

# Ex-post Assessment of Transport Investments and Policy Interventions

Roundtable Summary and Conclusions

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***Summary and Conclusions of the Roundtable:***  
**Ex-post Assessment of Transport Investments  
and Policy Interventions:  
Prerequisites for ex-post assessments and  
methodological challenges**

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## 1. Introduction

Ex-post evaluation can be used to serve multiple purposes at the core of which is the improvement of ex-ante analysis:

- it can help policy-makers better identify the kinds of projects that work best in certain situations;
- it can identify the effect of concurrent non-transportation investments and their interaction with transportation investments;
- it can contribute to establishing the time frames in which we expect to see economic impacts materialize, thereby helping to set realistic expectations for the effect of investments and economic development;
- we can make use of findings of ex-post assessments to support communication with the public, improve the information provided, and support consensus-building efforts.

But ex-post evaluation is often also perceived as a weak link in the assessment process for transport infrastructure and policy initiatives. The assessment methods have tended to rely on ex-ante appraisal, making predictions of how a scheme or policy might perform rather than being based directly on the outcomes of past decisions. Substantial resources have been devoted by those countries which rely on economic appraisal as a means of informing decision-makers to improving and updating appraisal methods. Many of these developments, for example research on the valuation of crowding on public transport or on the valuation of agglomeration and other wider economic benefits, have been the subject of ITF discussion papers and Roundtables (OECD 2015, 2014, 2011) and most countries have access to extensive national guidelines on transport investment appraisal.

Many countries also have legislation and guidelines in place that require ex-post evaluation but few actually enforce it. In the UK, for example, the National Audit Office (NAO) in its reports regularly “reminds” the Department for Transport to conduct ex-post evaluation. The non-execution of ex-post evaluation is not unrelated to the lack of dedicated funds.

Although one might think that ex-post evaluation is a far more straightforward exercise than investment appraisal and the forecasting of what might happen in the future, the experience of evaluators and an increasing volume of research literature would beg to differ. There are a number of reasons for this. When funds are available, there may be limitations in terms of available data. Data collection protocols are seldom introduced before project starts in order to enable ex-post analysis. Our investment/intervention is very likely not the only change that happened to a certain location or region. Multiple other changes probably occurred in the years since our project became operational, which can make it very difficult to ascertain what the net contribution of our investment/intervention was. This is can be a substantial methodological challenge, even when data are available.

These challenges involve methodological and practical issues for the execution of ex-post evaluation. A more fundamental question is: are there other roles for ex-post evaluation? The primary role is informing and improving the ex-ante appraisal process, but can an ex-post analysis also serve accountability in decision-making?

Four discussion papers were prepared for the roundtable to address these questions. Each discussion paper examines either a role ex-post evaluation can play in enhancing decision-making or an approach to improving the execution of ex-post assessment.

The structure of this summary is as follows:

- Chapter 2 outlines the meaning of ex-post vs. ex-ante evaluation.
- Chapter 3 examines the accuracy of the conventional ex-ante methodology.
- Chapter 4 describes two basic systems/approaches to data collection and evaluation.
- Chapter 5 describes the challenges in expanding the conventional investment appraisal to broader development effects.
- Chapter 6 presents statistical tools that are available to evaluate the broader development effects in ex-post evaluation.
- Chapter 7 discusses the need to expand the concept of ex-post evaluation to monitoring and corrective actions to be taken already during project execution.

The report ends with the concluding remarks in Chapter 8.

## **2. The roles of ex-ante appraisal and of ex-post evaluation in the assessment of transport investments and initiatives**

This focus on ex-ante appraisal in transport sector planning provides a contrast to the methods adopted by politicians and their advisors in many other fields of evidence-based public sector decision-making. Here the approach is to conduct well specified trials or experiments and to monitor the effects of the intervention. Such trials often require establishment of two or more otherwise similar groups of people or places and administering the treatment to one segment of this population and not to another. Comparison between the two groups provides evidence of the outcome; if successful, the treatment or policy can then be rolled out to other similarly affected groups. Conversely, if the test cannot be shown to deliver the desired outcomes, it can be discontinued and the experiment either abandoned or alternative treatments can be tested.

Examples of such an approach to decision-making are found in the health sector, where drug trials are administered by testing two otherwise similar populations, with one given the treatment to be tested and the other group a placebo. Education provides another example of public policy decisions being based on experiments to test different teaching methods and monitoring the outcomes.

Governments may provide guidance to ensure consistent and cost effective evaluation methods, such as the UK Treasury's Magenta Book<sup>1</sup>. Guidance in these fields is concerned with setting up the trials, selecting a control group, correcting for the placebo effect and avoiding or eliminating confounding effects.

Transport investments and policy initiatives are generally different from the examples in health and education quoted above. Location is an important consideration: places differ from each other in terms of their populations, their transport networks, the quantity and location of household and economic activity. The solution to any problem, its cost and its impacts on transport users and others tends to be specific to the location. What works in one place may not work so well in another.

Investment in transport is lumpy and the assets generally cannot be moved to another location if the initial outcome is not a success. So the evaluation 'model' of trialling an initiative, careful monitoring and rolling it out if successful, perhaps modified if the evaluation suggests such changes, is not usually a practical option for transport. It is not an option to build a short section of a high speed line, evaluate this trial length and deduce from this the economic and other impacts of a full length city to city scheme. So in the transport field there is a need for good quality appraisal methods to be used in advance any decision so as to inform the decision-maker of the likely outcomes of that decision.

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<sup>1</sup> <https://www.gov.uk/government/publications/the-magenta-book>

There is another sound reason for this emphasis on ex-ante appraisal in the transport sector. There is good evidence about how and why people travel and use the transport networks which are often congested, overcrowded and slow and which decision makers, responding to their voters, want to improve. Based on this evidence, the well-established theory of consumer behaviour can be used to estimate the benefits – their willingness to pay and the surplus in excess of their willingness to pay – that transport users and others derive from an intervention.

Most countries collect transport use and traffic data which include information on the use that business travellers and industry make of their transport networks. From these data estimates can be made of the transport cost savings and hence economic benefits gained by the productive sector of the economy that result from providing more capacity, reducing congestion and providing for quicker, more reliable journeys. Offsetting these benefits are the costs that agents responsible for the provision and operation of the infrastructure and associated services incur, estimated using the judgement of the engineering professionals who are responsible for the design, construction and operation of the scheme.

The evidence about how and why people travel is complemented by information gained from research – Stated Preference and Revealed Preference based studies – about how people value those impacts of a scheme which do not result in direct cost savings, including savings in non-working time, reductions in crowding on trains and improvements in reliability. Incorporating these values into the utility maximising model of transport users' behaviour shows how transport users will respond, in terms of changing their choice of mode, destination or route, when presented with the option of a new scheme. Research continues to update and improve the values that make up this model and to extend it to cover the external impacts of transport investments, including the impacts on the environment and on accessibility, economic mass and hence on the productivity of urban agglomerations.

The existence of a widely accepted theoretical basis and rich set of behavioural based evidence has had an interesting consequence which singles transport out from many other areas of public spending. Most of the resources devoted to research in transport economics have been aimed at methods of improving the ex-ante appraisal process: fewer resources have been targeted on carrying out ex-post evaluation studies. If the appraisal methods are judged to be fit for purpose because of the plausibility of the theory on which the methods are based and because of the evidence which supports that theory, there is, arguably, no need for evaluation. Moreover, on those occasions when an evaluation is carried out, the results of the evaluation become available long after the scheme has opened. In the intervening years, many improvements have been made to the modelling, forecasting and appraisal methods and the findings of the evaluation may have little relevance to the choices that currently face decision-makers.

### 3. Shortcomings of the appraisal process – errors in forecasts

The ex-ante cost benefit appraisal methods have, quite rightly, been questioned. There have been many cases of errors in forecasts of patronage of a public transport scheme or in forecasts of road traffic volumes. Project costs are often underestimated<sup>2</sup>. Changes are made to the scope of a project, sometimes after decision-makers have approved it, without any assessment of the incremental costs and benefits of this change. Questions have been raised about some of the key values in the cost benefit appraisal. For example, criticism has been made of the UK's approach to valuing rail business passenger time savings in the context of the economic case for high speed rail, on the grounds that business passengers often work productively while on a journey.

Some errors are due to exogenous changes – changes in the reference case, for example on account of the failure to anticipate at the time of the appraisal future changes in fuel prices, GDP or in local or regional economic or territorial development assumptions. Many of the transport models used to appraise schemes assume that land use changes are not induced by the scheme, since the relaxation of this assumption complicates the attribution of the benefits of the scheme. Differences between forecast and actual values also occur because of errors in the traffic or transport model's prediction of mode, destination or route choice.

More recent studies<sup>3</sup> also suggest that the systematic errors in forecasting of traffic and cost estimation may at least in part be the inherent result of the characteristics of the methods applied.

A further source of error arises because the economic appraisal generally omits any assessment of the responses of transport providers to the investment or policy intervention. There has been a systematic failure to anticipate the growth of low cost air carriers and their response to high speed rail, or to consider the scenario in which an open access operator might provide on-rail competition to the operator of a new high speed line either by using the freed up capacity of the existing line or on the new one. Nor is any account generally taken in the appraisal of transport schemes of technological change – for example the implications of self-guided cars on the economic case for the additional highway capacity.

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<sup>2</sup> Flyvbjerg, B. (2004): Procedures for Dealing with Optimism Bias in Transport Planning. Department for Transport. London; Flyvbjerg, B., Holm, M.K., Buhl, S.L. (2005): How (In)accurate Are Demand Forecasts in Public Works Projects? The case of transportation (Journal of American Planning Association, Spring 2005, Vol. 71, No.2).

<sup>3</sup> Eliasson, J., and Fosgerau, M. (2013). Cost-overruns and demand shortfalls – deception or selection? Transportation Research Part B: Methodological, 57, 105-113; Rose, J. M., & Hensher, D. A. (2013). Toll roads are only part of the overall trip: the error of our ways in past willingness to pay studies. Transportation, 1-19; Makovšek, D. (2014). Systematic construction risk, cost estimation mechanism and unit price movements. Transport Policy, 35, 135-145.

## 4. Systems for Evaluation

These deficiencies in the appraisal process provide a clear motivation for carrying out evaluation studies. They can help decision-makers and their analysts understand some of the causes of error in the appraisal and learn from these. However, evaluation studies need planning well in advance. Transport schemes take many years to plan and construct. The impacts expected of a scheme evolve over a long period and take time to develop. Time series data are essential for any evaluation. Rent-seeking agents respond well before a scheme has opened, while other effects materialise some years after its completion. Data on networks, services and rail fares, while publicly available at the time of travel, are multi-dimensional, evanescent and complex. As a result they are often impossible to reconstruct post-hoc.

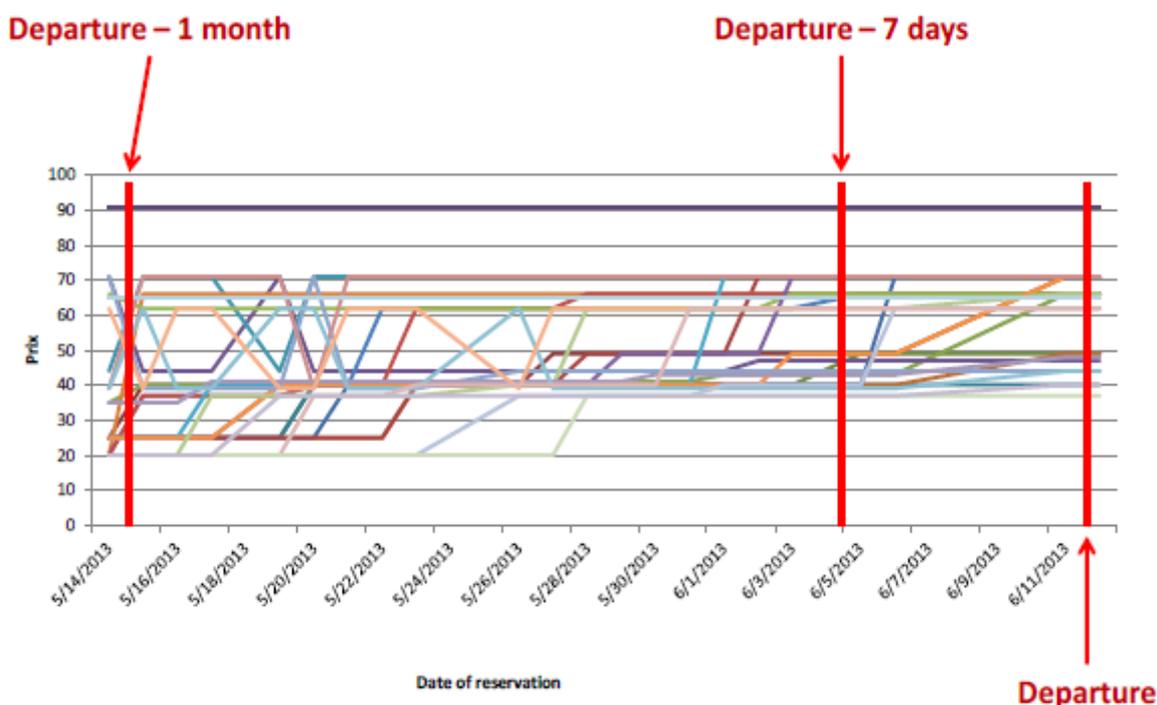
In France there is a long tradition of setting up observatories, established by law (LOTI of 1982), for collecting data to facilitate a detailed evaluation of all major transport schemes. Information is published setting out key indicators of ex-post performance, including data on actual and forecast costs, patronage or, in the case of highway schemes, road traffic volumes. The LOTI audit provides an estimate of the predicted and actual economic internal rate of return for the investment. In addition, the LOTI audits include a high level assessment of the causes of any observed differences between forecast and outturn values as a means informing analysts about potential improvements to appraisal methods. The audit is published so that decision-makers and the public have some understanding of the impacts of the project and any errors in the forecasts. LOTI imposed a legal obligation on the infrastructure companies to fund an audit of each scheme, to be carried out by a different department in the organization to the one that prepared the ex-ante analysis. The report is then reviewed by another body, although within the same line ministry, which may limit the independence of the reviewers.

Despite the discipline imposed by the LOTI-based audit process, certain limitations were identified, in particular on account of the difficulty of attributing local and regional development impacts to the scheme and comparing these ex-post estimates with the ex-ante aspirations. In addition, the time period over which data were collected and the coverage of the data were both judged to be inadequate for a full evaluation of projects.

The establishment of permanent observatories has greatly improved the quality and coverage of data on major transport schemes in France. For the largest projects, an observatory is now set up at the same time as the project is approved, so as to ensure that the 'before' conditions are adequately recorded. Data which are available for only a short period of time – for example the fare charged by a rail or air operator using yield management methods to maximise revenue – can only be collected through a systematic and timely monitoring process. Information on attributes of demand such as the price actually paid by the passenger and the restrictions on the availability of the ticket improves the basis

for analysing and understanding trends in patronage and can explain some causes of errors in the forecasts of demand. Figure 1 illustrates the volume of information – price shifts in yield management on a train line Bordeaux-Paris – which becomes unavailable after a few months as nobody stores the information.

Figure 1. **An example of the fleeting nature of information: Minimum fares for all Bordeaux-Paris trains, based on length of time elapsed since reservation to departure date**



Source: Bonnafous 2014<sup>4</sup>.

A different approach to evaluation has been followed in the United States. A Transport Project Impact Case Studies (T-PICS) database<sup>5</sup> has been set up, based on 100 projects that vary by size, location and motivation. The on-line database contains details of the characteristics of each scheme and the objectives it was intended to achieve. Information is provided on the indicators of change used to measure its success when compared with otherwise comparable locations, the regional and local area context and data from local interviews about the extent of complementary policies and their role in delivering the outcomes in terms of economic development and local employment.

<sup>4</sup> Bonnafous, A. (2014). Permanent observatories as tools for ex-post assessment: the French case study. Discussion Paper No 2014-10. International Transport Forum at the OECD. Paris.

<sup>5</sup> <http://www.tpics.us/>

The T-PICS database<sup>6</sup> is intended to provide decision makers and the public with information about the range of outcomes delivered by a sample of projects which are broadly comparable to one that these decision makers might be considering for their locality. The database provides information on the type of scheme and the circumstances in the area served, so as to facilitate the matching of the project under consideration with a number of broadly comparable projects in the database. Information is provided on the factors that are judged to have contributed to the success or failure of the schemes in the sample. Fifteen of the 100 projects failed to deliver any direct employment effects although these projects did have other impacts on property prices and productivity.

The database is intended to be used well in advance of any detailed design or appraisal of a project, to be considered at the early stage of the decision process as a means of sifting potential options. It also helps decision makers and the public understand whether, in circumstances similar to theirs, complementary policies have been a necessary condition for delivering the objectives of the project or whether the transport scheme alone is has in these other examples been sufficient.

## **5. Challenges in extending the forecasting methodology – development impacts**

Conventional appraisal methods estimate, at the best, the first round impacts of a scheme on transport users – the travel time/generalised cost savings. These time savings make it possible for users of the improved transport network to change where they live, work and carry out the whole range of activities that every household partakes in. The savings in travel time estimated and measured in the ex-ante appraisal are converted into changes in land use, with second round effects on house prices, labour markets and wages. Firms use the cost savings to re-organise the location of their production, distribution and retail networks, passing cost savings on to consumers. And these changes result in a change in the spatial distribution of economic activity and, in some cases, its overall national level.

Policy-maker's concerns – in this age of austerity – are with the economic development impacts of transport. The impact of a transport scheme on economic development is far more important to decision-makers than the present value of the time savings – and of more interest to voters. Transport appraisal methods are largely silent about these second round effects. Transport appraisal experts regard these impacts as difficult to estimate and in any case largely accounted for in terms of the overall size of economic benefits by measuring the

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<sup>6</sup> Fitzroy, S.; Weisbrod, G.; Stein, N. (2014). TPICS, TIGER and US Experience: A Focus on Case-Based Ex Post Economic Impact Assessment. Discussion Paper No 2014-11. International Transport Forum at the OECD. Paris.

direct impacts of the project on users. Some progress has been made through the incorporation in the appraisal of Wider Economic Benefits, covering agglomeration, labour market and imperfect competition effects within the cost benefit framework. But these developments of the cost benefit model provide only limited information on possible changes in the location of economic activity. They do not provide decision-makers with a comprehensive assessment of the local or regional impacts of the project on economic development. While there have been advances in integrating models of land use change into the conventional transport model, these land use transport interaction models are costly to set up, complex and the predictions from these models have not been subject to extensive testing.

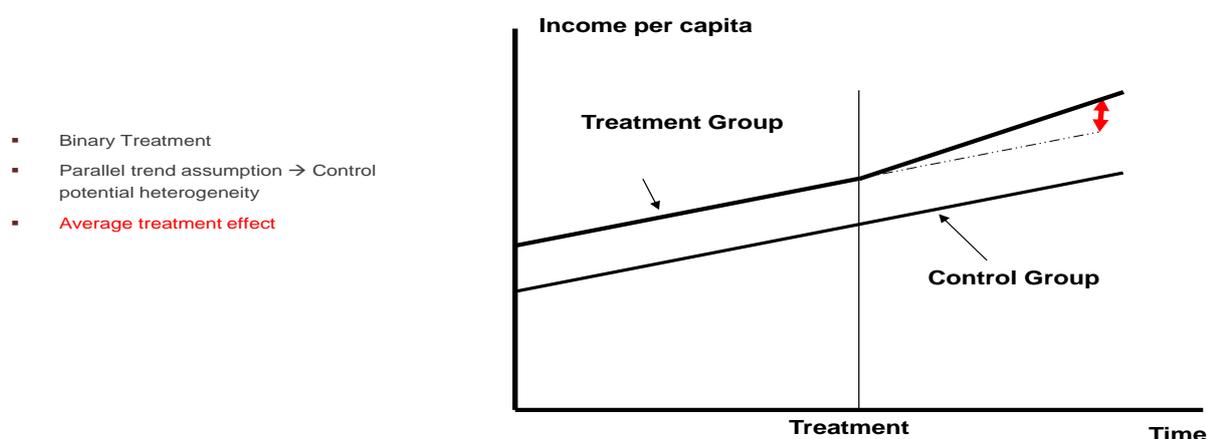
Evaluation, as is shown in the US and French papers, has the potential to provide decision-makers with information about the economic development effects of a scheme. It can tell policy-makers what they want to know about the decisions on transport investment that they or their predecessors have taken. The US paper describes the process of collecting an adequate sample of completed schemes and data on them. It describes a process of identifying the extent of any economic development effects in the area affected by the scheme and the circumstances that might have facilitated those impacts. While this does not demonstrate causation, it can help decision-makers and the public understand what schemes and associated policies might have a chance of delivering the desired economic development effects. The evaluations carried out by the French observatories provide similar evidence about the effects of the investment on land-use change and economic development.

## **6. Evaluation - causation**

Decision-makers need to be confident that a transport investment or initiative they approve will be the cause of the outcomes that they are elected to deliver. Yet establishing that any observed correlation can be interpreted as causation is a challenge. Decisions about where to intervene are not made across a random set of choices. Investment is targeted on those locations where congestion or overcrowding is at its worst or where the accident record is highest, or where there is a particular need to stimulate economic activity. Methods that assume interventions are made at random will produce biased results if applied to transport. In addition, the specific nature of each transport scheme – each place is different in terms of its transport networks on the supply side and of the population and economic circumstances determining demand for that network – means that data on the counterfactual, the hypothesis that the investment had not taken place, is unobtainable.

The paper by Dan Graham<sup>7</sup> describes a means of avoiding these potential sources of bias through the use of statistical inference methods. The aim of the approach is to identify the differences between the areas which benefit from transport interventions and other areas where no such intervention takes place. The effect of the scheme, or of a sample of schemes, is identified by netting off the influence of these *confounding effects* when comparing the outcome in locations benefiting from transport investment with what has happened elsewhere. The use of causal inference models to identify the impacts of transport schemes avoids imposing on the evaluation the assumptions about transport user behaviour that underpin the conventional cost benefit based economic appraisal model.

Figure 2. **An example of a causal inference method: Differences in differences**



Source: Graham *et al.* 2014<sup>8</sup>.

The paper provided examples of applying these techniques to a sample of highway schemes in the US and to high speed rail in Spain. In the case of the US study, the evidence did not support the hypothesis that providing more road capacity in urban areas reduced road congestion or increased productivity in the areas where the investment took place. These findings should not be interpreted as implying that there were no benefits from the investment. The trips induced by the schemes delivered benefits dependent on increasing mobility. But if the objective of the programme was to reduce congestion, it failed to deliver. The same method was used to assess the impact on regional economic performance of the Madrid-Barcelona high speed rail line. The results showed that, once confounding factors had been accounted for, there was no significant difference between economic growth rates in the target corridor and in other unaffected provinces in Spain. While these examples show

<sup>7</sup> Graham, D. J.; Brage-Ardao, R.; C. Melo, P. (2014). Causal influence for ex post evaluation of transport interventions. Discussion Paper No 2014-13. International Transport Forum at the OECD. Paris.

<sup>8</sup> Graham, D. J.; Brage-Ardao, R.; C. Melo, P. 2014. Quantifying the Economic Development Impacts of Major Transport Infrastructure Projects: A Case Study of High-Speed Rail in Spain Presentation at the Roundtable Ex-post Assessment of Transport Investments and Policy Interventions, 15-16 September 2014, OECD, Paris.

the application of the technique, they do not provide any more general lessons about the role of transport in facilitating economic development as they depend on the nature of the projects assessed.

## **7. Evaluation to inform the process of procurement, implementation and financing a transport project**

The term “ex-post” immediately suggests that something will take place after an action/event is completed. With regard to evaluation of transport investments, “ex-post” usually refers to evaluation after the completion of the construction phase or later. But the term is generic. An evaluation can be executed at any point during the project development and operation.

Indeed, one part of the work of the UK’s National Audit Office is concerned with monitoring the progress of major infrastructure schemes or policy interventions prior to their completion. Barker et al. (2014)<sup>9</sup> notes that the NAO provides the UK Parliament’s Public Accounts Committee with the evidence that they need to understand whether government departments and their ministers are obtaining value for money in their spending and investment programmes. The PAC has the right to investigate spending decisions and to ask questions of departmental officials and ministers about whether they are delivering or are likely to deliver value for money.

Major infrastructure projects take many years to deliver and the NAO will often review progress during the implementation and construction phases if in its view such an intervention might be beneficial. The NAO seeks to ensure that the discipline imposed on project sponsors by the process of cost-benefit appraisal is not relaxed once the project has been approved. For example, changes in the scope of a major project frequently arise after it has been approved and, while such variations might not be subject to economic appraisal, the NAO’s examination can act as an incentive on project sponsors and funders to manage the costs of such alterations to the initial contract.

The NAO’s role is not restricted to reviews during the phase of project implementation: it also carries out evaluations of a sample of major projects after they have opened to understand whether they have delivered the expected benefits in terms of traffic volumes, time savings and regeneration impacts. These post opening audits provide the NAO with the opportunity

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<sup>9</sup> Barker, G.; Beardsley, G.; Parsons, A. (2014). The National Audit Office’s value-for-money assessment of transport investments. Discussion Paper No 2014-12. International Transport Forum at the OECD.

to make recommendations to the Department for Transport about improvements to its appraisal methods.

In general it can be noted, that both the NAO and T-PICS approaches to ex-post assessment rely heavily on interview and interaction with people and organizations directly affected by the investment(s) being assessed.

## **8. Conclusions**

While economic appraisal tends to follow a standard approach based on the theory of consumer behaviour, there are several different approaches to conducting an ex-post evaluation. The model chosen depends on the purpose of the evaluation and the linkage between the purpose of the evaluation and the method for the evaluation is examined here.

### **Purpose of evaluation – audit during implementation**

Audit of the stages of implementation, procurement, management and financing: By monitoring these stages of project development and delivery, evaluation can provide those responsible for approving the funding the project (Parliament, in the case of the UK's NAO) with an account of the management of the project by the transport department or other responsible authority. The evaluation can highlight risks to successful project delivery and recommend changes to tighten overall management so as to reduce the risk of project delays and of cost overruns. This also provides lessons for management of future projects.

There is a strong case for ensuring that such an audit is carried out by an organisation that is independent of the project sponsor. The UK NAO has noted that independent audit at an early stage in the delivery of a project reduces the risk of any overrun only becoming apparent when it is too late to take remedial action.

Experience in the UK suggests that the threat of external audit imposes a stronger discipline on Department for Transport and supports the Department's process of internal audit.

Many countries have within government an audit department which is independent of the department responsible for transport and other spending departments. Not all are as active as the US GAO or the UK's NAO or have the support of the UK Parliament's PAC to ensure that the legislature is aware of their findings. There is a case for strengthening the role of independent government audit departments in many jurisdictions and encouraging them to contribute to the objective of better management of the delivery of transport projects, thereby reducing cost overruns and encouraging those responsible to improve cost and demand forecasts.

## Purposes of appraisal – did the project deliver its objectives?

Policy makers need to know whether a project has delivered its objectives. Reassurance that the outcomes delivered by the investment are in line with impacts that were predicted at the time the decision was made provides policy makers with the confidence to continue with or extend the transport investment programme. It can also provide evidence to support the ex-ante appraisal methods used to justify the initial decision to approve the investment.

Evaluation can serve a number of objectives. These include:

1. *Identifying the differences between forecast and actual values for project costs, road traffic or public transport patronage volumes and other key impacts such as carbon dioxide emissions.*

One approach is to provide a high level assessment of the possible causes of any differences, such as the impact of the economic downturn, not anticipated when the scheme was approved. While such an approach might not provide the level of detail needed for a full comparison of the counterfactual with observed demand, it can help to improve the allowance to be made for risk and uncertainty in future decisions.

2. *Validation of the transport model used to estimate mode, route and destination choice.*

Evaluation is only used infrequently for the purpose of validating the transport model adopted to appraise a scheme. In many circumstances models become obsolete by the time the scheme has opened and become established, or the data and model runs are no longer available. Decision-makers are unlikely to be willing to prioritise funding for a new best-practice model to represent a counterfactual which, because the scheme has been built, could not exist.

3. *Understanding some of the key relationships between transport investment and its outcomes through econometric analysis of a sample of schemes.*

Several studies have been carried out in the UK to examine the link between changes in transport costs and changes in employment and productivity.<sup>10</sup>

4. *Determining the extent to which the decision-makers' objectives for the scheme or programme were delivered.*

These objectives might include economic development, defined in terms of additional jobs in the area, increases in productivity or take-up of industrial sites, population growth, encouraging housing developments, shift from car to public transport or to active modes, and reductions in carbon intensity or other environmental goals. This forms the main focus of most evaluations of transport schemes<sup>11</sup>.

<sup>10</sup> <https://www.esrc.ac.uk/my.../1eae75a5-2f1f-41f3-90e0-deb0c11f5a0e>

<sup>11</sup> A point mentioned in the roundtable discussions is also the need to properly define the project's objectives in the first place. For example, one can only speak about having a problem if there is at least

It should be noted that the objectives of some projects do not necessarily coincide with the value-for-money concept in economic theory or with the purpose of maximizing socio-economic welfare. For example, it is entirely possible that it is in the public interest to improve a transport connection to a dislocated community even if this intervention does not increase the social welfare of the nation (i.e. the project is assessed to have a negative net present value). In this context the challenge for the ex-post evaluator is how to devise a clear measure of success, which would differentiate between abuse of power and social necessity.

Evaluation to determine whether an investment or a programme of projects has delivered on policy objectives does not necessarily establish any causal link between the project and the outcomes. Even when the evaluation takes the form of validating the transport model and the responses to the changes in transport costs as a result of the investment, there is an implicit assumption in such an evaluation about the structural form and behavioural relationships within the model. The use of causal inference methods to attribute causation is particularly suited to transport investments because the decision about where and when to invest is not a statistically random one but one based on the greater perceived need in the location where the investment is made. In addition, the approach does not require any hypothesis about the counterfactual or about transport users' responses to changes in transport costs. While its application to transport schemes is still at the research stage, it has the potential to provide a valuable method for better evaluation.

Data are essential in any evaluation method. The French permanent observatories have set a new standard for monitoring changes over the long period during which a major new scheme influences travel demand and territorial development. The process of data collection needs to encompass the technological developments that have made possible changes in the way public transport is priced and accessed and how travel time is used.

Each approach has strengths and weaknesses – in terms of costs of collecting the data, the target audience and how it helps to improve decision-making and provide for more informed decision-makers. Case-study approaches in particular help transport ministers understand what complementary policies (land use planning, skills and training, institutional changes etc.) might increase the likelihood of transport programmes or schemes delivering their objectives.

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one solution available. If this is not the case, then our problem is only a fact. An example would be a road connection, which is congested and winding and the objective was to reduce congestion. An investment into a straight road would reduce travel time, but it would not reduce congestion (due to induced traffic for example). Thus the success of an intervention is also dependant on the proper definition of the objectives.

### **The way forward?**

The discussion papers presented at this roundtable each introduce a unique element:

- NAO's assessments, already in the project preparation and execution stages, enable monitoring on the spot, while the project is still running and corrective action is still possible, and accountability still enforceable.
- The T-PICS case-study approach, among other things, involves field research and interviews. Potentially it provides a source of information that can explain the relations between cause and effect.
- Transport observatories represent a robust approach to ensuring that short-lived data can be preserved and used in the ex-post evaluation.
- Causal inference methods provide a tool for the objective assessment of effects (but do not explain the functional relations which lead to them),

The latter three approaches also enable an improvement or calibration of structural models used in ex-ante assessments in terms of functional relations applied as well as the accuracy of predicted outcomes.

Combining these elements together may represent a holistic approach to ex-post evaluation, creating a high-resolution image of the outcomes we might expect from transport investments and other interventions. What perhaps remains to be determined in the future is a standard or best practice of ex-post evaluation that would combine these methods and their unique elements in the most efficient and cost effective way.

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