main source of funding for transport projects is public, although public-private partnerships are a growing trend. Energy networks are funded through mainly private capital and are owned by the grid operators. The source of funds eventually affects the rate of return required by a project: projects funded by public funds tend to require a lower return rate than projects funded by private capital, which have to compete in profitability terms with other options for capital investment and the financial markets in general.

While many alternatives can be considered to a given transport project, this is not the case in the energy sector, in particular in the electricity transmission sector, where except considering several route options for e.g. the construction of a new electricity transmission line, no further alternative exists unless considering the construction of a new power plant for example. In addition, the construction of new electricity or gas network connection often faces strong public resistance due to environmental concerns, while transport projects often overcome those concerns exploiting the indirect economic advantages that they can bring. The expected indirect benefit from transport or energy networks is another major difference with repercussions in the evaluation process. Whereas energy grid projects tend to concentrate their impact on the improvement of the efficiency and/or reliability of the energy transport system itself (with usually some limited indirect environmental benefits and costs), a large part of the overall benefit from transport projects comes from the secondary economic impacts and the reduction of external costs (pollution, CO_2 emissions, accidents, etc.). This allows in many cases decision makers to give the green light to investments that would not be justified by a purely financial analysis.

Further common issues have been identified for both sectors, such as the policy priority of improving modal split (transport) and energy mix (energy), and the problem of external costs (e.g. social or environmental) which in both sectors are not fully reflected in evaluation methodologies yet.

A common challenge for the evaluation in both types of projects is the rising energy costs and, perhaps, more importantly, the volatility in energy and fuel prices. In addition, oil & gas supply dependency raises geopolitical/strategic issues, adding security of supply as an evaluation parameter.

A result of the combination of uncertainty and non-financial benefits in (mainly transport) projects is the difficulty to involve private capital in core infrastructure financing (public private partnerships). In parallel, long term policy priorities in the field of alternative technologies also face a bottleneck in the build-up of integrated systems of alternative fuel vehicles and the required infrastructure, delaying significantly the development of real private demand.

Finally, common assessment methodologies and approaches between both sectors are needed, as well as a more transparent decision making and an earlier consultation of further potential stakeholders. The main outcomes in relation with both energy and transport sectors are raised in the following part.

6.2 Lessons learned from case studies

The main problem encountered in the two EVA-TREN energy case studies was the unavailability of economic and financial figures, which is mostly lying on the fact that large infrastructure projects in the energy sector are in general conducted by private companies. This made the access to economic and financial information very difficult for both case studies. However a methodology has been proposed to re-evaluate ex-post the economic impact of such projects. This relies on scenario comparisons with a long term energy system model and a conjectural variations model, enabling to show the impact of a new interconnection on the marginal costs of electricity production in the (cross-border) energy system under consideration.

Demand analysis of both energy projects showed very low ex-ante ex-post deviations, which is explained of a lower level of uncertainties than in the transport sector. The electricity transmission grid constitutes in deed a network which is much more physically driven and less dependent than it is the case in the transport sector.

One out of both case studies included an analysis of uncertainties, however only relying on the n-1 security criteria, and considering a set of possible network improvement options. This criterion is however only used for the analysis of security of electricity supply and relevant for short term planning. Main critics formulated about this approach comprise the fact that the relevant data are once again the property of concerned network operators only, and that this criteria does not constitute an economic analysis, but only a technical one, limited to a specific (short) time period.

6.2.1 Data and models

In the electricity transmission sector, the data collection needs to be global, and not only focus on the project analysed, but take into account the whole European electricity transmission network. This is of crucial importance because of the strong sensitivity of the network, which is particularly relevant as regards the important congestion of the area Switzerland-Italy-France-Germany. As an example, a network expansion in an east-European country might have impacts on the whole network, including west-European areas of the transmission system. The elaboration of a European reference scenario is expected to theoretically improve project assessment in the electricity transmission sector, in particular by providing a common database for energy demand forecasts, of interest especially for cross-border network projects (harmonisation of data). It would as well permit to take into account European energy policies in addition to country-based forecasts, and should thus serve as a reference while comparing alternative scenarios. However, in regards with the congestion situation observed e.g. in Germany, Italy, Switzerland and France, the decision of a network expansion project is often taken independently of socio-economic scenarios, and therefore the impact of common databases and scenarios is lowered within the present situation of the electricity transmission sector.

The type of data needed and used in ex-ante analyses is of seasonal nature (1-year last curves depending on typical days, peak load and base load) relative to (cross-border) transmission capacity flows. This data is already existing and used, and will be in future published by the ENTSO-E, new structure resulting from the merging of the UCTE (Union for the Co-ordination of Transmission of Electricity) and the ETSO.

The most widely used modelling approach for the calculation of transmission flows in the electricity sector is the PRIMES model and its variations. These are global simulation models calculating a static equilibrium between energy supply and demand, taking into account energy demand and supply technologies and pollution abatement technologies. It includes a detailed representation of the European electricity and natural gas grids enabling the analysis of network reliability issues. In comparison with transport, it is important to keep in mind that the electricity transmission sector is considerably more physically driven, and not so strongly influenced by external behaviours. It is added that the multiplicity of models and algorithms in electricity transmission planning makes it difficult to match different flow data from different models, but the competition between models tends to improve the overall methodological approaches. The improvement of forecasts thus implies the improvement of already very complex network simulation tools used by e.g. the UCTE.

6.2.2 Stakeholders' involvement, transparency and acceptability

Improving transparency and continuity of the decision making process of projects is a necessity for increased acceptability. It should integrate a provision of the relevant documentation and public debates at an early stage of the project in order to face the strong public opposition occurring in energy network infrastructure projects. Moreover, it is a prerequisite to a better evaluation, taking into account project mutations over time such as the stakeholders involved, the robustness of analyses conducted and the evolution of data.

The problem of stakeholders' involvement into the decision making process is also a significant problem in the electricity transmission sector. This complex issue is often driven by the changing of project situation and objectives over time. As an example of the paradox arising with this issue, a high involvement of a large number of stakeholders is needed for the decision making process and acceptability of projects but increases overall project costs in the meantime. Further points constitute strong similarities with the transport sector, as e.g. the need of public debate before project start, of process transparency, the scale differences between the technical project and the land use, the importance of the political framework in which the project is implemented, and finally the importance of considering not only the phases before and after the project, but also during the project, as project duration often lasts about one generation time and thus cannot be neglected.

In comparison with the transport sector, the strong public opposition and the weaker acceptability is explained by the absence of real return for citizens from the electricity transit situation. However, concerning public awareness before the start of electricity network expansion projects, environmental studies are very often published before the project starts but it is not a guaranty as it does not necessarily accelerate the decision making which remains very long. Finally the impact of an improved procedure for the decision making is expected to remain quite low regarding the already existing rather high transparency and continuity.

6.2.3 Specific European policy issues

The assessment of European policy measures within project evaluation should be considerably improved while taking into account comparison scenarios. In the field of context analysis, which is particularly relevant for the electricity transmission sector, interdependencies must be and are

already generally widely considered during project evaluations. However, the private ownership of electricity network operators makes planning process at European level very difficult to implement.

The electricity grid is by essence supranational and there is therefore a need of general coordination at the European level. The lack of coordination currently existing implies that national specificities are often not fully considered, thus leading to a less effective electricity transit than planned. The creation of a EC supporting team for energy network infrastructure projects would guarantee, through its expected neutral status, a better involvement of stakeholders, which could lead to an improved and more continuous decision making process. This might be very helpful in elaborating an agreed common evaluation methodology for projects, providing some common tools and reference data for project assessment, and finally providing output indicators for the different categories of stakeholders concerned by the projects.

Most of other statements related to the EC support team for project evaluation discussed for the transport sector are also relevant for electricity network expansion projects. Thus, there is a real need for a cycle in project evaluation between ex-ante and ex-post assessments, which could be encouraged by such a team, contributing to provide some references to be used (data, scenarios) and foster independency in evaluation processes.

7. Recommendations for methodological improvement of ex-ante and ex-post evaluation

The following recommendations are aimed at improving the methodology for ex-ante and ex-post evaluation of large infrastructure projects in the energy and transport sectors. They derive mainly from the results of work packages 2 and 3 (deliverabes D.2.2 "Case studies for ex-post evaluation" and D.3.2 "Methodological developments"), whose results were also discussed in a experts workhop on November 2008.

7.1 Consider the whole project cycle

The "project cycle" has different stages, from preliminary appraisal to ex-post evaluation. In the appraisal stage, we recommend an approach, comprehensive and adapted to the level of debates and analyses that takes place at different stages, with more global assessment in the beginning and more complete and more detailed assessment at the end, including economic review. Decisions are clearly path dependent, and assessing conflicts continuously throughout the decision making process could contribute to resolve potential conflict before they become actual conflict. Stages should be integrated into the project cycle, so that the main issues are monitored systematically, thus enabling a better project selection.

This requires that interrelations between ex-post and ex-ante evaluation are taken into account since the beginning of the project appraisal. In this comprehensive approach, the ex-post evaluation should enable the ex-ante evaluation procedure to be fine tuned through an ongoing feedback process between the operating results of existing infrastructures and the assumptions used to evaluate new capital expenditure decisions.

The whole evaluation process must develop in a smooth way since changes of objectives or contestation, which are legitimate, might influence the results of evaluation, ex-ante and ex-post. Possible changes and implementation problems must also be considered in the evaluation process definition.

7.2 Adopt a dynamic approach to ex-ante appraisal

The decision making process of large infrastructure projects takes place during a period of time which is a "very long" one. Objectives might change during such a period and the time dimension of the decision process must be integrated, managed and controlled. Consequently, appraisal cannot be made once and for all, but must adapt to such different stages, with more detailed analysis when the project is defined. This asks for the establishment of a clear design of the decision making process for large infrastructure projects of EU interest. A dynamic use of ex-ante evaluation, carried out with different levels of detail each time the project is subject to modifications and adjustments, can represent an extremely useful approach to highlight the essentials matters and to ensure an adequate basis for decisions in the course of the process shaping period. Changes of objective will

be in such framework registered with their possible impact on expected outputs, and consequent adaptation of tools. Delays in decision process and implementation will be considered as part of such process with an analysis on how such delay might positively or negatively affect the expected impact of the project.

7.3 Use a progressive approach to environmental analysis

Despite the formal recognition of their importance, environmental priorities still play a marginal role, with no real influence in the decision whether or not the project should be implemented. The capability of Environmental Impact Assessment (EIA), when carried out at the very beginning of the project appraisal, to influence the project technical solutions adopted in order to minimise the environmental costs to society, as well as to organise the public debate around the project and contribute to reach the consensus should be extended also to the whole assessment procedure. By proceeding in parallel with a dynamic ex-ante appraisal and a progressive environmental analysis, reappraising the project each time it is modified in order to mitigate environmental impacts, and re running the environmental analysis each time the project is adjusted will guarantee for a positive dialogue between environmental and social issues.

7.4 Perform quantitative risk analysis

The evaluation process necessarily entails a forecasting exercise: assumption on costs, benefits and effects has to be done before they are realized. A quantitative risk modelling a subsequent plan for risk management and mitigation are of paramount importance for improving the performance of large infrastructure projects. The quantitative risk assessment involves the selection of the variables to which the project design is most sensitive, the assignment of a probability distribution to the selected variables and then determine the effect of varying simultaneously the variables on the project performance indicators (NPV - IRR). Since the definition of probability distribution is the cornerstone of a meaningful risk analysis and, at the same time, is often the most challenging task, it is worth exploring possibilities to address this issue. Reference forecasting is suggested as an important tool for generating sound probability distributions.

7.5 Monitor project development

In the progressive approach recommended along the whole project cycle, the continuous monitoring of projects implementation represents the starting point for a successful project cycle approach based on learning form past experiences. The monitoring process should look at all factors that may potentially affect the project feasibility, bearing in mind that the implementation of large infrastructure project may last several years, during which many thing may happen. This means that the checklist of the “monitoring” system that must be put in place should include not only investment costs, but also the socio economic context, the transport context, the expected impact as regards transport evolution of demand, supply and environmental impact of the project.

7.6 Adopt risk management and mitigation strategies

Scope of the "risk management and mitigation" is to identify possible strategic answers to the more critical items identified through the risk analysis. We recommend risk planning to identify how the various risks can be managed and by whom.

7.7 Systematically perform ex-post evaluation

We recommend a systematic use of ex-post evaluation. The ex-post evaluation increases transparency by giving evidence to the effectiveness of the investments in relation to the reached financial, economic, environmental and social objectives; provides elements to improve the ex-ante assessments of future interventions; collects relevant information about past projects to be used as reference class forecasting; and finally, by giving publicity to the real achievements of the projects, provides incentives for better and more accurate ex-ante analysis. Concerning ex-post evaluation we recommend the following.

- Start the planning of the evaluation process at the stage of the project design together with the definition of the analytical framework, which produces a requirement for the data collection activities.
- Maintain all the project documentation available, in order to provide feedbacks for the improvement of ex-ante techniques performance.
- Collect ex-post information about projects performances, and compare the observed outputs and outcomes with those expected in the appraisal stage.
- Identify the "after-without" the scheme (called the counterfactual situation) to be compared with the "after" opening.
- Identify and quantify the discrepancies between the ex-ante appraisal and the ex-post results and assess as far as possible what caused the discrepancies, distinguishing between endogenous or exogenous factors. While the latter are hardly predictable and outside the control of the project management, the former might be included in the ex-ante analysis to reduce the related risks.

Concerning costs evaluation and undue optimism, a specific requirement of ex-post evaluations should be to investigate the methods used to obtain costs and the reasons behind the divergences between expected and actual costs. In order to progressive improve the cost estimate, we recommend to develop country based database where information would be classified according to several relevant dimensions, and to use the statistical distribution of the discrepancies as benchmark for future assessments. Looking at the reasons behind the difference between the observed outcomes and those expected in the appraisal stage, it might be extremely useful to examine aspects of the development and implementation of the project from the decision-making process point of view (process evaluation). Finally, in order to give a measure of the effectiveness of the investment, the evaluation should be conducted in the same manner as the ex-ante economic appraisal and the actual economic performance indicators, to be compared with the expected ones.

7.8 Use harmonised models and data

Different transport infrastructure projects should be made comparable on the basis of the same assumptions at least from the point of view of international flows. Given the relevance of demand forecast, we recommend to define a common platform for the modelling tools supporting projects demand projections. The main pillars of the common modelling platform for demand forecasting at the strategic level could be the following:

- appropriate geographic scale is needed to take into account also the international flows (often accounting for a significant share of expected demand) and to simulate appropriately alternative routes that demand could choose;
- multimodality is especially important because the market response of competing services (e.g. reductions of tariffs) has been often a major cause of overestimation of demand;
- the models should distinguish basic segmentation of market for demand/supply confrontation;
- consistency between modelling parameters and evaluation parameters; v. finally, models outputs should be sufficiently disaggregated in order to allow the assessment of the project contribution to the different objectives.

A second area of harmonization is the availability of databases. Data plays a key role for projects appraisal as well for models. With an harmonised database, the evaluation framework at European level could be considerably reinforced and become a common reference framework for partner countries. We recommend to provide:

- a reference database of the main socio economic variables for base year as well as for medium and long term horizons;
- long distance flows (current and projected matrices of trips/tonnes moving between European regions);
- a common reference scenario for long distance demand projections at the EU level, taking into account key exogenous elements at the strategic level (European Transport Policy, infrastructure development, energy price, cost of competing modes, etc.);
- GIS network reference (reliable network attributes such as speed, density, and eventually capacity stemming from physical characteristics).

7.9 Make maximum use of evaluation results

First of all, we recommend that presentation and dissemination of the evaluation's outcomes are as wide as possible, for two main reasons: i. democracy, and ii. by giving publicity to the real achievements of the projects, incentives for better and more accurate ex-ante analysis are provided.

Secondly, the scope for systematic use of project evaluation is, among others, to provide a pool of information on the lessons that appear to follow from comparisons of projects outturns with forecasts, and the possible explanations for the differences. We recommend:

- to use these lessons and data to improve the understanding of appraisal generally, and of modelling and forecasting in particular, and to really enable the ex-ante evaluation procedure to be fine tuned through an ongoing feedback process;
- to build up a database on costs and demand deviations to indicate how they varies in systematic ways across different types of schemes;
- to use data from past to inform future estimates (e.g. reference forecasting) and
- to use past experience to derive the statistical distribution of parameter values as an important input to the risk analysis.

7.10 Establish a EC supporting team

We recommend the identification of a EC supporting team in charge of collecting and capitalise ex-ante projects documentation, provide harmonised inputs for projects appraisal, collect information on projects monitoring and ex-post evaluation, establish minimum requirements for projects assessment and evaluation, and disseminate results. The supporting team should have a progressive approach, starting from providing data already available, collecting information on past experience and promote project implementation monitoring. The team capability to support the project appraisal will be built on the accumulated experience and information and data collected.

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