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Economic appraisal of European transport projects: the state-of-the-art revisited

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Substantial investment has been made at national and European level in transport infrastructure over the past 50 years and is likely to continue in the future. The need to appraise transport projects in economic and social terms has developed alongside this in both scope and complexity. The state-of-the-art in the economic appraisal of transport projects is reviewed, progress is assessed and future challenges are identified. The review addresses the general framework, treatment of major impacts, presentation of outputs and issues such as uncertainty. It draws on national practice in Western European countries, which varies substantially reflecting a range of cultural and economic differences. Some points of commonality exist and the principle of monetizing direct transport impacts is generally accepted. Progress has been made towards the measurement of environmental impacts, but the assessment of the wider impacts remains underdeveloped. Increased sophistication and complexity has brought increasing data and presentation requirements, where computerized decision support methods have potential. Many challenges exist for the future of appraisal and the review is concluded with a discussion of some key issues. At the heart of these is the continuing debate over the relative roles of national and European government in decision-making and resource allocation.

1. Introduction

During the past half century, the European transport infrastructure has been revolutionized. Motorway networks, high-speed rail services, the airport and air transport network, and the development of city region transit systems are all products of this time. Huge resources have been devoted to this infrastructure investment programme. Nonetheless, it is clear that substantial further investment has a high place on the European policy agenda, especially with regard to links to the former East European states now seeking EU membership. The aim here is to review the progress made in the economic and social appraisal of transport infrastructure and to identify perceived future challenges.

The development of transport appraisal has been a response to an identified need. Many of the early and important projects, such as the M1 London to Birmingham motorway in the UK were committed before any economic consideration of the case for the road (Coburn *et al.* 1960). The major upsurge in the development of appraisal techniques for transport projects came in the late 1960s and early 1970s. During this period, the principles of cost–benefit analysis (CBA) of transport projects were given practical detailed effect through programmes of theoretical and empirical work on, for example, the relevant monetary values for time and safety

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benefits. This work found its application in the appraisal of individual mega-projects, in the development of standard appraisal methods for smaller projects such as new sections of road, and in the assessment of city and regional transport plans.

When the EU consisted of just six member states, one of the most important meeting places for the discussion and development of ideas relating to appraisal was the series of ECMT Round Tables held in Paris under the organization of Arthur de Waele. A series of Round Table reports, among them Harrison and Quarmby (1969), Beesley and Evans (1970) and Frost (1977), chart the practical development of CBA at that time. Work of this vintage has provided the foundation for current appraisal practice, and it is against this base that progress should be measured.

If the role of appraisal had remained the same, then progress could be measured purely in terms of the development and refinement of the methods and values used. In a number of respects, however, things have changed so that appraisal is aiming at a moving target. First, the focus has broadened. Appraisal based on time, cost and safety impacts is seen to be too narrow, and has been extended to cover environmental impacts and wider policy impacts such as economic development. Incorporating environmental impacts poses formidable measurement and valuation problems. Dealing with the economic development and other secondary impacts creates issues of both principle and practice.

Second, the appraisal context has changed. Although there are obvious exceptions, it is probably not an unfair generalization to say that the paradigm of appraisal in 1970 was at the project level for a single mode and funded by government. Now, the emphasis is much more on plans at the area or corridor level, on the interactions between and integration of modes within those plans, and on a variety of funding sources. The latter may involve mixes of central, local and European Government together with private sector operators and sources of private finance in partnership.

Third, the balance of power between governments and the public has shifted. Whereas 40 years ago it was possible for government to push through a large motorway programme with relatively little public consultation and with relative immunity from technical challenge, that is not the case today. Now, governments need to demonstrate their case to an often sceptical public with access to professional expertise.

All these developments have placed increasing demands on the appraisal system. Appraisal needs to incorporate environmental and wider policy impacts as well as the direct transport impacts. It needs to be multi-modal and multi-agency in structure. The results have to be accessible and comprehensible in arenas such as public inquiries. It is, therefore, timely to revisit the state-of-the-art to see how appraisal of transport projects and plans is responding to these challenges. This is done by considering implications for the appraisal framework, for the appraisal content, and for the presentation and use of appraisal results.

2. Appraisal framework

Before considering the nature of changing appraisal needs, it is useful, first, to review the historical context of developments in this field and to summarize some of the features of current appraisal practice. At the national level, considerable differences currently exist within Europe in the definition and scope of the appraisal framework. The understanding of the scope of appraisal frameworks currently used in a selection of European states is given in table 1. These represent official, standard or representative examples (where no standard framework exists).

One of the common bases for an appraisal framework is CBA and the main characteristics of this approach can be summarized as follows. Both the potential costs and benefits of a particular project are estimated across a set of impacts and converted

Table 1. Evaluation framework and impacts by country.

Direct impacts	AUS	BEL road	DEN road	FIN	FRA	GER	GRE road	IRL	ITA	NRL	POR	SPA	SWE road	UK road
Capital														
Construction costs	M	M					M			M				
Disruption costs		M					M							
Land & property costs		M					M							
Recurring														
Maintenance costs	M	M					M			M				
Operating costs							M			M				
Vehicle operating costs	M	M					M			M				
Revenues	M						M							
Passenger cost savings							M							
Time savings	M	M					M			M				
Safety	M	M					M			M				
Service level	M						M							
Information							M							
Enforcement							*							
Financing/taxation							M							
Environmental impacts														
Noise	M	M					M	*		M				
Vibration		M		*										
Air pollution – local	M	M					M	*		M		*		
Air pollution – global	M	M					M	*						
Severance	M			*						*		*		
Visual intrusion				*			M		*					
Loss of important sites		M		*	*		*	*		*	*			
Resource consumption							M			*				
Landscape	M			*		*	*	*		*			*	
Ground/water pollution	M						M			*				
Socio-economic impacts														
Land use	*M						M			*M				*
Economic development	*M	M			*		M		*	*M				
Employment		M			*		M				*			
Economic & Social cohesion							M				*			
Internationl traffic					*		M							
Interoperability							M							
Regional policy		M					M			*M				*
Conformity to sector plans		M					*	*				*		
Peripherality/ distribution					*		M							

CBA (monetized impacts), ; Measured impacts, ; qualitative assessment, *; M, included in multicriteria analysis.

Note: It is understood that Luxembourg has no tradition of formal project appraisal in either the CBA or MCA paradigm.

Source: Nellthorp *et al.* (1998)

into monetary terms by multiplying impact units by prices per unit. Calculating the difference between the sum of the monetized benefits and the sum of the monetized costs derives the overall or net benefit of the project. Often this is reported in terms of a discounted net present value, but other summary values may also be produced. There are many issues that arise as part of this process, however, including:

- Identifying the broad group of impacts that should be included in a CBA and can be monetized in this way.
- Specifying how each of the impacts included should be formally defined and measured.
- Modelling or otherwise estimating the size of the impact in terms of the measured units.
- Arriving at a set of prices per measured unit for each impact based on social market valuation or willingness to pay principles.
- Defining appropriate time horizons over which costs and benefits are measured and a suitable discount rate.

Issues concerning the evolution and state-of-the-art for some of these points are discussed in Section 3, but for general background on CBA, see Pearce and Nash (1981) or Sugden and Williams (1978). The basic principle underlying the CBA, however, is that the decision objective is to maximize the net socio-economic benefit of the project. In other words, there is an underlying assumption that social decisions can and should be founded on the aggregation of individuals' willingness to pay.

An alternative approach to appraisal may be objectives led, with the goal of maximizing with respect to a set of socially based objectives rather than market values. Multicriteria analysis (MCA) typifies this approach and a number of different techniques fall within this category. A simple and characteristic MCA methodology is as follows.

Based on the objectives of the responsible decision-makers, a group of impacts is defined which between them capture the performance level of each alternative project in achieving the set objectives. Unlike CBA, achievement of objectives can be assessed in a number of ways, such as a measured quantity, qualitative assessment or rating. These assessments are then transformed onto a scale (typically 0–100) giving a score for each impact for each project. The overall performance of the project can then be estimated by producing an overall project score, calculated by multiplying each impact score by a relative weight for that impact (reflecting its importance with respect to the other impacts) and then summing over all impacts. As with the CBA, there are many potential complexities and issues involved including:

- Identifying and defining the impacts to be included.
- Specifying the measurement method and how each impact will subsequently be assigned a score.
- Issues surrounding the use of weights and how these might be obtained in practice.
- Variations in how the scores and weights are combined to give an overall project score.

Over and above these technical questions, additional factors surround the use of MCA appraisal frameworks (e.g. Beuthe *et al.* 1997). In particular, MCA is often

seen as competing with CBA, although there is no reason why the two approaches may not be used in an entirely complementary manner within the overall framework. While monetizing impacts (as in a CBA) gives considerable clarity within the appraisal process, the intrinsic difficulty of measuring and even defining some impacts typically included in an MCA gives potential for some ambiguity. The choice and use of weights within the process may be seen as somewhat arbitrary and the interpretation and role of the overall project score can also be misunderstood in the appraisal context. In particular there may be a sense that the MCA is *making the decision* rather than *supporting the decision-maker* where projects are ranked by overall score, although it is interesting to note that broadly similar concerns exist about the role of CBA assessments. For further detail and discussion of MCA techniques, see, for example, Olson (1995).

This review of European practice reveals that in spite of these issues, many countries have a strong historical tradition of MCA in a transport appraisal context and others include some form of MCA procedure in an overall appraisal framework. Within table 1 the starred cells indicate a descriptive treatment of impacts, and the light grey or dark grey cells indicate a quantitative measure. While the light grey cells indicate a quantitative measure with no monetary value, the dark grey cells indicate impacts that have a quantitative measure, are monetized and included in the CBA.

From table 1, across a selection of European countries for which detailed information on the appraisal framework is publicly available, three points are apparent. First, all appraisal frameworks contain a mixture of monetized impacts, impacts measured in both physical and qualitative terms. Second, practice in different countries is not uniform. Although the direct transport impacts tend to have monetary values, and the environmental and socio-economic impacts tend not to be monetized, there is variation between countries. Third, the details of the framework within which the impacts are brought together also vary across the CBA/MCA spectrum.

Within the broad framework spectrum ranging from the CBA dominated through to the largely MCA or qualitative, it is clear that most national frameworks have a CBA at the core. In some cases (e.g. Denmark and Sweden) there are few or no impacts measured or qualitatively assessed in addition. For other countries (including the UK, The Netherlands and Finland) it appears that the CBA is a part of a more holistic approach, encompassing further impacts either measured, formally included in an MCA or on which a qualitative report is required. In these cases there are ways in which the framework and overall assessment procedures link the different impact groups and impact treatments together in the decision-making process.

The numbers of impacts included in the national appraisal framework ranges from a relatively small number (10 in the case of Denmark) to a comprehensive list (over 30 for Greece). In both cases this represents road appraisal only; note that several countries currently have entirely separate frameworks for different modes. Regardless of the total number of impacts considered, their scope is seen to stretch from direct impacts such as capital and maintenance costs through environmental impacts to a group of socio-economic impacts such as land use and peripherality. The treatment of different impacts and their place in the evaluation framework are discussed in Section 3.

The current state-of-the-art with respect to appraisal frameworks is, therefore, highly developed with a degree of sophistication nonetheless tempered by the need for a framework to be pragmatic and politically acceptable.

To the best of our knowledge, a historical comparison of appraisal frameworks in Europe 30 years ago has not been carried out. Moreover, at that time the easy international channels of communication and principles of openness and transparency had yet to be established. It is only possible, therefore, to speculate on the extent to which different national frameworks have evolved from perhaps something very basic and limited to their current state. It is almost certain, however, that changing political and social climates will have played a significant role in the process (as is the case for the UK). With that perspective, the evolving political and social context at the Community-wide level is sure to have some influence on the development of both individual national frameworks and any Community-wide appraisal guidelines.

Considering appraisal guidelines at the European Community level, one strand of recent appraisal research has grown largely from the development of ideas established in the EURET 1.1 Concerted Action report, *Cost–Benefit and Multi-Criteria Analysis for New Road Construction* (Mackie *et al.* 1994). This focused on the appraisal of road schemes specifically and a subsequent series of APAS studies broadened the coverage of appraisal procedures to incorporate rail, inland waterways, and nodal centres for passengers and goods. Following this, the expert Transport Investment Evaluation (TIE) Group developed a summary and synthesis of the four APAS reports and the EURET report, as well as other relevant APAS studies such as the one concerned with evaluation of Advanced Transport Telematics projects (Beuthe *et al.* 1995). In common with these previous reports, the TIE report (Bentzen *et al.* 1995) saw a joint CBA/MCA model as the most effective way to pursue project evaluation.

Since those studies, some Fourth Framework projects have addressed both project and policy appraisals. There are other distinctions to be made between studies, but for simplicity the project appraisal studies include EUNET, CODE-TEN and MAESTRO (addressing TEN, Eastern Europe and demonstration examples respectively), while the principal policy appraisal study is TENASSES (Halcrow Fox, 1997). The focus of the latter is to assess the extent to which a given transportation project achieves, or constrains, explicit policy objectives. In addition, PROFIT is examining the potential role and implementation of public–private partnerships in facilitating the development of transport infrastructure at a European level. All of these have been targeted at the development of EU Common Transport Policy or at the process of making decisions about the best use of resources among the TEN programme. Several projects have had the development of decision support software as part of their goal and this has served to draw attention to pragmatic as well as conceptual issues.

At the European level, appraisal *practice* is still very much at its formative stage and informed both by research carried out under the Fourth Framework and by techniques and practice at the national level. Progress towards the greater use of recommended appraisal guidelines depends not only on the technical integrity of the guidelines, but also on a host of additional factors including those based on politics, pragmatic constraints and historical tradition. Despite these difficulties, it is becoming increasingly desirable to share best-practice appraisal principles at the European level.

It is clear the different traditions in transport appraisal practice persist in different countries, but there are also many similarities that present initial support for common guidelines:

- In all countries, appraisal is used for prioritizing projects, for making recommendations and for evaluating alternative options (for the same project) but *not* for making a final decision. Implicit in all national appraisal frameworks is recognition that, over and above the appraisal results, an additional series of political, cultural and other priorities must be weighed into the final decision on project approval (e.g. Secrétaire d'Etat aux Transports 1995). In theory there is, therefore, a separation between the roles of the decision-maker (whether an individual or a committee) and the analyst. In practice, however, the distinction may not be so clear. The point at which political, cultural and other priorities enter the process is likely to vary between countries with, for example, variations in the use of public consultation, local enquiry committees, etc. While the recognition of the difference between analysis and decision-making provides a point of commonality across national frameworks, it may also provide a potential source of division in establishing common guidelines.
- There is a growing trend towards multi-modality arising from an increasing priority, both at the national and international level, to establish an integrated transport system. This in turn has driven the need to design appraisal frameworks that simultaneously cover several modes and mode interchanges. A specific example is the UK Guidance on Methodology for Multi-Modal Studies (DETR 2000a). Arising from a multi-modal outlook is the need to define new impacts, generic measurement methods and reconcile some of the theoretical problems raised. An example of the latter is the case where the use in evaluation of different values of time (VOT) by mode in the urban context can lead to public transport improvements apparently having net disbenefits rather than benefits.
- The use of CBA within the appraisal framework by the majority of European countries provides a potential starting point for any common guidelines eventually produced.

These changes in the state-of-the-art and in current best practice have both been driven by and are feeding back into the changing needs and perspectives of decision-makers in Europe and in national governments.

3. Treatment of project impacts

The question asked here is what progress has been made towards the treatment of transport impacts within the overall CBA/MCA framework? How consistent is practice in different countries, and what is the pace of change? The answers have implications for appraisal at the European level—if appraisal practice is similar in most countries, it becomes possible to adapt the same practice for application at the European level. But if appraisal at the national level is very different, then issues arise of the relations and consistency between national appraisal and EU level appraisal of projects of European interest. Here, the state-of-the-art of valuation is reviewed by considering direct transport impacts, environmental impacts and wider policy impacts.

3.1. *Direct transport benefits: travel time savings*

Understanding of the value of travel time savings has come a long way since the pioneering works of the late 1950s and 1960s in which the behavioural foundations were explored and numerical values debated (Beesley 1965, Waters 1995, Wardman

1998). From the start it was clear that time savings would have major significance in the appraisal of new highways and publicly owned rail lines. In the M1 motorway study (Coburn *et al.* 1960), time savings accounted for between 64 and 78% of the first year gross benefits, depending on the value per hour of working time used. Later, widely quoted data suggested time savings comprised on average 80% of quantified benefits for an average UK road improvement scheme (DoE 1976). A review of European Investment Bank appraisals of transport projects found the same percentage (Vilain 1996).

It was also clear, however, that the magnitude of time benefits in the early transport CBA was heavily dependent on assumptions made about issues such as:

- the ratio of non-working to working times—as high as 70% in some early studies such as Foster and Beesley (1963);
- relative values placed on various aspects of travel—including walking, waiting and travelling in-vehicle;
- the variation of VOT with income; and
- the apparent variation of VOT by mode.

Thirty years later, much light has been shed on these and some of the other issues that faced early authors. In 1996, journey time savings were included in transport infrastructure investment appraisal in all the EU member states surveyed within the EUNET project (table 1). While not all countries use separate appraisal values for working and non-working time, a majority does. The non-working times equate on average to just over 20% of the value for working time (range 10–50%) and this illustrates an important reason for separating the two: using an averaged value would distort the results wherever the proportions of working and non-working travellers were different from the 'average' situation. Many of these European non-working values—which include commuting and leisure trip purposes—are derived from research based in random utility theory (MVA, ITS 1987, TSU 1987).

Focussing on non-working time only for reasons of space, table 2 shows the range of values after adjusting to resource cost for those countries which use a separate appraisal value of non-working time. Quite a wide spread of values is observed, which highlights one of the key problems in European level appraisal. This is the tension between the wish to apply national (or even local) values to reflect consumer preferences, and the desire for an even-handed approach to the allocation of EU transport resources between countries without good reason. Some working solutions, including a set of weighted average EU-level values, are proposed in EUNET (Nellthorp *et al.* 1998), but both policy and research questions remain.

Table 2. Appraisal values of non-working time, 1995 prices.

Non-working time (ECU/h)	Country
1.5–3.5	Finland, Portugal
3.6–4.5	Denmark, Ireland, Sweden, UK
4.6–8.0	Germany, Italy, The Netherlands

Source: Nellthorp *et al.* (1998); exchange rates from Eurostat. Base years differ. Other countries use averaged working/non-working values.

For non-working time, the question of disaggregation is one that also needs to be addressed. There is ample theoretical and empirical evidence that VOT vary with personal incomes, indeed the Dutch Government favours the disaggregation of non-working VOT by income group in appraisal (Kleijn 1996). Other governments, including that in the UK, currently favour the use of behavioural values of non-working time for forecasting, differentiated as appropriate, with standard average values of non-working time for evaluation (DETR 1999). This policy has recently been questioned, however (Sugden 1999).

Disaggregation of appraisal values of non-working time by mode is often discouraged (e.g. DETR 1999), since the variation in behavioural values by mode is believed to reflect the attraction of higher or lower VOT individuals to faster or slower modes ('self-selectivity'). Insofar as VOT is a function of income, there is clearly an equity issue involved in attaching different non-working times to different modes of transport. Instead, a standard appraisal value taken as a weighted average across modes is adopted. Other disaggregations identified include by trip length (e.g. Swedish rail appraisal—regional versus inter-regional trips), and by class of travel (French rail). Each has some basis in behavioural evidence, but to what extent they are important is unclear, and in the case of 'class of travel' the equity questions raised in relation to income groups arises again.

In the past decade, some value of time studies have been conducted in Europe, including in The Netherlands (Gunn and Rohr 1996), Norway (Ramjerdi *et al.* 1997), Sweden (Alger *et al.* 1996) and the UK (Gunn *et al.* 1996). A meta-analysis of VOT derived from 105 travel demand studies using revealed preference and/or stated preference methods is also a useful source (Wardman, 1998). It remains clear that walking, waiting and interchange should be valued significantly more highly than in-vehicle time—probably a factor of between 1.5 and 2.0 times the in-vehicle time value.

These studies have left many empirical issues unresolved, not least of which is the question of the income elasticity of the VOT, and hence their projected growth rate over time. There is also a lack of consensus on the principles governing the use of appraisal values where international projects or projects involving significant international traffic are concerned. There are some conflicts of national appraisal practice to be addressed and this is seen even more clearly below.

3.2. *Direct transport benefits: safety*

The valuation of accident savings has undergone a transformation since the mid-1980s, owing to the development and widespread acceptance of monetary values based on individuals' willingness-to-pay to avoid accidents. Jones-Lee (1989) set out the theory; Persson and Ödegaard (1995) and Nellthorp *et al.* (1998) give a European perspective on its implementation in national-level appraisal procedures. Previously, values per casualty (i.e. per person injured or killed) have largely been based on measures of lost output—that is, the average reduction in gross domestic product (GDP) due to the injury or death of an individual member of the workforce. This was augmented in some cases by allowances for 'human costs' or 'pain, grief and suffering'. Willingness-to-pay methods bring these components together into an overall value per casualty. Their implementation often led to a significant increase in safety values in appraisal. For example, the UK fatality value rose from £180 000 to £500 000 at 1985 prices, or Euro ~1.5 million in current prices.

Fatal casualty values in the EU member states are shown in table 3. The principal challenge in searching for a common European approach is to address the large discrepancy between the appraisal values supplied. For example, after adjusting for price inflation but not for any other differences, the appraisal values for a (statistical) fatality differed between the two extreme cases of Portugal and Sweden by a factor of 48. This, it turned out, was largely reflective of fundamental differences in definition and measurement.

Among the various components within the value of a fatality the 'human costs' dominate. In the case of Denmark, these components account for two-thirds of the appraisal value of a fatality. Not all member states include these components in their definition, however. In table 3, in those countries marked with an asterisk, welfare/human costs are included within the definition of the cost of a fatality, whereas in those not marked, it is understood that a narrower definition is used and their values are among the lowest. The relationship between inclusion/exclusion of human costs and high/low values is readily apparent. Note that The Netherlands also excludes the human costs from the CBA because these are placed separately in the MCA instead.

Adjustments can be made to put the appraisal values on a common basis in terms of definition and measurement, as a result of which the range of fatality values is reduced to a factor of $\sim$4.5 from the above factor of 48.

Other factors that could be contributing to the range of values include:

- Variations in income per capita between member states, which would impact on individuals' ability/willingness to pay for safety.
- Cultural differences in attitudes to risk and to loss of life, which would affect individuals' tastes and preferences for accident reducing measures, or the attitudes of governments.
- Remaining definitional differences, in particular the inclusion or exclusion of legal costs, delays to other vehicles, police, fire and rescue services, and other public sector costs from casualty-related costs.
- The nature of the measurement methods used, e.g. problems of bias in willingness to pay measures, or of market imperfections where insurance compensation payments are used as a proxy for accident costs.

What are the implications for European appraisal, say of the TEN? Given the information gathered, some adjustment could be made to values (as in EUNET; Nellthorp *et al.* 1998) to take into account the inclusion/exclusion of human costs

Table 3. Appraisal values of a fatality.

Fatality (ECU)	Country
35 000–199 000	Greece, Portugal, Spain, The Netherlands
200 000–749 000	Belgium*, Denmark*, France*
750 000–1600 000	Austria*, Finland*, Germany*, Ireland*, Sweden*, UK*

Source: Nellthorp *et al.* (1998); exchange rates from Eurostat.
Note 1: Values are at 1995 prices and values, although original base years differ.
Note 2: For *, see text. Data are lacking for Italy.

(and some of the factors raised above). The case for adjusting values within or between countries to allow for variations in incomes is obviously controversial.

It is also argued, however, that CBA should respect differences in the preferences of groups of individuals where possible, since these affect total willingness-to-pay. For this reason, some residual variation in country values is to be expected. This would need to be explored further if consistent multi-country appraisal was felt to be worth undertaking.

3.3. *Environmental impacts: extensions of CBA*

By the mid-1990s in the EU15, decisions on transport infrastructure investment were being made with the benefit of environmental impact information. These practices have been reinforced by EC Directives (EC 1985, 1987) that require a formal environmental impact assessment (EIA) for larger projects including highways, ports and airports.

In transport project appraisal at the national level, EIA is usually summarized—either descriptively or by using a limited set of quantitative indicators—before being presented alongside the direct transport benefits and any other impacts being taken into account. Table 1 shows how different member states treat a selection of 10 different environmental effects. It is clear that quantitative measures have been accepted far more readily for some impacts (e.g. noise and air pollution) than for others (e.g. landscape and the loss of important sites).

Some member states have gone further by placing values or weights on the quantified environmental effects. These cases are indicated either by a dark grey cell, indicating that the effect is given a monetary value and included in CBA, or by an 'M', which indicates that the effect is given a numerical weight and included in the total multicriteria score for the project. Among the countries adopting an explicit money value for at least one environmental impact are Belgium, Denmark, Finland, France, Germany, Portugal, Spain and Sweden. Countries building environmental impacts into the MCA include Austria, Belgium, Greece and The Netherlands. The remaining countries that have held back from such explicit weighting are Ireland, Italy and the UK. This diversity of appraisal practice is partly a symptom of the evolving state-of-the-art in environmental valuation—so that 'best practice' keeps changing in each member state. It is also partly a symptom of the differences of view among the member states (which should not be exaggerated but which exist) about the quality of the evidence and the balance of advantage in appraisal of monetizing environmental impacts. The following give a thumbnail sketch of the current position regarding noise, air pollution and other impacts for which the assessment is necessarily more subjective.

3.3.1. *Noise*

Six of the EU15 countries have adopted monetary values for transport noise (table 1) based either on hedonic pricing approaches or avoidance cost measures—such as the cost of sound-absorbing windows. While the latter are relatively easy to calculate and are in use in Germany and Spain (and possibly elsewhere), they are open to the criticism that they do not necessarily reflect willingness-to-pay. The hedonic price approach is, therefore, conceptually preferable.

A seminal study was that by Soguel (1994)—a hedonic analysis of property rents and the impact of road noise, whose results are comparable with other contemporary

studies (ECMT 1998). Soguel's expression of the values in units of 'dB(A) 16 hour Leq' means that they are applicable to modes of transport producing intermittent noise (e.g. rail or air) as well as to the continuous noise of roads. Furthermore, perhaps surprisingly, a 1 dB(A) noise change increases only very slightly with the pre-existing level of noise, suggesting that the same appraisal values may be applied to noise changes experienced by individuals in any initial setting. Not all researchers concur with this result, however, and transferability remains a live issue for noise valuation. Table 4 shows how values may vary by country (ECMT analysis). The contrast between this range of noise values and the earlier range of safety values helps to emphasize the wide spread of the values for safety in different parts of Europe.

For projects with localized effects it is probably preferable to carry out location-specific studies (using hedonic pricing or stated preference techniques) to validate the use of Soguel's/ECMT's results and to ensure that variations in preferences are being taken properly into account. The existence of a rule-of-thumb value, however, is likely to be extremely useful in early-stage appraisals.

3.3.2. *Local and regional air pollution*

For local and regional air pollution, part of the achievement of recent research has been to isolate more clearly which are the most important pollutants (in terms of their impact on people and the environment) and to clarify how the impact varies depending upon where the emissions occur. Among the key findings from this field of research are that:

- *particulates* are the most significant local air pollutant;
- damage costs are much higher per unit mass of pollutant emitted in urban areas than for extra-urban areas (by a factor of up to 5 for smaller cities and as much as 50 for larger cities such as Paris or London), so in project appraisal it is essential to separate urban from extra-urban traffic before the valuation stage; and
- calculation of the total environmental damage due to transport needs to include the whole fuel cycle, including electricity generation facilities for electric vehicles and the processing of fossil fuels (CEC 1995). The location of these facilities does not feature in a conventional transport model, so something more comprehensive may be needed to compare fairly the emissions of different transport modes.

As with noise, several meta-analyses (including Bleijenberg *et al.* 1994, Tinch 1996, ECMT 1998) have added to confidence in the range of values being identified. There remain some differences between studies, potentially due to differences in population density, income, preferences and other contextual factors, and to

Table 4. Monetary values for noise reduction.

Location	Euro 1991 per person per dB per annum
EU average	20.9
Range	17.2 (Greece) to 22.4 (Luxembourg)

Source: ECMT (1998); authors' analysis.

variations in the evaluation methods adopted. The degree of consensus has proved sufficient, however, to persuade the governments of Belgium, Denmark, Finland, France, Germany, Portugal and Sweden to adopt money values for changes in air pollution in their appraisal of transport infrastructure projects. Table 5 summarizes some of the 'best estimate' values emerging.

Values given in table 5 are based on estimated damage valued using willingness to pay based methods. Marginal prevention costs do not necessarily equate to the value of damage inflicted, so can be viewed as a second-best source of values for appraisal purposes. Recent research not only has estimated mean values such as those shown in table 5, but also has sought to quantify the uncertainty surrounding these values. This is an important issue because the uncertainty about values for air pollution is much greater than the uncertainty about VOT and vehicle operating cost, and uncertainty about values feeds through into uncertainty about the final ranking of alternatives. The confidence intervals associated with the values in table 5 are explored in Bickel *et al.* (1997), and are, in fact, extremely wide. For example, for particulates, one can only be ~68% confident that the urban value lies in the range Euro 46–740 kg^{-1}. Given this level of uncertainty, sensitivity testing is highly desirable as part of any project appraisal using these values. Note that the uncertainty problem is concealed if money values are not used, but it does not go away.

3.3.3. *Climate change*

For climate change, key studies by Cline (1992), Fankhauser (1994), Maddison (1994), INFRAS/IWW (1995) and others point to a central estimate of Euro 50 $tonne^{-1}$ CO_2 emitted, with the convenient feature (from an appraisal point of view) that it is unimportant whereabouts the emissions occur. In this case, the confidence limits are even wider, with Bickel *et al.* (1997) reporting only 68% confidence that the value lies between Euro 4.2 and 600 $tonne^{-1}$, so again sensitivity testing will be absolutely essential.

3.3.4. *More subjective environmental impacts*

Finally, more subjective areas of environmental quality are also amenable to monetary valuation and inclusion in CBA. Walker (1997) examined the willingness to pay of individuals in central Oxford for measures that would reduce traffic levels and improve the street environment. Significant valuations were found and the results were included with the CBA submitted for decision by central government. A similar experience with Midland Metro in Birmingham (Medhurst 1997) is also

Table 5. Monetary values for reductions in air pollution.

Pollutant	Euro 1995 kg^{-1} reduction in emissions	
	Urban areas	Extra-urban areas
Particulates $PM_{2.5}$	185 (EUNET)	19 (EUNET); 0 (rural areas—ECMT)
NO_x		4.5 (EUNET)
SO_2		1.7 (EUNET)

Sources: Values are from Nellthorp *et al.* (1998) and ECMT (1998).

encouraging about the acceptability of environmental values to decision-makers in national governments.

3.3.5. *European-level appraisal*

Environmental valuation has been advocated in the context of Trans-European Networks and is also being developed for use by the European Conference of Ministers of Transport (ECMT) (Perkins 1997). Again, however, there is scope for disagreement between the EU and the various member states over what the money values should be and, more fundamentally, the legitimacy of monetizing impacts such as climate change at all. The state-of-the-art in valuing the environmental impacts of transport is, therefore, a sensitive area of current research. Attention must be drawn once again to the confidence intervals found for air pollution values. While these are very wide, they provide the opportunity for informed sensitivity testing which will help to inform future discussions about whether investment funds are best spent on new infrastructure or other aspects of transport service delivery, and what the optimal balance may be between the modes.

3.4. *Wider policy impacts*

When moving from the direct transport and environmental impacts of infrastructure projects to the wider policy impacts, one enters an arena that is both fraught with technical and theoretical difficulties and highly politicized. A key problem for appraisal is that the area of greatest political interest—the impact of infrastructure on economic performance—is precisely the area of greatest technical weakness within the appraisal.

The wider policy impacts most often mentioned within transport appraisal are: improving accessibility, promoting economic regeneration and/or economic competitiveness. In the EU context, additional wider policy impacts include: reducing peripherality, promoting social cohesion, eliminating or reducing barriers such as border crossing costs (which may have been artificially elevated by past political or technical decisions), and promoting interoperability.

The principal technical difficulties that follow are:

- Operationalizing the concepts—creating appropriate indicators of change in, for example, peripherality or social cohesion, that can be described, measured, modelled and predicted in an appraisal context. This is very demanding, and in some cases it is not clear that the impacts have been specified sufficiently clearly to be capable of measurement at the project level, much less valued in monetary terms.
- Seamless framework—given that some impacts are dealt with in the CBA, and others within the MCA, there is a need for clarity within the framework as a whole. Some of the wider policy impacts are really there because of incompleteness or deficiency of the CBA. For example, many CBA contain either no model of the slow modes and public transport, or only a very inadequate model. In this situation, recording within the 'accessibility' entry an assessment of the impacts on pedestrians and cyclists or people with disabilities—groups not properly modelled in the CBA—is completely legitimate.
- Double counting—however, there are other cases where the approach of considering the direct transport impacts in the CBA and the wider policy impacts in the MCA creates a huge risk of double or even treble counting. A transport

project that reduces direct transport costs will also promote accessibility and maybe also economic regeneration. The issue of distinguishing wider policy impacts transferred from the direct impacts from effects that are genuinely additional to the primary benefits is a big one (for an extended review, see SACTRA 1999).

- Decision hierarchy—in practice, major projects may be appraised at several different spatial levels: regional, national and international. The project impacts may be different depending on the spatial level, and the relative weights on the project impacts may vary according to the perspective taken. This creates further risks of overlapping benefits and double counting at different stages in the appraisal process. For example, a scheme with significant transport and regeneration impacts from the regional perspective may also be seen as promoting the EU's goal of reducing peripherality. Is there additionality here? Particularly if financial contributions from certain institutions depend on the extent to which projects achieve certain objectives, consistency at all levels of the appraisal hierarchy becomes crucial.

Across such a broad field, the state-of-the-art cannot be fully reviewed, but probably the economic indicator of leading interest is employment effects.

3.5. *Employment effects*

The creation and safeguarding of employment is an objective of the European Structural Funds. It is, therefore, of policy interest whether expenditure on Trans-European Networks as a whole or on specific schemes leads to a change in the level or structure of employment. In practice, however, there is a substantial forecasting issue. One of the main channels through which new transport infrastructure is often argued to influence economic performance is the reduction of transport costs to a peripheral region with unemployed labour. The cost reduction for exporters from the region provides a stimulus to business activity there and to inward investment. The costs of exporters from the 'centre' to the peripheral region are, however, also reduced: their market area is effectively widened and for a producer the arguments in favour of centralization of employment are strengthened. The balance between these forces depends upon a range of economic factors, including the endowments of resources in the areas concerned, which cannot be determined without a careful analysis across the sectors of the economy.

Table 1 shows that seven of the member states (i.e. less than half) currently attempt to forecast these employment impacts in a quantitative fashion. Germany has a standardized and rigorous approach using input–output tables (PLANCO *et al.* 1993). Belgium has used input–output analysis to estimate value added as well as employment, but in a specific sector—road haulage—which limits applicability. Others rely on a range of economic impact assessment techniques that it would be hard to generalize for use at the European level given the diverse assumptions made.

Valuation of employment impacts is attempted only in Germany, Greece and Spain. Germany bases its 'value per job created' on the alternative cost to the taxpayer of creating one job by other means. *Ex-post* evaluation of an EC funded regional programme for 1980–89 showed the investment per job created rising from ECU ~81,000 in 1980 to 154,000 in 1989. Assuming that on average a 15% investment subsidy was required, and then annualizing the costs gives a 'value per job created per

annum' of ECU 9900 in the former Federal republic, or ECU 13,000 in the former East Germany, where conditions for job creation are regarded as less favourable.

The assessment is that the linkages between transport, and overall economic and social performance are poorly understood. But it does not follow that they should, therefore, be excluded from the appraisal framework, especially since they are precisely the matters of greatest concern to the politicians. What is important is that some sort of coherent, consistent, auditable method assesses these impacts, and that they should be presented in ways that facilitate the assessment process rather than obscuring it. A good, well-judged description of the likely impact within an overall multicriteria assessment framework is infinitely preferable to a poorly based numerical value in a cost–benefit table.

To summarize, on the direct transport impacts much technical work has been done to refine the values. The conventions and values used differ between countries, but the principle of valuing the direct transport impacts in monetary terms is generally accepted. Many issues of application of these principles remain open, however. The current UK debate about whether both rail and road fatalities should have the same appraisal values is just one of these. A lot of work has been done in the environmental field with a fair degree of progress towards measuring the impacts, but less than might have been expected 30 years ago towards finding money values for use in appraisal. The wider policy impacts are the most acute problem area since even a convincing framework for dealing with them which is both logical and practical still seems some way off.

4. Presenting appraisal results

Given that the appraisal framework, including the treatment of individual impacts has extended and developed over the past 30 years, the need to consider storage and presentation of the results has also become an important issue. Increased sophistication and complexity brings with it increasing data requirements. Not only is there a need to store and retrieve parts of this mass of data quickly for review, but also alongside this is the natural limit to the amount of information a single user can visually assess and mentally process in a single presentation. This in turn suggests a need for a systemized delivery of information and flexibility in the range of summary or aggregate statistics available. Where data or appraisal processes are partly computerized, there may be the need to address potential concerns of a lack of transparency or 'black box' nature. There may also be barriers to overcome such as fundamental dislike of technology and a sense of 'loss of control' by the user. These factors prompt this review of the current demands and state-of-the-art in presentation of appraisal results.

Recent developments imply that the user requirements include:

- providing immediate access to a stored background of disaggregate information according to groups affected such as mode, investor, benefits over time, etc.;
- allowing sensitivity testing on assumed parameters such as growth and provide revised appraisal outputs;
- giving a range of summary outputs likely to be of interest to different groups involved in the overall appraisal process; and
- providing a high standard of visual presentation on a large number of data, options and summary outputs in a form which is clear, concise, transparent and assists the decision-making process in a digestible and user-friendly format.

Several examples now exist of recommended presentational formats for appraisal outputs based on documented or computerized materials. The Appraisal Summary Table (AST) used in the UK trunk road scheme assessment process is representative of the former (DETR 1991). The AST is a one-page summary of the main economic, environmental and social impacts of the trunk road scheme, and the stated aims in the use of the AST are to encompass both *understanding the problem* and providing *summary information*. In brief, its purpose is thus:

- to assist an understanding of the problem and ask what priority it deserves;
- to identify a range of options; and
- to appraise options to determine the extent to which they meet the UK government's objectives as cost efficiently as possible.

The overall design of the table is one that could be readily adapted for use in other appraisal contexts and includes the facility to store an overall summary measure (either monetary or qualitative as the background guidelines recommend) together with supportive qualitative remarks for each impact.

The use of a written document to store and present outputs carries certain limitations and there is increasing interest in and support for the idea of computerized presentational tools. One specialized example of a software tool focused on MCA decision support is MUSTARD (Scannella and Beuthe 1999). It has been designed to help a decision-maker in situations where there is a need to rank or prioritize a large number of competing schemes with a relatively small number of impacts to consider. It has a particularly sophisticated range of facilities to carry out sensitivity testing where a decision-maker is uncertain in their priorities.

A more general appraisal tool is the one developed and prototyped within the EU funded EUNET project (Grant-Muller *et al.* 1998). The tool represents the implementation of the overall recommended EUNET appraisal methodology, providing a framework that draws together both CBA and MCA outputs to provide an overall summary measure for schemes. A summary of the data flows input to the tool is given in figure 1.

Internally the tool consists of five modules; input, CBA, basic financial appraisal, MCA and output. While a CBA alone could be used for assessment, a rigorous interface between all modules has been established to allow the decision-maker full use of all the recommended impact criteria in assessment. The software has been developed in a Windows environment allowing the user access not only to overall project scores and rankings, but also to disaggregate outputs, summary tables, statistics and graphs. An advantage of a computerized facility such as the EUNET tool is that it allows a considerable degree of flexibility in terms of sensitivity testing on parameters, accessing disaggregate information or summary tables which are user-specified.

Computerized storage and presentation of appraisal information represents a clear step forward from current practice and one which would have been impossible 30 years ago. This represents only one challenge for the future of appraisal and a more general policy decision is needed on the extent to which this can be more widely utilized. Further appraisal challenges of a more theoretical and conceptual nature are discussed below.

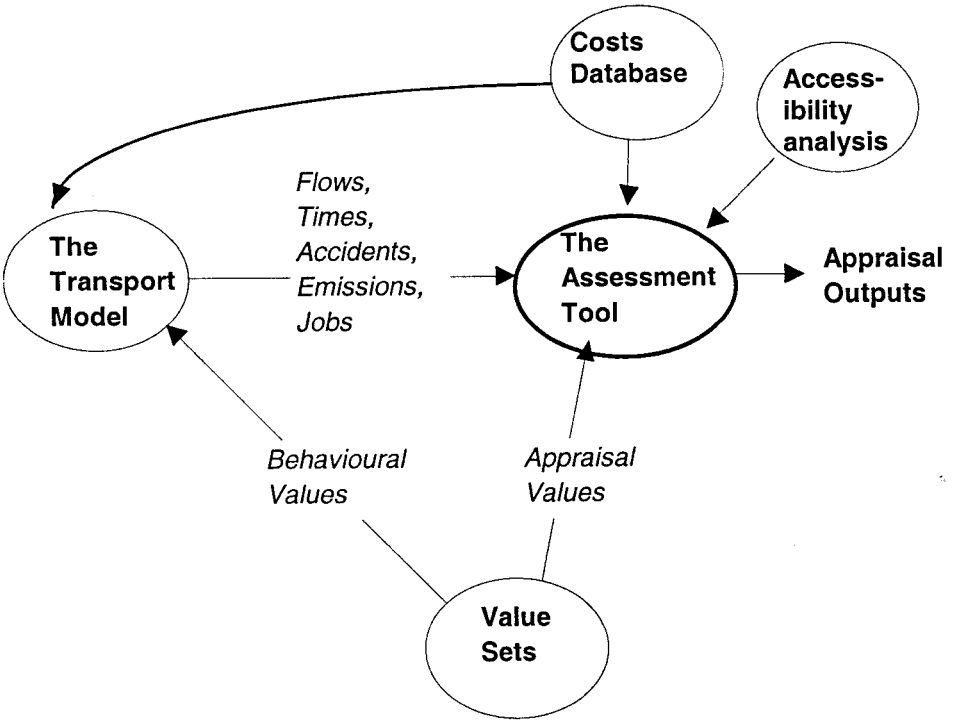

Figure 1. Data flows to the EUNET assessment tool.

5. New challenges for appraisal

During the past 25 years, an interacting set of political, economic and social development has occurred, and has combined to change the context within which appraisal takes place. It includes:

- Greater attention to the linkages between transport and the environment and other broader policy.
- A move from a project focus to a policy focus, creating the need for Common Appraisal Framework.
- Increased computing power, facilitating increased capability for information processing (but have interpretation skills kept pace?).
- Much greater social awareness, and, therefore, need to present project and policy options to an informed public.
- A move from national government responsibility for transport with single level appraisal to a mixture of local, regional, national and international responsibility with multi-level appraisal.
- A move towards privatization and public–private partnership creating need for explicit assessment of the impacts on individual agencies, operators, etc. within the overall appraisal.

What does this imply about outstanding research and development issues concerning the nature of support for intelligent decision-making and the role of appraisal within it? Here six areas are identified.

5.1. *Interface between modelling and evaluation*

The quality of project evaluation is strongly dependent on the modelling and forecasting that provide the key evaluation inputs. This in turn raises issues both of data and model quality. A particular challenge is to distinguish exogenous from endogenous effects consistently throughout the modelling and evaluation. In the past, it has often been thought acceptable to model demand on a fixed matrix basis with all traffic growth over time attributed to exogenous factors such as growth in income and changes in the real cost of travel. Now, however, the need to consider the impact of new infrastructure on traffic volumes—so-called induced traffic—is on the agenda (SACTRA 1994, Kroes *et al.* 1996). This is for two reasons. In the densely populated part of Europe with heavily congested networks, it has been shown that allowing for the effect of induced traffic on equilibrium flows and costs can, depending on the demand and flow–cost elasticities, significantly reduce the user benefits. In the areas with less well-developed networks and lower traffic volumes, induced traffic may be a significant component of the benefits and may provide some relevant indications for the assessment of wider economic benefits. Achieving consistency between modelling and evaluation is, therefore, important.

5.2. *Reliability and the congested network*

With transport policy continuing to shift away from road-building in Western Europe, congestion on the existing network is expected to increase, at least in the short-to-medium term. The UK government, for example, forecasts that congestion will rise 11% by 2010 (from 1996) in terms of average time delay per road–vehicle-km (e.g. DETR 2000b) and behind this lies a much wider range of journey time variability from one trip to the next. At the same time, the scope for journey time savings due to better and wider roads is running out. Hence, ensuring reliability is becoming a more important policy objective, and reliability increasingly has a role to play in project appraisal. This has become particularly clear for the freight sector, where logistics studies have shown that freight operators build substantial slack time into their schedules and producers incur additional inventory costs as a consequence. In the passenger transport sector, research has established significant values for late time (1 min of delay may be valued in the region of 2.5 times the value of expected journey time). However, conventional transport demand models still neglect reliability— therefore, it is difficult in practice to evaluate how particular projects and system improvements would contribute to the reliability of the services delivered. This may be one of the most significant issues for project appraisal in the future.

5.3. *Indicators and double-counting*

Many of the factors seen as of growing social and political importance to transport sector decision-making are not readily measurable. Indeed, many are proving elusive even as far as definition is concerned. Some are primarily project-level variables, such as community severance or, perhaps, social exclusion. Others are clearly strategic: cohesion, interoperability, etc. In both cases the definition of such indicators, linking them to appropriate ways of categorization or measurement, and establishing money values, weights or other ways of facilitating their aggregation into overall indicators of project or policy performance are major theoretical and practical challenges. Many of these important social and similar impacts readily

double-count with each other, or with other dimensions already incorporated in conventional CBA, which provides a further challenge.

5.4. *Cost–benefit and multicriteria analyses*

The boundaries of CBA have slowly expanded, as more of the impacts of typical transport projects become capable of being monetized. Where to place the border between the two, when to shift it and in what circumstances will continue to pose challenges for theoreticians and practitioners alike. There are issues too about the nature of the MCA modelling component. Should it be separate from the CBA or be integrated? If so, how and how fully? Should MCA simply mimic CBA and use a simple linear additive format, or should it seek to capture within the MCA procedure itself other features of the real-world decision-making environment such as uncertainty or the search for consensus among different stakeholder groups? Where is the balance best set between model complexity and transparency to users and the concerned public?

5.5. *Communication*

Although the changes may occur at varying pace within different parts of the hierarchy, discussions of transport interventions are likely to become increasingly multi-tiered. This is occurring not only because of EU concerns about transport strategy, but also following from increased emphasis on regionalization within member states, etc. down to the level of quite localized stakeholder groups. If such a planning process is to work well, effective communication between tiers is critical. This affects appraisal models, as mentioned above, and also has wider implications for decision-making processes. In particular, the on-going tension between demand for simplicity to facilitate wide communication and demand for sophistication in modelling which typically brings complexity remains an unresolved question. In general, there are many outstanding questions arising from the need to effect informed decision-making in a multi-tiered decision-making environment.

5.6. *Uncertainty*

Uncertainty has always been, and remains, a key concern in appraisal. Typically, it has been characterized as deriving from a lack of accurate knowledge of: the external economic environment; and/or model structures; and/or model parameter values. A new feature, however, of the developing decision-making environment is policy uncertainty. The emergence of a potentially powerful policy-forming body, in the shape of the European Commission, has enhanced the potential to influence the course of events via Europe-wide policy measures. From the perspective of transport sector appraisal, there is thus a further dimension of uncertainty, about how precisely that policy influence may be used. Such influence may derive from policies targeted at the transport sector itself, or any of a number of other sectors that interact significantly with transport. How to reflect this form of uncertainty in the scenarios or other tools used to try to bring recognition of uncertainty into project appraisal is unclear.

5.7. *Financeability and the private sector*

The ability to cover the costs of transport infrastructure from sources other than governments' general tax revenue is of growing importance. In turn, this raises the

question of understanding the extent to which the costs of individual schemes can be recovered through user charges and the consequences for society as a whole of any significant shift towards this form of financing. In a similar vein, increasing involvement of the private sector seems essential to many of the policy ambitions for expansion of European transport capacity. If this is to be achieved, then project designers need to know how best to set up projects that will both achieve their social objectives and appeal to private sector finance. Familiarity with the private sector's perspective on what constitutes an attractive project is still not high among transport planners as a whole. It is important to recognize that projects will increasingly be evaluated explicitly and simultaneously from the point of view of several stakeholder groups, both public and private sector. Evaluation and decision-making procedures need to accommodate multiple viewpoints (e.g. Turro 1999: 244–8). From the point of view of the contribution of appraisal to intelligent decision-making, one particular need is improved modelling. Combined traffic and evaluation models sensitive to factors such as varying toll levels and that successfully coordinate the behavioural inputs underlying traffic models and the resource inputs relevant to evaluation are urgently needed.

5.8. *Exploiting developments in computer power*

To deliver the integration referred to above between traffic modelling and appraisal will require full exploitation of developments in computer capability. A suite of procedures that can move seamlessly between levels of spatial aggregation and which can be applied throughout the planning process, from sketch planning through to final, formal evaluation, would necessarily need to take full advantage of the continuing changes in computer power. Additionally, however, more radical options are becoming feasible. For example, it is only now that we are coming to terms with what Geographical Information Systems (GIS) might bring to aspects of planning and evaluation. Potential also exists to exploit more fully the developing ability to create visual images to stimulate discussion and evaluation of different project designs and to visualize the outcome of appraisal processes in new and more informative ways.

6. Concluding discussion

Thirty years on from the development of transport project appraisal at an operational level, a considerable amount of progress has been made and issues remain. Rather than attempting to summarize the totality of this, this paper concludes with a few key points.

First, the art of appraisal has developed at the technical level. More is known now about the measurement and valuation of impacts. Appraisal frameworks have been progressively developed, and modern computing power makes possible the implementation of various combinations of CBA and MCA within an overall framework, of which the EUNET tool is a particular example.

Second, the context within which appraisal is used has become significantly more challenging. The multi-level, multi-agency dimensions, the need for appraisal to speak to the public as well as the professional, the need for consideration of a wide range of social, economic and environmental impacts all mean that the nature of the problem to which appraisal is addressed is now more testing.

Third, although there is a broad similarity between the appraisal approaches used by different countries in Western Europe, there are many points of difference. This is

not surprising given that the countries have different traditions of thought in political economy, different perspectives and cultural values, and different institutional arrangements and, therefore, uses for appraisal information. In the context of Europe opening to the East, good-quality appraisals are a vital input requirement for the international banking institutions, which must reconcile the politically desirable with the practically possible.

Fourth, there remains an issue about the role of appraisal in decision-making, in other words where the boundary lies between the technical process of decision support and the political process of decision-making. The CBA plus framework approach allows the decision-maker to weigh together the CBA with the other elements in the framework in the process of arriving at a decision. A comprehensive MCA, as in the objectives-led approach, could be argued to reduce decision-makers discretion by applying fixed weights to the full range of impacts. The acceptability of this depends partly on the quality of the data and weights used, and partly on the roles assigned to the technician and the politician in the decision process.

Fifth, the shape of an appraisal regime is crucially conditioned by the political system within which it operates. After several years of involvement in the European appraisal scene, the present authors remain unclear about the fundamental political model for which the appraisal research work being undertaken for the EU is designed. This is perhaps not surprising because it touches on issues of primacy and subsidiarity that go to the heart of European policy-making. The problem can be put this way. One approach to transport infrastructure policy—and hence to the appraisal regime—would be to assign prime responsibility to national governments (or, for border crossing projects, to groups of national governments). The EU interest would enter in as much as these essentially national projects had beneficial or adverse impacts at European level, beyond the ambit of national governments. European funding would take the form of top-ups to national funding where projects supported identified pan-European goals. The implications for appraisal would then be clear—the basic appraisal would be at the national level, following national appraisal principles, with a submission to Brussels relating to those aspects considered as having wider European impacts. There would be no reason or need for uniformity of appraisal practice between member states.

The alternative is a more unified approach in which at the limit all projects 'of European interest'—say initially the TEN—are subject to a standard form of appraisal so that priorities can be determined for the use of scarce funding resources. This raises philosophical and practical problems encapsulated in the phrase 'whose values?'. Should local values be used, should they reflect the willingness to pay of the consumers affected? Or should pan-European values be used? Is there a need, in this case, for complete harmonization of investment appraisal of projects of European interest? The answers do not lie in the technical arena. As with many appraisal questions, the detail is in the politics.

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