

EVALUATION OF RAIL SERVICES

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Abstract

Rail services are needed for basic mobility especially in rural areas and as a mean of reducing congestion and pollution as part of an integrated transport policy in urban areas. In transport expenditure generally there may be a number of options open but in the case of train passenger services there are essentially three: a) to retain the service in its present form, b) to close the service, c) to rationalise the network (by amending merging routes). The only railway likely to be profitable is one where there is an intensive use with high load factors. This is never going to be so for rural railways or on large commuter rail systems. This places the evaluation of such services into the political context. Therefore, it is important to identify the impacts generated from rail services and to determine the social value these represent. This information provides an objective basis for decisions on public funding of rail services.

The paper is planned as follows. Section 1 discusses the role of rail services. In section 2 examples of currently used evaluation techniques and criteria are described. This is followed by an examination of a potential approach to the evaluation of rail services, section 3. Section 4 discusses practical issues in relation to the approach outlined. Finally, section 5 summarises the findings and gives suggestions for further research.

1. INTRODUCTION

The process of evaluation of different options constitute an important activity in many different areas in order to enable and improve decision-making for various parties. This is also the case within the transport area where a range of different forms of evaluation can be identified such as financial analysis of service frequency increases for the Eurostar or cost-benefit analysis for the Great Belt Fixed Link. In this paper we will concentrate on the approach to evaluation for rail. In particular, our focus will be on rail evaluation undertaken from a social point and not a limited private perspective. A social perspective allows for a comprehensive evaluation of a given rail option, where all relevant impacts are taken into account. Therefore, our aim is to identify the social benefits and costs rather than the private benefits and costs for rail. The need to apply a social perspective to rail evaluation arise at least when public funding is involved and it is required to establish the “social value for money”. Two situations where public funding is involved in rail are:-

- Major rail infrastructure projects;
- Loss-making rail services;

The first situation refers to public funding for investment projects while the second one is concerned with funding support to the operation of rail services. In both situations a private perspective could imply that the “do-nothing” option is selected. However, if significant social benefits exist then these could justify public funding support. Obviously, other cases arise where it could prove necessary to undertake an evaluation from a social perspective. A good example could be the evaluation of the social benefits/social costs from rail services which are profit-making.

In this paper we will mainly consider the situation with respect to evaluation of rail services although experience gained from rail infrastructure investment appraisal will be taken into account. It should be mentioned that it is difficult to provide a clear-cut procedure which can distinguish between rail services and rail infrastructure projects for all cases.

The rest of the paper is structured as follows. Section 2 will examine currently used evaluation approaches for rail. In particular the proposed framework for evaluation of loss-making rail services in Great Britain will be analysed. In Section 3 it will be suggested how an evaluation framework for rail services could be developed. This will include the identification of relevant impacts generated from the operation of a given rail service and the approach to be adopted to allow for an overall assessment. This is followed by Section 4 where practical issues in relation to the suggested framework will be discussed. The analysis will include the extent to which data can be expected to be available and comparability issues will be considered with reference to the possibility to compare different rail services. Finally, Section 5 will conclude and summarise the paper and outline areas for further research.

2. CURRENTLY USED EVALUATION TECHNIQUES

There are three fundamental techniques available to evaluate projects involving rail services:-

- Financial Appraisal;
- Cost-benefit Appraisal;
- Multicriteria Appraisal;

Unless otherwise stated the appraisal is undertaken by comparing the situation with the rail service to the situation without the service.

2.1 Financial Appraisal

Financial appraisal of rail services assesses the financial viability in terms of revenue generated (or costs saved) and cost incurred (capital and operating costs). Provision of rail services will be considered if the revenue generated is larger than the capital and operating costs incurred. Obviously, financial appraisal excludes a range of different impacts which are of importance to society. Therefore, this appraisal form is more relevant in those situations where a private perspective is dominating, e.g. appraisals undertaken by private operators.

2.2 Cost-benefit Appraisal

Cost-benefit appraisal includes a wider range of impacts as community effects are taken into account, see e.g. Glaister & Layard (1994). This appraisal technique requires that the included impacts can be translated into monetary units. For example, in order to allow for travel time effects it is necessary to estimate a value of time measured in monetary units. According to cost-benefit appraisal a rail service is worthwhile to retain if the monetised social benefits are larger than the monetised social costs. A social surplus should be contrasted to an eventual financial deficits. In this way cost-benefit analysis enables the decision maker to obtain information about the social value of a rail service option measured in monetary units. Cost-benefit appraisal is relevant for rail services supported by public funding as these should take into account wider objectives compared to private operators which are mainly concerned with profitability. The applicability of cost-benefit analysis depends on the extent to which it is possible to translate the different impacts into monetarily measured impacts. If it is difficult to obtain such measures for some impacts it introduces a bias towards support to rail services which are achieving high levels for monetised benefits irrespective of the impact levels for the non-monetised impacts. Good examples of impacts which are difficult to measure in monetary units are environmental related impacts, accidents and psychological effects.

2.3 Multicriteria Appraisal

The multicriteria approach has been developed in order to allow for project appraisal with inclusion of impacts which cannot be measured easily in monetary units, see Nijkamp & Blaas

(1994). The decision maker's value judgment does not have to follow a monetary basis but can reflect subjective values. In general a multicriteria appraisal is directed towards the ranking of several project alternatives with the purpose to select the best possible option. Therefore, multicriteria appraisal requires the evaluation situation to be such that several project alternatives are available, the minimum is the comparison of one project alternative to a Do-Nothing alternative. A general problem with the multicriteria analysis is that the scope for double counting impacts is likely to be larger compared to cost-benefit analysis.

Below, a recently formulated evaluation approach will be detailed out. It describes the proposal for appraisal of loss-making services in Great Britain.

2.4 Rail Service Evaluation - Office of Franchising Director OPRAF, Great Britain

In a recent consultation paper, OPRAF (1996) the UK Government's Agency responsible for franchising and funding of rail services in Great Britain (Office of Passenger Rail Franchising Director - OPRAF) suggested an appraisal framework for loss-making services. This proposal will be outlined below. The rationale given for appraising loss-making services is that it can be used to establish whether support by OPRAF provides good value for money and to demonstrate that without support socially desirable projects would not be undertaken. OPRAF states that it needs to develop an appraisal framework which reflects the objectives of OPRAF and is able to cover a wide range of different projects. OPRAF believes that a cost benefit analysis (CBA) is the best suitable option with allowance for impacts which cannot be transferred into monetary units. It is stressed that a full CBA will not be required in all cases. In some cases it will sufficient to compare revenue to costs and a broad impact statement. In the final guidelines from OPRAF it is intended to produce some indications regarding when a detailed CBA is needed. In developing the appraisal framework OPRAF has been seeking to achieve consistency to the approach followed by Department of Transport (DoT). It should be noted that OPRAF does not consider the appraisal framework as fixed but will be open to new research into evaluation. The framework is intended to be used for assessment of rail projects affecting service provision and the budget position of OPRAF.

The main decision-making criterion for OPRAF will be the net present value of benefits per pound of OPRAF support, where the precise cut-off ratio will be determined by the available funds. Non-monetary impacts should, where material, be presented in qualitative or, where possible, in quantitative terms. In the presence of non-monetary impacts OPRAF is suggesting three ways to take this into account in the evaluation:-

- a) assessment of the required value on non-monetary impacts to justify a project;
- b) comparison of schemes only serving similar markets; and
- c) adoption of different cut-off levels for the ratio of net benefits per pound OPRAF support for service enhancements and reductions.

The points a) - c) might lead to more detailed analysis of the non-monetary impacts. The final

decision on whether to support a project will depend on affordability in terms of amount of support and funds required over different periods. Following the DoT approach, OPRAF will in general assume users to pay for the benefits from service improvements such that new services can only expect to get support up to the level of non-user benefits. However, OPRAF is willing to consider additional support up to the level needed to secure the project, where there are compelling reasons to believe that user benefits cannot completely be captured through fare revenues.

The following monetary costs and benefits are included:-

- Financial costs. These costs are defined as the avoidable costs of the project, such as capital costs, implementation costs and operating costs over the life time of the project. Most projects will involve only current expenditures to be compared with revenue benefits because of the separation between service operation and infrastructure provision. Changes in access and leasing charges should generally provide a sufficient guide to avoidable costs. This general assumption should be reassessed where a service reduction is being considered. Station access charges (paid by train operators) are allocated on an average rather than marginal cost basis. The withdrawal of a train operator from a station served by more than just the one operator, would lead to a proportional increase in access charges for the remaining operators.
- User costs and benefits. Changes in operator's revenue are in general assumed to approximate people's willingness to pay to achieve user benefits, that is fares should be adjusted to capture changes in user benefits. However, the appraisal proposal recognises that user benefits might exist which are not reflected through the farebox. The valuation of such unpriced user benefits should be based on the concept of generalised time/cost of travel. Each component is given a monetary value, which are added to other monetary costs (e.g. fares). The total represents the amount users are willing to pay over and above the fare actually paid. The user benefits/costs considered in this framework are: fares, journey time (in-vehicle, waiting, access/egress), frequency, reliability/punctuality, interchange, rolling stock quality overcrowding and station facilities.
- Non-user benefits - congestion. Improvements in rail services may lead to decreased congestion for other modes e.g. roads. This will effect journey times, operating costs and efficiency. These effects are likely to be material, for example, significantly effecting urban commuter services, whilst having less effect on off-peak rural services. Second wave effects need to be taken into account. Other factors would include journey time savings and reduced operating costs to non-rail users. In addition, accident reductions could be relevant.
- Safety. OPRAF is only involved in discretionary projects concerning safety improvement. OPRAF would expect improvements equal to and above the specified safety standards to be included in the evaluation. Safety forms part of the non-user benefits assessment and the evaluation of impact on accident costs. Central to this process is the "values of life" criteria recommended by the DoT. The Franchising Director would expect safety benefits for users to be taken into account via the farebox.

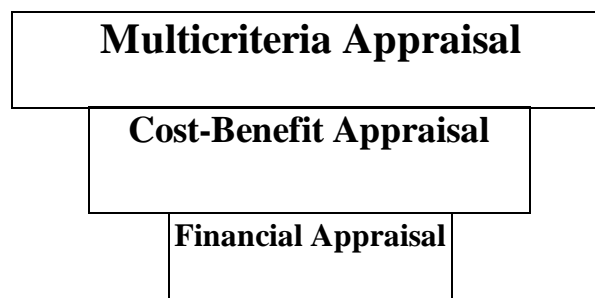
Non-monetary Costs and Benefits:-

- Environmental impacts. These are not readily measurable. Environmental impacts can be split into those which are subject to planning regulations and compensation procedures, and those impacts over and above these administrative processes. The costs of the former will be included in the scheme costs. The latter impacts would include issues such as planning blight, landscape/land use, noise, severance, pollution (air), land/water pollution, and lineside ecology. In terms of environmental externalities, policy initiatives aimed at internalising impacts in the transport sector would have to be accounted for.
- Option values. In some cases people may be willing to pay to preserve the option of using the railway in the future, given uncertainties concerning future income, and modal preferences, even if the train is not used by the individuals at present.
- Existence values. These values are not concerned with usage, but the value of railways as part of the national heritage.
- Status Quo. Service reductions are valued more highly than service gains.
- Accessibility. These benefits will mostly be covered by standard user benefits and option values. There may be changes in accessibility values associated with alterations in travel opportunities. These changes may impact heavily on certain sections of the travelling public e.g. the provision of first and last trains. Changes in transport provision have to be assessed in terms of impact on the level of accessibility. The detail of analysis will depend upon the materiality of the decision. Normally a qualitative assessment would be made of all trips to analysis how many of the trips could continue to be made by public transport. Wider social impacts such as accessibility for the mobility impaired and leisure travel would be assessed.
- Economic/Regeneration impacts. Changes in transport provision may bring wider economic impacts. These impacts, if material, would be considered, but would not be included as a net benefit of a service change. The risk of double counting impacts is stressed for this type of impacts.

The proposed appraisal framework for loss-making rail services in Great Britain represents a clear step forward as it provides for a comprehensive generalised approach with sufficient flexibility to be applied in a variety of different situations. However, the proposal contains two important problems. Firstly, it is problematic that the framework aims at marginal projects without securing that the total rail service provision profile is appropriate from the outset. Secondly the suggested procedures to use in relation to non-monetary impacts are questionable. In particular, it is difficult to utilise the procedure for calculation of the required value to be assigned to non-monetary impacts as it will imply that the residual value will be assigned to one non-monetary impact at a time without the possibility to examine the interaction between the different non-monetary impacts.

3. THE CHOICE OF APPROACH

In this section it will be considered how a comparative approach to evaluation of rail services can be developed. This will be undertaken on the basis of the information presented in the previous section. As a starting point consider Figure 1 which summarises the characteristics of the evaluation techniques from section 2. Figure 1 illustrates how the three main forms of project appraisal techniques differ with respect to the impacts considered.



Number of Impacts

Figure 1

The figure shows that financial appraisal includes the smallest number of impacts, followed by cost-benefit appraisal, while multicriteria appraisal allows for the most comprehensive evaluation. This does not imply that multicriteria appraisal should be used to evaluate all projects related to rail services and financial appraisal should be avoided. Obviously, a financial appraisal is needed for privately undertaken rail projects without public sector involvement. In addition, financial appraisal can have a role for public funding support to rail services too in order to assess the financial viability of a project. However, the main focus for public sector involvement should be on project impacts related to the community, thereby suggesting that the core appraisal should be based upon cost-benefit and multicriteria analysis.

Similar, although multicriteria analysis can accommodate for a wider range of impacts than cost-benefit analysis it is not possible to conclude that multicriteria analysis should always be used to evaluate rail service projects while cost-benefit analysis should never be applied. Cost-benefit analysis provides useful information concerning the monetary value of a project and this type of information is per definition excluded to appear in a multicriteria analysis. In addition, multicriteria analysis can be difficult to apply in situations where only a single project alternative is to be considered, as noted in the overview of the technique. Cost-benefit analysis can be used with a single project alternative (with reference to a do-nothing option) giving this method a strong role in such situations. Therefore, a more appropriate conclusion would be to use cost-benefit analysis along with multicriteria analysis to evaluate rail service projects. The joint application of multicriteria and cost-benefit analysis can be undertaken in two ways:

- (i) Separated application of cost-benefit and multicriteria analysis
- (ii) Integrated application of cost-benefit and multicriteria analysis

The first approach is relative straightforward to apply following the standard principles for the two techniques. An integrated application of cost-benefit and multicriteria analysis is more interesting but also more cumbersome to apply. It is necessary to modify standard methods in order to reach a combined methodology which can utilise the flexibility given by multicriteria analysis without lacking the monetary basis from cost-benefit analysis. This new approach could be reached by either changing the multicriteria technique to include monetary valuations or changing cost-benefit analysis towards multicriteria analysis.

One possibility could be to apply cost-benefit analysis in a first phase with respect to those impacts which with no or only limited problems can be transformed into monetarily measured impacts. This appraisal is then supplemented by multicriteria analysis where non-monetary impacts are included as well. This phase can eventually be divided into several sub-stages according to the degree of difficulty of measuring non-monetary impacts. This approach has been recommended in a recent EU transport research project APAS, see APAS (1996). The choice of the specific multicriteria techniques to use will depend upon the type of data available for the analysis. A range of different techniques have been designed to accommodate for the various forms of data.

Although we argued above for an integrated application of cost-benefit and multicriteria analysis it is important also to recognise the value of using several evaluation techniques rather than just a single one. If the assessment of a rail service project is based on a single method then it is possible that the results could be caused by the specific method used and not some general properties. Therefore, the use of several techniques can give the evaluation a broader basis and enhanced credibility. In addition, the use of several techniques to evaluate a given rail service project enables more and different aspects of the project to be revealed.

Apart from specification of the relevant methodology framework it is also necessary to identify the impacts to be considered in the evaluation. On the basis of the information presented in the previous section the following list seems to provide a valid identification of relevant impacts. It should be noticed that these impacts are net-impacts in the sense that impacts appearing as benefits for one party and as costs for another group have been excluded from the list. Therefore, a list of gross impacts comprise additional elements:-

- avoidable operational costs
- avoidable infrastructure costs
- time impacts for rail users
- public transport overcrowding impacts
- other user impacts
- road congestion impacts
- road maintenance impacts
- road accident impacts
- environmental impacts
- regional development impacts

These impacts generated from provision of a rail service are the ones which should be assessed when public funding support is considered. The most controversial impact category is probably regional development impacts as it is difficult to determine whether regional development impacts merely involves redistribution or in fact provides for net regeneration.

4. PRACTICAL ISSUES

So far the feasibility of the proposed evaluation approach has not been considered. Below, we will examine two practical issues in order to assess the extent to which the approach is feasible:-

- data availability;
- comparability between rail services;

For the majority of impacts listed above it is possible to collect information measured in quantitative terms and translated into monetary based units. Infrastructure and operational costs will be available from cost accounting systems. User benefits can be estimated from passenger demand forecasting models and translated into monetary units through information from stated/revealed preference (SP/RP) experiments. Non-user benefits can be established from traffic forecasting models and transformed into monetary units through SP/RP results. Difficulties arise among the last listed impacts such as environmental impacts and regional development effects as well as (to some extent) accident impacts. These can be difficult to translate into monetary units and problems can appear in relation to the quantification. The problems of quantifying these should be connected to the extent that these impacts are complex and somehow intangible. Furthermore, the problems are increased by the limited extent to which it can be identified that changes in these areas are the result of a rail service project. This problem could in fact also be of relevance to other impacts.

The second mentioned issue concerns the extent to which different rail services are comparable. Obviously, each rail service can be described as unique. However, within a given country the institutional/organisational set-up is relatively similar for the different rail services. This is less likely to be the case for comparisons between rail services in different countries. In relation to the context of rail service evaluation the main question is whether comparisons between rail services can be based on the identified impacts. In general, it can be claimed that the identified impacts have been put forward in order to establish an evaluation approach which can be used in different situations without the need to change the variables included. A major issue will be to secure that the different impacts have the same interpretation for different rail services. This includes the need to secure data compatibility.

5. CONCLUSIONS

The evaluation of projects involving rail services can be undertaken using a number of different techniques. This paper has examined the applicability of the three main types: financial, cost-benefit and multicriteria appraisal. It was shown that they all have a role to play in the assessment

of rail services. However, it was stressed that financial appraisal techniques are more relevant for private funding cases while public funding involvement should also be evaluated using cost-benefit and multicriteria analysis. In addition, it was recognised the importance of evaluating rail projects using several techniques in order to reach robust conclusions about the worthwhileness of the projects. The use of a too conservative appraisal technique can lead to the rejection of projects which would pass with other techniques.

It was suggested how cost-benefit analysis and multicriteria analysis could be integrated in order to achieve a comprehensive evaluation approach. In addition, a series of relevant impacts generated from rail services were identified and practical issues with respect to these impacts were discussed. Further research is necessary to improve the impact assessment methods with respect to determining whether impacts occur as the result of the provided rail service or are caused by other factors.

The point of assessing rail options by several techniques indicate also that the evaluation process should mainly be concerned with providing information about the worthwhileness of the projects rather than deciding whether projects should be approved or not. In this way the outcome of an evaluation can be seen as a way to improve the decision making basis but not as way to decide on the projects. This point emphasises that the ultimate decision concerning approval or rejection of supporting rail service projects will be a political one.

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