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EVA - TREN

Improved decision-aid methods and tools to support EVAluation of investment for TRansport and ENergy networks in Europe

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EVA-TREN's 1st Experts' Workshop, November 7, 2006, Lausanne
Summary and conclusions

Abstract

The European Union needs harmonised guidelines to improve the appraisal of large-scale infrastructure dedicated to the Trans-European Networks (TEN); in order to contribute to such guidelines, EU-funded EVA-TREN analyses ex-ante studies and projects outcomes at European level.

EVA-TREN's First Experts' Workshop brought together experts on large-scale infrastructure planning and operation in the domain of transport and energy. Examination of their practices highlights the following issues: first, the appraisal frameworks EU countries apply for transport and energy projects differ considerably in scope, sophistication, methodology and parameter values; second, the EU Member States share only a small part of all research results; and third, transnational projects are still problematic within the Union. As a result, cost overruns appear in the majority of projects. Investigation of the EU Cohesion Fund programme reveals that one project in four costs more than 20% above budget, while only one in five costs below + 10%. The main problems are modifications to the project (30%) and delays (25%); inadequate cost estimates and technical reasons are blamed for only 20% of cost overruns. Sustainability does not explicitly appear in the appraisal process, even though it is repeatedly quoted as a central aspect of the decision whether an infrastructure should be built or not.

EVA - TREN

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

EVA-TREN's 1st Experts' Workshop, November 7, 2006, Lausanne

Transport and energy infrastructure appraisal in Europe: Theoretical basis in perspective

SUMMARY AND CONCLUSIONS

Workshop Report – Deliverable D4.1 (main text)

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Executive summary

The European Union needs harmonised guidelines to improve the appraisal of large-scale infrastructure dedicated to the Trans-European Networks (TEN); in order to contribute to such guidelines, EU-funded EVA-TREN analyses ex-ante studies and projects outcomes at European level.

EVA-TREN's First Experts' Workshop brought together experts on large-scale infrastructure planning and operation in the domain of transport and energy. Examination of their practices highlights the following issues: first, the appraisal frameworks EU countries apply for transport and energy projects differ considerably in scope, sophistication, methodology and parameter values; second, the EU Member States share only a small part of all research results; and third, transnational projects are still problematic within the Union. As a result, cost overruns appear in the majority of projects. Investigation of the EU Cohesion Fund programme reveals that one project in four costs more than 20% above budget, while only one in five costs below + 10%. The main problems are modifications to the project (30%) and delays (25%); inadequate cost estimates and technical reasons are blamed for only 20% of cost overruns. Sustainability does not explicitly appear in the appraisal process, even though it is repeatedly quoted as a central aspect of the decision whether an infrastructure should be built or not.

Transport and energy projects essentially differ in finance and elasticity: most infrastructure investments in the transport sector require public funding, whereas those in the energy sector usually do not need any; the situation is similar for operation at regional level. In the transport sector, provision of new road capacities induces additional transport demand, while provision of new electricity lines has very little effect on demand.

In terms of methodology, the quality of evaluations would benefit from increased transparency and from improved feed-back, as would provide, for instance, peer review of ex-ante assessment and more systematic ex-post evaluations.

Combinations of methods may also contribute to better appraisal. Two approaches based on Cost Benefit Analysis (CBA) look promising: Netherlands' Overview of Infrastructure Effects (OEI) and Japan's combination of CBA and Multi-Criteria Analysis (MCA). OEI puts emphasis on the exploration of the problem and on the survey of effects, while Japan's procedure relies on MCA for ranking projects amongst those that score sufficiently well in CBA outcome and it allows other projects to be reassessed considering non-tangible values, which gives them a second chance. Experts consider macroeconomic models very poor at providing data that are meaningful for CBA; spatial dynamics is regularly tackled at national level only, which produces data that are not detailed enough for assessments at regional or local level. In such cases, regional/local scenarios should provide the missing data.

In practice, the match between evaluation results and project outcomes would be improved if authorities take action on four topics: to start with, they should use masterplans; then, they should only select mature projects - for which they request measurable and quantified goals, results and impacts; third, they should establish a clear managerial body; and fourth, they should provide assistance on administrative and financial matters as well as methodological support on assessment procedure.

1. Objective

The key objective of EVA-TREN project is to improve appraisal methods for large infrastructure projects of the Trans-European networks (TEN).

The purpose of this report is to clarify the state the art of large-scale infrastructure appraisal in Europe, as it came out of EVA-TREN's first experts' meeting "*Transport and Energy Appraisal in Europe: Theoretical Basis in Perspective*"[1]. The present report highlights what practitioners consider problematic now, it shows how they solve actual problems and it clarifies similarities and differences between practices in the transport sector with those of the energy sector. The suggestions for improvement that are formulated here are further developed in EVA-TREN case studies, whereas EVA-TREN final workshops provide definitive guidelines and recommendations (end 2008).

EVA-TREN is supported by the European Commission under the 6th Framework Programme. More information on: www.eva-tren.eu.

2. Introduction

In Europe, large-scale infrastructure projects are assessed according two different scales: an *environmental impact assessment* (EIA) provides an estimation of the effects of the project on humans, fauna, flora and other ecological issues, while an *economic analysis* attempts to transform all costs and benefits (CBA) of the project into monetary units.

In EIA data is kept in its original value (square meters of land, tons of emissions, number and name of protected species, etc) during the entire assessment process, which makes it explicit and consistent. Still this quality can make decision difficult to reach since different groups of actors could consider every single stake to be so important that they would tolerate no change in their own fields and, together, they would tolerate no project at all!

On the contrary, CBA, which in some cases takes social impacts into consideration, is a powerful decision-making machine since it produces figures that can be added up until a bottom line result tells the reader whether the project yields more costs or more benefits to society, and how important they are, as well as how they are spread amongst society and amongst the regions. These advantages are counterbalanced by the fact that objective data are required for economic evaluations to be relevant – which makes them as complex as environmental assessments- and that the conversion of objective data into monetary values is far from universal: *i.* money values are not similar in all regions and *ii.* CBA studies give a very low monetary value to potential losses or gains that are far in the future (discount), which is not relevant for impacts that are exceptional or dramatic.

As a response to the problems of both CBA and EIA, multicriteria analyses allow to collect different types of data and to gather them according to rules given by the authority in charge of the decision. In this case, the main problem is the difficulty to reach a consensus about such rules. Here, local specificities play an important role. The significance of long-term impacts remains an issue as well.

All assessment methods rely on some form of forecast of project impacts. Projection is the simplest way to express future values. This technique has the advantage that it may clearly show underlying assumptions, which facilitates objective discussion. Scientists regularly consider projection too simplistic and they propose more sophisticated models that couple socio-economic data with

[1] "*Transport and Energy Appraisal in Europe: Theoretical Basis in Perspective*". Meeting held in Lausanne, on November 7, 2006. Proceedings available at: www.eva-tren.eu

geographical information and/or system dynamics. Such requirements for complex models lead to the classical "*accuracy vs. transparency*" debate.

3. Recurrent issues and similarities

Realisation of new infrastructure for transport and energy invariably implies expensive and complex projects, which are sometimes multi-national. Ex-ante assessments must demonstrate that five issues have been resolved:

1. Sustainability: the project must yield benefits to society as a whole, over the long term, and the impacts should be equally distributed;
2. Finance : cost are likely to deviate; very high investments need to be shared;
3. Time: long planning and construction period may lead to projects inadequate to market demand after they have been delivered;
4. Stakeholders: harmonious and efficient stakeholders management is a complex task since many actors are involved during project life, with specific missions at given times;
5. Operation : the project evolves from the political world, as a concept linked to budgeted costs, to the real-world, as an object with real infrastructure and operating costs. Management capabilities required at these two stages are fundamentally different.

Sustainability

Even though sustainability is regularly mentioned as an important aspect in transport and energy decisions, it does not explicitly appear in the appraisal process: neither in theory, nor in practice. More precisely, infrastructure projects must not only yield benefits to society as a whole, but their advantages and drawbacks must also be spread as fairly as possible amongst stakeholders, over several generations. This involves attention to issues that are significant *per se*, even if quantitatively minor.

Aggregated or monetary evaluations, such as cost-benefit analysis for instance, help estimate global impacts, but they are of little help to estimate equality and fairness. Hence, for investigation of ethical and environmental stakes that sustainability implies Mackie and Kopp (2006) recommend balancing global evaluations by non-aggregated assessments.

Finance: cost deviations and investments sharing

Energy infrastructure projects cost between a few million Euros to a several hundreds million Euros. To cope with such investments, energy companies often group and share the burden. As costs of transport projects are one or two orders of magnitude higher it is –in most cases- necessary to build partnership with public authorities.

Partnership may also help avoiding bankruptcy in case of severe cost overruns. Having examined EU Cohesion Fund programme, Scholten (2006) underlines that cost overruns appear in the majority of projects, with an average 15%-20% above budget. One project in four costs more than 20% over budget, while only one in five stands below + 10%. Inadequate cost estimate and technical reasons are quoted in only 20% of overcosts: the main problems are modifications to the project (30%) and time delays (25%).

Financial engineering of projects is widely used in the US and in Europe (public-private-partnership « PPP » but there are at the moment no "*golden recipes*" that are considered solid enough to be used as standards. Investors and researchers should exchange objective information concerning practical cases and systematically examine what went well or wrong, and why it did so.

Planning time-span vs. construction time

Most transport and energy infrastructure projects are launched in a situation where existing supply is considered insufficient in quantity or in quality, but in most cases, only the expectation of a higher demand in the future can justify important investment. This leads to the question whether the new infrastructure will meet market requirements once it is completed. An important part of the answer will remain uncertain despite careful market surveys. Investigations shall consider the progression of demand, behavioural changes, provision of alternatives and changes in environmental conditions.

Late delivery of projects not only increases costs (cf. Finance) but also amplifies the risk of inadequacy to demand. According to Scholten (2006), 80% of projects supported by European Cohesion Funds lag behind schedule, and 30% even show delays of more than 2 years. They highlight the following reasons for delay:

i. Insufficient preparation of projects or technical reasons

ii. External factors (sometimes foreseeable)

iii. Opposition from local population

iv. Lack of management capability

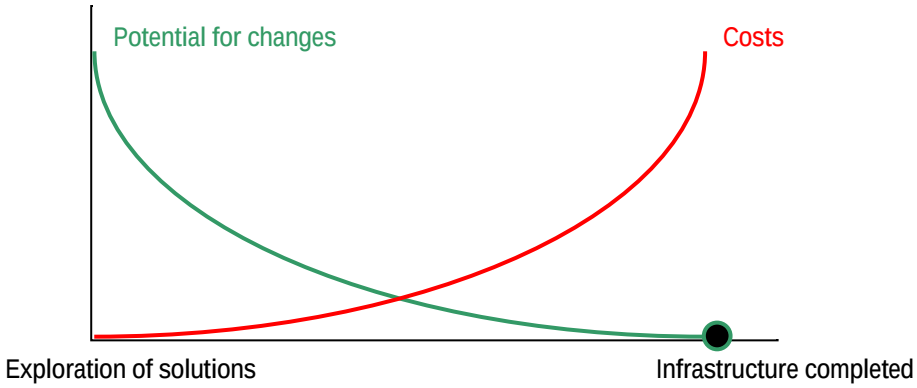
Stakeholders

Big projects involve many actors, with promoters and opponents acting on the political, economical, financial, technological or regulatory stage. All have a specific mission at a given moment: some of them provide financial support, others build, others make decisions, while others benefit from the project or from its operation. Some cannot be avoided and some play many roles. In order to reduce project uncertainties, it is essential to identify these people as early as possible and to involve them in the most constructive way.

The project itself has its own life, while most of the players follow each other in the planning and construction process. Therefore, it is essential that one leader coordinates work from the start until operation and that this leader is supported by a stable working group, which bears responsibility of all the decisions it takes prior to and during project realisation. Continuity in leadership is essential to ensure that original objectives of the project are safeguarded over time: decision-makers, constructors and users need to have a single body and, possibly, a single person of reference.

Changes in project design and operation concept

As the project progresses from concept to implementation, its potential for changes shrinks from quasi-infinite to nil (see green curve on Fig. I below), while the place of action shifts from the political arena to field works and ends with pragmatic operation. Consequently, politicians must progressively leave the lead to managers with specialised knowledge; they should not anymore interfere with u-turns in terms of project objectives, financial engineering or specifications (such as escalating safety standards).



I. Changes during project evolution

Last-minute changes in infrastructure design or operation concept usually generate significant expenses (red curve on Fig. I above), delivery delay, together with sub –optimal use of the parts of the project that have already been completed. Inclusion of new technologies in large-scale projects entails by definition a relatively high level of uncertainty (if not the technology itself, then the adequation of all other components to the new items).

In a big project, even a minor deviation in time or in cost may entail very high stakes. Therefore, such projects are not appropriate to use unproven technologies. Novelties and new procedures should be introduced where potential delays, overcosts and failures would entail limited impacts.

Quality improvement process

Ex-ante studies are much more comprehensive than ex post analyses. This lack of feed-back makes it difficult to improve new ex-ante studies. Therefore, ex-post studies should be undertaken more systematically and they should tackle all issues that had been considered relevant in the ex-ante assessment reports.

Scientific soundness and pragmatism

"Roughly right, or precisely wrong?" Better evaluations should be scientifically sound, achieved through a transparent process; ex-post assessments should be in line with their ex-ante counterparts. This requires a true dialogue between all stakeholders as well as strong coordination of all inputs and provision of results that are meaningful at all significant levels (planners, decision-makers, citizen).

The European project HEATCO[2] has established a series of guidelines for improving transport costing. Amongst other, HEATCO recommends to balance pragmatism and theoretical robustness; to use local studies and values wherever this evidence is better and to make sure studies are transferable.

Despite guidelines, some issues are tricky and they will possibly remain so during the next generation. According to Mackie (2006), these issues are: first, the inconsistency between national appraisal methods ; second, the need for overarching assessment of projects with trans-boundary impacts "*who owns the appraisal?*"; third, the treatment of transit traffic "*the values of the origin country, the destination country, the driver or the transit country?*"; and fourth, the quality of data "*always remember: garbage in, garbage out*". (*sic*, ibidem).

[2] See http://heatco.ier.uni-stuttgart.de

4. Differences

Energy and transport are both considered network economies. Nevertheless, despite profound similarities, the two sectors present numerous differences, which mainly lay in the cost structure and in the importance of induced demand.

Infrastructure investment and operation costs

Most infrastructure investments in the transport sector require public funding, whereas those in the energy sector usually do not need any (Rossat, 2006). The situation is similar for operation at regional level.

Burden of congestion cost

Transport users bear network congestion costs (above all on roads), whereas electricity operators pay the congestion cost of their networks (Florio, 2006).

Marginal capacity-induced demand

In the transport sector, provision of new road capacities induces additional transport demand. Elasticity of demand is much lower in the electricity sector where provision of new electricity lines has very little effect on demand (Doll and Huber, 2006).

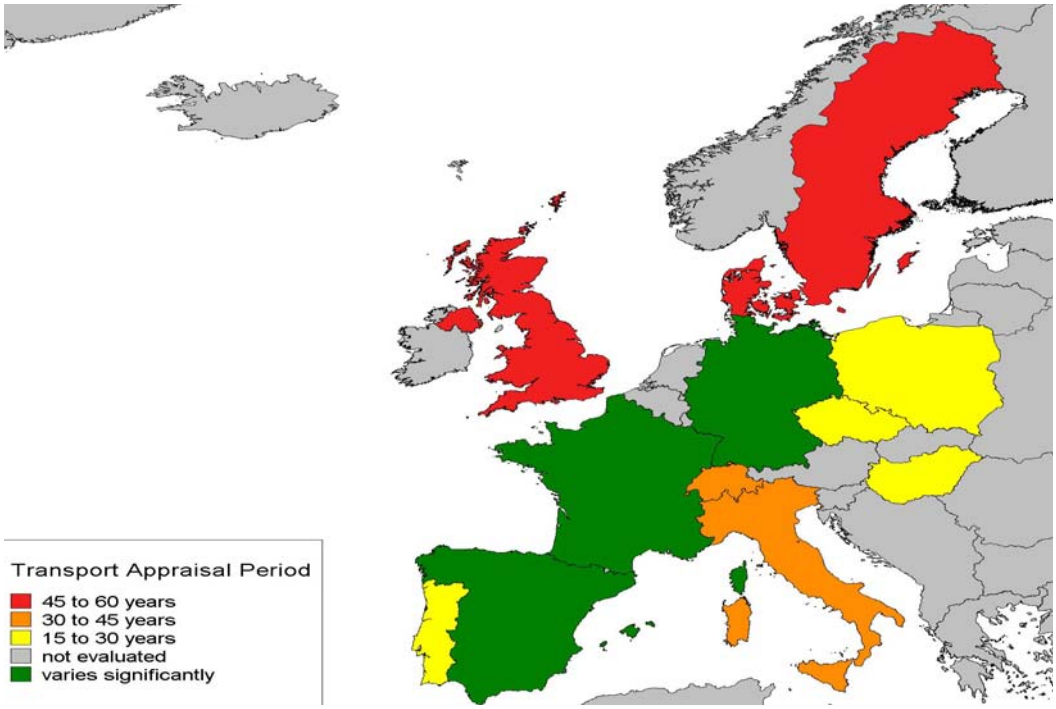
5. National appraisal systems

Practice in European Member States

Ex-Ante assessment for transport

All EU Member States and Associated States apply some form of ex-ante appraisal for transport infrastructure projects: Environmental Impact Assessment (EIA) is compulsory, while the States regularly rely on Cost Benefit Analysis for the selection of projects.

Project lifespan is not uniform over the Union (see Fig. II below): Northern countries tend to assess costs and benefits over a period that is longer than Southern countries. Nevertheless, the time-span taken into account varies significantly according to project specifications in Spain, France and Germany.



Source : Scholz, 2006

II. Appraisal period for transport projects in Europe

Ex-post analysis for transport

Ex-post analysis is not compulsory in Europe. Only France, the United Kingdom and Ireland apply some form of ex-post analysis. In those cases, however, the procedure is different from the ex-ante assessment.

Appraisal for energy projects

Assessment procedures for energy infrastructure projects widely differ amongst European Members States. France requires a feasibility study, while other countries require security, reliability, environmental impact assessment and/or other evaluation, according to project specifications.

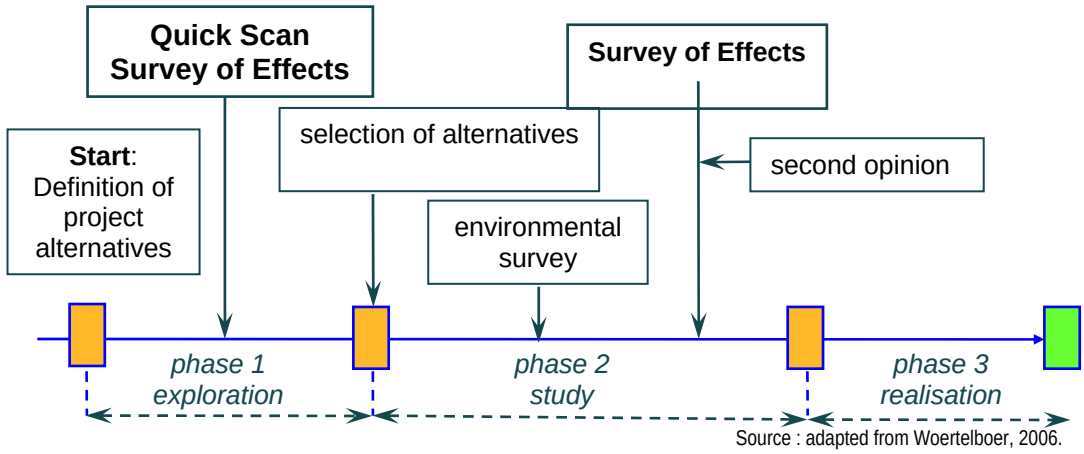
Ex-post evaluation is not compulsory in the countries investigated.

The Netherlands

The Dutch framework for infrastructure evaluation *"Overzicht Effecten Infrastructuur"*, or Overview of Infrastructure Effects (OEI) is based on a 9-steps Cost-Benefit Analysis (Woertelboer, 2006).

1. Problem analysis: what do we want to solve?
2. Project definition: design and alternatives, base case.
3. Identifying project effects.
4. Forecast relevant exogenous developments.
5. Estimate and value project effects.
6. Estimate investment and development costs.
7. Producing a cost-benefit set-up.
8. Alternatives and risk analysis.
9. Additional tasks (PPP, ex post evaluation).

OEI Evaluation is achieved in three phases (Fig. III below): 1. exploration of the project and of alternatives; 2. proper study; 3. realisation.



III. Overview of Infrastructure Effects - OEI - procedure used in the Netherlands

Support for project developers

An interesting feature is that the government has set a "Support desk for Economic Evaluation" (SEE[3]) which helps project developers answer questions about economic evaluation of infrastructure. SEE supplies support for practical questions about economic evaluation (max. 8 hours) as well as general information at national and international level.

In the Netherlands, OEI is increasingly used for projects smaller than national scale.

An important aspect of OEI philosophy is that the first question is not related to the project itself, but to the initial problem: "*what do we want to solve?*" This is an objective way of opening the deciders' minds to a wide range of solutions, some of which might require consideration of modal shifts or non-infrastructural investment, such as new operating systems.

[3] SEE means "Steunpunt Economische Evaluatie". More on: www.rwa-avv.nl/SEE

North America

In Canada and in the United States, transport projects are assessed according to CBA, while there is no specific guidance for energy projects.

USA

Transport

The Department of Transportation (DOT) has established two steps methodology for ex-ante evaluation: 1. evaluation of the project's consistency with the US strategic plan for transport infrastructure; 2. quantitative evaluation of the effects of the project (CBA). In the USA there are no official requirements or guidelines for ex post evaluation of transportation projects.

The DOT has issued a guidebook for transport CBA. Nevertheless, within DOT, the Highways and the Air Transport departments have delivered their own guidelines.

Three bodies share the main responsibilities for infrastructure investment: *i.* the Office of Management and Budget (OMB) prepares the budget on the behalf the Federal President, it is the main decisional instrument in the allocation of capital spending and federal investments and it has issued specific CBA guidelines; *ii.* the Congressional Budget Office (CBO) advises Congress on the approval of the Budget; *iii.* the General Accounting Office (GAO) checks whether evaluations meet formal and financial regulations.

Offices evaluate projects through CBA's that only differ in terms of discount rates (Florio, 2006): OMB's nominal rate is supposed to be the market interest rate to which the expected rate of inflation is subtracted. In practice, 7% real rate is commonly used for "public investments". The CBO applies a real rate similar to the rate on the Treasury debt, which is about 2%. The GAO sets the discount rate at the average market value of the nominal return on the Treasury debt (between one year and project lifespan).

Energy

Federal utilities are self-regulated by the Department of Interior. The Federal Energy Regulatory Commission (FERC) has the regulatory authority over any interstate energy commerce. FERC also has regulatory authority over any new construction of transmission lines, pipelines, etc, across State boundaries. Finally, FERC is the body in charge of setting electric power transmission rates.

The regulatory authority for site selection, construction and operation of all nuclear power plants in the United States is the Nuclear Regulatory Commission (NRC). Reliability and security of the electric power grid in the United States is coordinated the North American Electric Reliability Council (NERC).

Canada

The Canadian Treasury Board guidelines for project appraisal (1994) are generic to all sectors. As in the USA, CBA is considered as the most appropriate tool to identify the option that best conforms to the economic goal of maximizing net benefits for society at large.

The Canadian Department of Transport has delivered a specific manual on transport CBA, which complies with the Treasury Board guidelines. Transport project assessment is composed of three main steps: *i.* identification of the problem and formulation of the base case and of other options; *ii.* CBA to compare alternatives; *iii.* choice of the best option. In the energy sector, NERC (see USA) contributes to the coordination of reliability and security of the Canadian electric power grid.

Japan

The Ministry of Construction has set up a combination of CBA and Multi-Criteria Analysis for transport projects (described in the chapter "Combination of methods" and Fig. IV below). Even though ex-post evaluation of transport projects are formally required, no specific guidelines have been written to date (Florio, 2006).

6. Methods and contexts

European approach

All EU countries apply an appraisal framework for transport projects, but the frameworks differ considerably in scope, sophistication, methodology and parameter values ; the research results are not fully transferred between countries, and there are problems with transnational projects. Therefore, Mackie, (2006) calls for the definition of harmonised guidelines for the TEN. The main issues are (ibidem) :

i. Framework, specification of project alternatives

ii. Unit of account – factor costs

iii. For international projects, PPP as well as local values

iv. Discount rate

v. Criteria – NPV and benefit/cost ratio, with incremental analysis

vi. Project life and residual value assumptions

vii. Risk analysis and optimism bias

Impacts of projects

Projects generate impacts of very different nature, such as construction, maintenance and operating costs; travel time and congestion; accident risks; air pollution; noise; greenhouse gases. Not all of them can be satisfactorily expressed by CBA. Wider economic impacts are displayed in IASON project. Other decision-making tools consider non-monetary criteria[4] and rely on units that can be measured on-site over a long period of time.

Content and temporal consistency

Definition of contents and use of the ex post analysis should be improved: They should include the monitoring of project implementation as well as the analysis of real data. As far as possible, a ex-post studies should use methodologies that are similar to the ones used for ex ante appraisal.

[4] As *non-monetary* decision-making tools, cf. "AUDITOR", which provides a set of indicators used in Switzerland: http://lem.epfl.ch/francais/informatique.php.

Common reasons for error in infrastructure project assessment

Common issues	Ex post CBA
No clear problem description and with/without comparison	Difficulties in establishing ex post ERR (RERR)
Project documentation weak	Lack of data (e.g. on output)
No standard methodology applied	Ex ante CBA weak or no existing (or only financial) ; ex ante CBA's methodology unclear
Different treatment of VAT, shadow prices, wider economic impacts	Changes carried out in ex post CBA: project parameters (investments, output, timing, etc) and methodologies (shadow rates, inclusion of externalities)
RERR generally lower than ERR	

Source: adapted from Scholten, 2006.

Table 1. Common issues in transport project assessment and findings of ex-post studies

External factors

Ex-ante studies regularly overlook factors that will play a significant role during project implementation. Scholten (2006) estimates that external factors have had a strong impact on 17% of projects supported by European Cohesion Funds, and a small to negligible impact on 41% only. The main external factors identified were :

i. Public protest

ii. Archaeological factors / habitats

iii. Weather conditions

iv. Economic growth (faster/slower than expected)

v. Land purchase

Moderation of project optimism

CBA compares benefits, which are often uncertain, with costs, which are certain (i.e. not below budget). Evaluators should therefore adopt a more pessimistic approach to assessment (Ponti, 2006).

Quality of data at macro level

For the moment, macroeconomic models are very poor at providing data that are meaningful for CBA (Mackie, 2006).

Influence of financing scheme on CBA quality

The low quality of CBA carried out for projects funded by DG Regio can possibly be attributed to DG Regio's top-down financing scheme (A. Kopp, 2006) and / or to collusion between promoter and evaluator (Florio, 2006).

7. Combination of methods

Inaccuracy of results is considered a regular drawback in most assessment reports. In order to amend this, scientists propose to combine methods. This happens regularly in practice, in a case-by-case construction. Still, "adhocracy" does neither help transferring results, nor bring any contribution to improving practice since it prevents comparison. Optimal combination would be a panacea, while awkward arrangement can be fully misleading. What is the main flaw of current practice and what kind of combination have reached the level of "standard" procedure ?

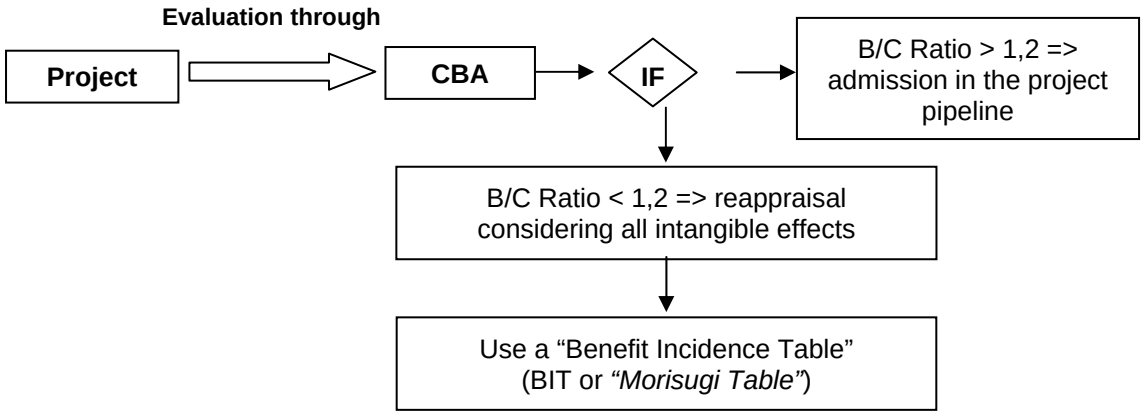
Spatial dynamics' lack of accuracy

According to experts and practitioners (Reynaud, 2006), a substantial problem of current assessment methods is that spatial dynamics is tackled at national level only, which provides results that are not sufficiently accurate for ex-ante studies at regional or local level. In such cases, regional/local scenarios should provide the missing data.

Japan's combination: CBA & MCA

In large countries or in unions of countries, so many different projects are under discussion that decision-makers not only have to support projects that yield good value for money –for which CBA appears as an appropriate selection method- but they may still have to make a selection amongst the projects that rank well in CBA, and, on top of this, they may have to make decisions on projects that are very important, but provide benefits of which the value is not transferable in money terms. Japan provides interesting practice in this respect (Cf. Fig. IV below).

Ex-ante evaluation of transport projects in Japan is carried out following an approach based on a combination of CBA and Multi-Criteria Analysis (MCA).



Source : adapted from Florio, 2006.

IV. Ex-ante evaluation process for transport projects in Japan

Each methodology serves a specific purpose: CBA is used to select a set of projects among the available options while MCA helps ranking the projects that have been selected.

8. Trans-disciplinary lessons

EVA-TREN Workshop contributions have highlighted that construction investment is the most decisive criterion for transport infrastructure, whereas operation is the key issue for energy infrastructure. Still, practice in both sectors suggests that differences lay more in the relative importance given to decision criteria than to the criteria themselves. DG Regio's new approach is innovative in this respect.

DG Regio's approach to transport and energy projects

In Europe, DG Regio requires assessments as a condition for financing major projects (above 50 million Euros total costs).

Ex-ante: Member States that submit transport and energy project applications to the European Commission have to provide -in addition to the justification for public contribution- a feasibility study, a financial plan, an environmental statement, a CBA that includes risk assessment.

Ex- Post: Once subsidy has been granted, the Commission should "*carry out an ex-post evaluation of all the operational programmes implemented*" (Reg. 1083/2006).

For the period 2007-2013, DG Regio has set a new reference framework that states how fundamentals such as project lifespan, discount rates, environmental impacts and level of subsidy should be considered:

i. Project lifespan is between 15 and 25 years for energy or between 25 and 30 years for transport.

ii. Environmental impacts are expressed as externalities. Monetary valuation is made using local reference or "shadow prices".

iii. The discount rate for the financial analysis reflects the opportunity cost of capital to the investor. It is set at about 5% in real terms. The discount rate can be higher for PPP projects.

iv. The discount rate for the economic analysis is about 3,5% for Member States and 5,5% for Cohesion countries.

v. The eligible expenditure (level of Community support) is based on the project's "funding gap".

vi. Projects generating revenues can be supported only at levels that make sure investors may not be in a position to earn excessive profit.

Appraisal procedure is similar for transport and energy, with emphasis given to most relevant issues of each sector (see Table 2 hereafter).

Infrastructure project appraisal	Important points for TRANSPORT projects	Important points for ENERGY projects
i. Demand analysis	Estimation of generated and diverted traffic.	Demand should be estimated for all tariff levels considered.
ii. Optimal pricing of services	Efficient pricing based on long-term marginal social costs and Polluter Pays Principle.	Prices should be estimated for all tariff levels considered.
iii. Quantification of time savings and safety enhancement (transport only)	a. Calculated using national estimates. Different values by reasons, by transport modes and users. b. Calculated referring to average safety of transport mode.	n. a.
iv. Evaluation of environmental impact.	Externalities should be monetized using local values or applying "shadow prices".	External effects should be monetized through a "willingness-to-pay" approach or estimation of the cost of cancelling out potential negative effects.

Source : adapted from DG Regio, 2006

Table 2. DG Regio requirements for infrastructure assessment

System limits

The energy sector relies mostly upon private finance, while transport heavily depends on public support. Transport also generates more impacts that *users* have to bear (congestion, vehicle accidents) as well as impacts that *non-users* suffer from (pollution, noise, accidents with pedestrians). Consequently, transport assessments require more parameters, and many of them rely on estimations, which lead to higher uncertainty in assessment results.

Most critical aspects of project implementation

Transport and energy projects raise issues that are similar in many respects. Nevertheless, these issues may lead to consequences of very different nature and importance. The following table describes the issues and ranks their significance.

Stakes		Transport		Energy
Legal requirements	***	Risk that safety authority requires substantial and costly amendments during construction.	*	Safety generally mastered before project construction.
	*	EIA compulsory, other assessments in specific cases and countries.	*	Simplified EIA.
Finance	*****	Extremely high investment, needs to be shared[5] => PPP for infrastructure & operation.	**	Significant to high investment, generally private[6] funding.
Private sector involvement	*	Building Co, transport operator, other operators likely to be in competition/using the connection, rolling stock providers, equipment providers, infrastructure provider, banks, major clients.	***	Energy producer, operator, major clients (banks if needed).
Public sector	***	Political parties, shareholders, states, regions and safety authority are involved.	*	States and regional governments involved.
Operation	**	Franchise, staff cost, rolling stock, interaction with transport users and the public.	*****	Instantaneous adaptation to changes in network conditions (loads, tariffs, n-1 security).
Technology	**	The critical issues are the potential failures and side-effects of new technologies. They need to be kept under financial and time budget.	*	Generally no technological gambles on energy transport infrastructure.
			***	Nuclear production may face significant decommissioning / decontamination costs.
Duration	*	Negotiation : 5 years to 25 years.	*	Negotiation: 1/2 to 3 years.
	**	Construction : 1 year to 15 years.	*	Construction: 1/2 to 5 years.
			Legend :	***** most critical aspect
				** critical aspect
				* important aspect

Table 3. Critical implementation aspects of transport and energy infrastructure projects

[5] 500-50'000 million Euro/ project.

[6] 5-500 million Euro/ project.

9. Conclusions

Infrastructure projects

Infrastructure projects become visible at two times in their life: when they need to be accepted by the responsible authority and when service is operated (or interrupted). Ex-ante assessments occur before that; they are part of the acceptation procedure, but they need to be considered much more valuable than mere "acceptation tools": ideally, they should ensure that the project provides optimal service to society, in the sense of a truly sustainable development.

Unfortunately, assessments of transport infrastructure tend to underestimate financial costs, while there is little feedback on the quality of energy infrastructure assessment. And problems that have not been highlighted in ex-ante evaluation arise during construction or in the course of operation.

Construction

Projects are accepted after public instances have given a green light, in line with a given budget. Nevertheless, contributors are generally bound by agreements stated in terms of percentage of total expenditure, which means that each contributor shall pay more in case costs increase.

Operation

Infrastructure projects have to be viable in economical terms, which means that operation has to yield benefits in the middle and long term. Estimation of benefits requires forecast of demand, which becomes extremely complex in case human behavioural considerations or very long term potential occurrences need to be taken into account.

Decision power and finance are intertwined while sound operation requires transparency. In many cases, infrastructure finance involves public and private partners (PPP): it is essential to identify the stakeholders who benefit from the project, to make them visible to the public, and to mention their names on decision documents, even if they only indirectly participate to the debate. Usually, such beneficiaries are the regions, counties, cities, nations, private companies as well as specific groups of citizen.

Transports

Big transport projects involve investments that are so significant that finance regularly casts shadow on project engineering: Public authorities care so much about limiting expenses and making them seem acceptable to the public that they neglect technological and organisational stakes, more precisely the authorities tend to accept politically positive projects without insuring that technology is fully mastered and that responsibilities are allocated accurately and most favourably. It is not possible to master the costs of a transport project without mastering its technology because technology has a price which cannot be modified without influencing project outcome.

Operation results for the first 20 years of rail transport are regularly over-estimated, whereas induced demand for road projects uses to be underestimated, which means that rail infrastructures reveal too expensive, while new roads do not solve the congestion problems which they were meant to.

Assumptions underlying ex-ante methods that produce monetary values should be clear and they have to match local situation. Long-term perspectives should better be expressed in their own value (time saving, accident rate, service frequency), but not aggregated into a single unit (money or other utility criterion), so that it remains possible to estimate the impact of any significant change in initial figures and hypotheses all over project life.

Once transport infrastructures have been completed, they are so visible that the authorities have little difficulties to convince the media of their symbolic and economic sense, regardless of potential cost overrun. Still, in terms of scientific quality and respect to citizen, it is necessary to make estimations closer project outcomes. To this end, more regular ex-post studies would help improving ex-ante appraisal of large-scale projects, which in turn would help improving the design of new infrastructures. Subsequently, the methodology of ex-post studies should be compatible with their ex-ante counterparts.

Energy

Investments in energy infrastructure are smaller than those for transport and they are mainly borne by private companies. Financial return of operation is essential, while the benefit of energy infrastructure is much less visible to the public than it is the case for transport, except when large-scale failures occur (black-outs). Citizen cannot see and often do neither know where the electricity (and other energies) they use comes from, nor how it does so. Moreover, compared to road transport, electricity transmission hardly causes any harm to people, and only very little damage to the environment. As a result, political debate on energy infrastructure investment is much more driven by rational considerations –which includes corporate profit- than discussions on transport infrastructure.

Appraisal of nuclear power production –seen here as a technological option- is far more critical than other energy infrastructure because assessment practice does not (and often cannot) take uncertainties and long-term impacts objectively into account.

Ex-ante appraisal of energy transmission infrastructure appears as less complex than it is for transport networks. Impacts on man and on the environment seem clearer and more direct as well, which justifies the predominance of CBA assessment. Energy generation is another issue, for which thorough appraisal and long-term consideration is essential. Ex-ante evaluation theory and practice would benefit from regular ex-post assessment of significant energy projects.

Methodological recommendations

Improvement of the evaluation process requires ameliorations in three fields (Kopp, 2006): *i.* the appraisal methods, which includes the way methods are combined with each other, *ii.* the coordination and *iii.* the quality of reputation.

i. Appraisal methods

Evaluation methods

The evaluation methods should be formally sound and transparent, they should take secondary effects into account, and they should enable approaches that complement each other.

Combinations of methods

In terms of combination of methods, two approaches look promising: Netherlands' Overview of Infrastructure Effects (OEI, Cf. Chap. 6.2) and Japan's combination of CBA and MCA (Cf. Chap. 8.2). Both are based on CBA: OEI puts emphasis on the exploration of the problem and on the survey of effects, while Japan's procedure relies on MCA for ranking projects amongst those that score sufficiently well in CBA outcome. In Japan, projects that do not score high enough in monetary values (B/C ratio < 1.2) are reassessed considering non-tangible values, which gives them a second chance.

As spatial dynamics is regularly tackled at national level only, the data it produces is not detailed enough for current assessments, which usually deal with regional or local matters. A way to avoid this problem is to generate detailed data by means of regional or local scenarios.

ii. Coordination

Coordination failures arise from interregional overlaps. Centralisation of data and of decision power could be seen as a solution, but this would harm political accountability of the regions. Kopp (2006) suggests to strengthen mechanisms for self-coordination on the regional or national level.

iii. Reputation building

Assessment methods need to be acknowledged more widely than they are now. In order to build a solid reputation, it is necessary to clarify the definition of project objectives as well as the selection procedure for evaluation and forecasting methods (i.e. provide limits to or reasons for "adhocracy"). Kopp (2006) proposes to submit ex-ante plans to peer review and to increase the importance of ex-post evaluations.

Practical recommendations

Ex-post experiences highlight that even the most accurate evaluations do not guarantee that new infrastructures will be delivered on time while meeting the expectations at budgeted costs. Scholten (2006) recommends caring about five critical points:

i. Use masterplans.

ii. Select only mature projects, which means to request fully developed technical studies, to adopt a multi-annual planning approach, which facilitates the management of delays (at any stage), and to request that active public consultation has been undertaken. Such plans should be gathered in a "pipeline of projects" from which to choose.

iii. Request measurable and quantified goals, results and impacts.

iv. Supply methodological support to beneficiaries, for instance advice on CBA methodology and on indicators or procedure.

v. Ensure professional management of projects, which means that the authority has to establish a clear managerial body and make sure that a competent body provides assistance on administrative and financial matters.

Many of these practical recommendations have been put in practice for specific projects, but where they were, they appeared as parts of a patchwork rather than as part of an exhaustive and global strategy.

There are nevertheless examples of successful practice, such as the "*Support Desk for Economic Evaluation*" (SEE), through which the Netherlands already provide support for practical questions about economic evaluation. Such practice saves project development resources, it ensures that an important part of all project evaluations are formally correct and it opens the road to systematic improvement.

10. Appendix

Authorities and development strategies in Europe

Country	Transport assessment	Energy assessment
Czech Republic	Transport Policy (medium & long-term direction) General development plan of transport infrastructure (GEDPARDI)	Czech Energy Act (2000) – rules for transmission system operating CEPA (Ceska Elektrizacni Prenosova Soustava) - member of UCTE
Denmark	Annual Danish state budget passed by government Banedanmark & Vejdirektoratet (Ministry of Transport and Energy)	Energinet.dk (founded in 2005 to guarantee competition) - member of UCTE
France	Ministry of Transport, National Commission für public debate, local authorities Implementation documents signed by the Ministries	Gestionnaire du Réseau de Transport d'Electricitè (RTE) – owns the infrastructure. Transmission system operator (TSO) - operate the transmission grids. Energy Regulation Commission (CRE) – sets the prices for transmission
Germany	Federal Investment Plan (by Ministry of Transport, Buildng and Urban Development)	Legal framework (Law on electricity and gas supply – 1998) Four private companies own, maintain and invest in transmission grids, under regulation of the Federal Network Agency (Bundesnetzagentur)
Hungary	Hungarian Transport Policy (2003 – 2015) Hungarian national road investment plan (approx. every 10 years)	MVM (public company – power generation and grid company) MAVIR (private company owned by the Ministry of Economics and Transport). Responsible for operation and infrastructure development
Italy	Nucleo Valutazione e Verifica Investimenti Pubblici (NUVV) – at regional and ministry level Inter-ministerial Committee for Economic Planning (CIPE)	Rete Elettrica Nazionale SpA is in charge of the grid network throughout Italy (1999) Traded on the stock exchange since 2004
Poland	Strategy of Transport Infrastructure Development in 2004 – 2006 and the following years (2013)	PSE (Polski Sieci Elektroenergetyczne) - owner of Poland's electricity network since 1990. Responsible for grid operation and power dispatching
Portugal	Assessment is done by the Departments of the Ministry of Public Works	REN (Rede Eléctrica National) – independent company since 2000 Separation of transmission, distribution and production (EU Directive)
Spain	Department of Transport (Ministry of Public Works)	REE (Red Eléctrica de Espana). Responsible for management of the transmission grid network (maintenance and development)
Sweden	Ministry of Industry, Employment and Communications (with associated institutions and Swedish federal states) National Transport Plan (2004 – 2015)	Svenska Kraftnät operates the Swedish national transmission grids (15,000km) Three companies (Vattenfall, E.ON Sverige, Fortum Power and Heat) own the regional network (36,000km) whereas the local network is owned by 177 network operators (ca. 400,000km)
Switzerland	Federal Department of the Environment, Transport, Energy and Communications (DETEC) Federal Office for the Environment (FOEN)	ETRANS (independent coordination company) - SwissGrid (2007) The 7 Swiss high voltage companies (e.g. atel, BKW) involve ETRANS in all network development decisions
United Kingdom	Department for Transport HM Treasury (financial planning)	National Grid UK is owner, operator and developer of the transmission network (private company) Ofgem (price and network regulator)

Source: adapted from Scholten, 2006.

Table 4. National specificities in infrastructure assessment: authorities and strategies

11. References

Chevroulet Tristan (ed.) "*Proceedings of EVA-TREN's 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective*", *Lausanne, November 7, 2006; Synthesis document,* 2008.

Doll Claus, a) *"Examining the real cases, ex-ante vs. ex-post analysis*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006*;* b) *"Key issues for good assessments: Critical analysis, on going research and new developments of appraisal methods*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Eberhard Claus, "*European Investment Bank (EIB) Politics and feasibility studies – EIB view*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Florio Massimo, "*International overview: USA, Canada and Japan*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Huber Philippe, "*Switzerland Risk assessment in energy infrastructures*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Kopp Andreas, "*Transport infrastructure evaluation – The OECD/ECMT view*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Mackie Peter, "*Harmonised guidelines for projects' assessment at EU level – HEATCO experience*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Murray Barry, "*Examining energy infrastructure projects Ex Post – The Operator View*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Ponti Marco, "*Critical Issues of the Assessment Process*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Püttgen Teddy, "*Trends in evaluation of energy infrastructure projects USA and Europe*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Rossat Jacques, "*Market and electricity interconnection – Problems and Cures*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Scholten Bas, "*The Netherlands Ex Post vs. Ex Ante, Overlooked issues, ECOTRANS experience*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

Woertelboer Pauline, "*Netherlands Institutional decision making developments in the Netherlands*", EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

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