

A REVIEW OF APPRAISAL METHODOLOGIES OF FEASIBILITY STUDIES DONE BY PUBLIC PRIVATE PARTNERSHIP IN ROAD PROJECT DEVELOPMENT

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Abstract

Recent years have seen a dramatic increase worldwide in the development and funding of public facilities and services, the techniques are continuously being developed to draw the public and private sectors together with a view to sharing the risks and rewards associated with such activities.

These various techniques are often referred to as 'Public/Private Partnership' (PPP) and range from the simple contracting out of services to the involvement of the private sector in the financing, design, construction, operation, maintenance and, in some cases, ownership of major infrastructure facilities.

In the PPP road projects, the government will carry out a socio-economic and a financial analysis as part of the appraisal of the project and its set-up at the time.

The results of the road project appraisal have significant impact on the decision-making of the people who are directly and indirectly concerned.

Since the aim of the road projects appraisal procedure is to prevent decision-makers from making subjective or risky decisions, the objective evaluation criteria should be used, and a reasonable and transparent evaluation procedure should be applied.

To this end, this paper reviews advantages and disadvantages of appraisal methodologies and suggests appraisal tools for the road project development in the frame of PPP.

Keywords: PPP, road project, socio-economic analysis, appraisal methodology, evaluation.

1. Introduction

Recent worldwide trend in road infrastructure has been to introduce private capital on the basis of public/private partnership (PPP) in many areas to build and operate road infrastructure. The private sector has access to vast amounts of invest capital and better management skills than government workers do in many cases.

The results of the road project appraisal have significant impact on the decision making of the people who are directly and indirectly concerned, whatsoever the results are from an economic appraisal or comprehensive analysis (see *Fig. 1*).

Since the aim of the road project appraisal procedure is to prevent decision-makers from making subjective or risky decisions, the objective evaluation criteria

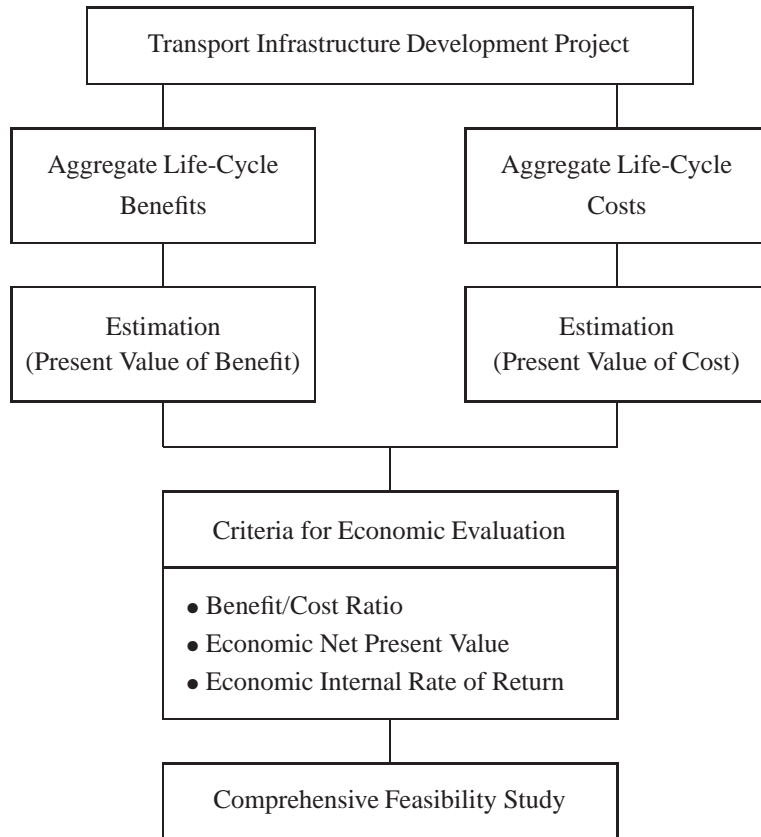


Fig. 1. Procedure of cost benefit analysis

should be used, and a reasonable and transparent evaluation procedure should be applied.

A comprehensive feasibility study ought to be threefold. Firstly, alternatives considered have to be technically feasible to design, construct, and operate.

Secondly, the environmental impacts need to be identified and possibly quantified and valued in monetary terms.

Last, life-cycle costs and benefits are to be projected, and the overall economic viability is to be determined.

This paper mainly deals with the economic aspect of the feasibility study making in the frame of PPP.

2. Cost Benefit Analysis (CBA)

CBA is one of the most frequently used methods for assessing the impacts of road projects.

It generalizes the classical criterion of financial gain by also considering the market effects as well as the non-market effects of decisions, positive (=benefits) and negative (= costs) and bringing these to a monetary value.

The values of benefits and disbenefits being derived from monetary values, the biases that may come from the analyst or the decision-maker seem weaker than with other methods of evaluation, which apparently contributes to making the method more objective.

Examples of elements taken into account:

Costs: Land Acquisition, Construction, and Maintenance etc.,

Benefits: Gain in time for the users, Economy in the wear and maintenance of vehicles, Economy in fuel, Reduction in traffic accidents and Comfort accruing to users etc.

The validity of a road project is satisfied when 1) the benefit is greater than the cost, and 2) profitability is greater than those of other alternatives.

The three main criteria for verifying the validity of the road projects are:

1. Net Present Value,
2. Benefit/Cost Ratio,
3. Internal Rate of Return.

The strong and weak points of the above mentioned three most important evaluation criteria are as follows:

2.1. Net Present Value (NPV)

NPV is an absolute and present value of total net benefits.

$$NPV = \sum_{t=1}^{t=n} \frac{B_t - C_t}{(1+i)^t}$$

Here, B_t : Benefits of t , C_t : Costs of year t , t : years (1, 2, 3 ...), i : discount rate.

NPV is a proper method to select one among several alternatives. The weakness of NPV is that the value changes as discount rate differs.

Therefore sensitivity analysis is essential when NPV is applied as criterion.

2.2. Benefit/Cost Ratio (B/C)

B/C calculates this formula and the meaning of letters is the same here.

$$B/C = \frac{\sum_{t=1}^{t=n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{t=n} \frac{C_t}{(1+i)^t}}.$$

B/C is a relative value, so it does not concern the value of NPV.

It is not proper to use B/C as criterion when choosing a project in mutually exclusive cases.

Though B/C is affected by the discount rate, it is an easy method to get a switching value.

2.3. Internal Rate of Return (IRR)

The calculation of IRR can be done using the following equation and then by iteration.

$$NPV = \sum_{t=1}^{t=n} \frac{B_t - C_t}{(1+r)^t}.$$

Here, r means IRR and the other letters mean the same as above.

IRR is the rate of discounting the future that equates the initial cost and sum of the future discounted net benefits (namely $B/C = 1$ and $NPV = 0$).

The good point of IRR is that it does not need a discount rate in economic evaluation.

IRR is a barometer to know the rate of return from the investment directly.

According to the criterion for IRR the project is effective (viable) when the latter (r) is greater than the discount rate (i).

3. Further Methods for Supporting Decision-Making in Road Project Evaluation

There are a large number of systematic frameworks that are advocated and used in many countries. The types of frameworks widely advocated and which we will concentrate on in this section are:

1. Cost Effective Analysis,
2. Multi-Criterion Analysis,
3. Risk Benefit Analysis.

3.1. Cost Effective Analysis (CEA)

CEA deals with benefits that are not easily quantified or for which there are no easily defined money units. There is, thus, no formal rule for determining whether a policy is desirable or not.

The principal aim of CEA is to obtain a money-based index that is helpful in comparing alternatives with the same general type of objective.

Such an index can be obtained as follows:

Cost Effective Index = Units that measure consequence/Cost in monetary units.

Thus a project with the highest index is preferred.

3.2. Multi-Criterion Analysis (MCA)

MCA takes into account both the effects that are valued in monetary terms and other effects considered to be of interest.

In relation to CEA, MCA tackles the problem of several effects arising from a policy, which CEA cannot.

Since effects of a policy cannot be added together directly because of the lack of a common unit (which would be money in case of CBA), MCA places a weighting factor on the individual effects.

If, for example, reduced accidents were more important than gains in scenic beauty, then they would be weighted with a higher factor.

The various benefits may then be summed up in their weighted form. For example, if benefits are accident reduction (A), scenic beauty (S), and savings in travel time (T), and their respective weighting factors are a , s , and t , then the overall benefit is B' , where:

$$B' = aA + sS + tT.$$

The weights are in fact prices since they reflect the relative importance of each of the objectives. They are, however, derived in a number of ways: by asking experts; by asking individuals and by asking decision-makers.

It should be observed that the resulting B' can be assessed as the cost effectiveness index shown in 3.1 as B'/C (where C is the cost in monetary units).

MCA is more complex than the general description given here.

The main advantage of MCA is that it incorporates the multiple objectives that decision-makers generally have, and if the weighting factors can be derived, it enables diverse objectives to be integrated.

When compared to CBA, the fundamental difference is that economic efficiency is not the sole objective of a policy.

3.3. Risk Benefit Analysis (RBA)

One of the key issues in PPP projects is the analysis and allocation of the various risks (such as completion risk, operation risk, commercial risk, financial risk, legal risk, political risk and environmental risk, etc.) associated with the project between the public and private sectors and, after that, among the individual parties involved.

The application of decision rules to risky events has led to the emergence of RBA. RBA is nothing other than CBA in the context of a risky event.

To see the formal equivalence, consider a transportation project that will increase the level of pollution and hence the risk of being sick.

The risk of such a policy is the number of people being sick due to the increased pollution. The benefits of “no action” are the avoided costs of decreasing the pollution and the illness.

We can therefore compare the risk with benefits to give us ‘risk benefit analysis’. The similarity with CBA is that RBA takes the number of sick people to be the cost and the foregone resource cost to be the benefit.

4. Comparison of Road Investment Analysis Methodologies

The economic analysis is used worldwide. Recently a number of countries, which realized the limitation of the economic analysis, applied the comprehensive appraisal methodology as an alternative method (see *Table 1*).

Table 1. Classification of road investment appraisal methodology concerning countries

Applied method	Traditional benefit-cost analysis	Relying on benefit-cost analysis	Relying on multi-criterion analysis	Mainly on multi-criterion analysis and partially benefit-cost analysis	No particular framework or framework varies with state or province*
Country	Denmark Greece Ireland Portugal	Germany Italy England Japan Korea	France	Belgium The Netherlands	Canada, USA

Source: European Commission (1996), Transport Research EURET Concerted Action 1.1, VII-2; Cost-benefit and multi-criterion analysis for new road construction, ECSC (Belgium) and Ministry of Construction of Japan (1998), Korea Research Institute for Human Settlements (1999), *(EURETT/385/94 report).

England prefers NPV and B/C for decision (see *Fig. 2*).

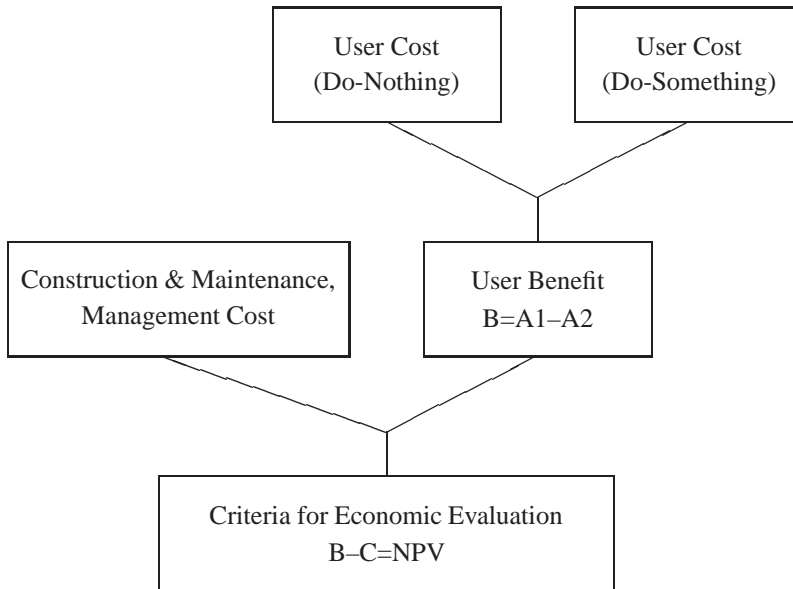


Fig. 2. Cost benefit appraisal system of COBA

The Netherlands and Belgium rely mainly on the comprehensive appraisal and partially the economic analysis method.

Germany, Italy, and England are based on the economic appraisal.

France used a multi-criterion analysis previously and nowadays considers the economic analysis. Germany valued the environmental impacts in money terms.

The countries that prefer the economic analysis adopt a road project if the B/C ratio is higher than 1.0. But, Japan adopts one if the B/C is over 1.5 and Germany ranks one as first-order project if the B/C is higher than 3.0.

IBRD, ADB etc. prefer the IRR because setting of discounting rate is not proper.

5. Appraisal Tools for PPP Road Project

In the PPP preparation phase the public project promoter will carry out a socio-economic and a financial analysis as part of the appraisal of the project and its set-up at the time.

The main objective is to determine whether the PPP option leads to a more efficient project implementation than that achieved with traditional public financing.

In the PPP negotiation phase these appraisal exercises will have to be updated for changes in the set-up of the project following Step2. Moreover, the preferred

bidders – lenders, investors, operators, suppliers and/or constructors – will perform their own (cash-flow and risk) analysis of the project.

In principle, there are several conceptual and functional differences between typical socio-economic and financial analysis.

5.1. Socio-Economic Analysis

The socio-economic analysis in its widest sense remains a fundamental criterion influencing decisions on tolling either stand-alone projects or a whole infrastructure network.

This means that the capital and operating costs, the direct benefits to the road users and the indirect benefits to all other entities and the community as a whole (especially associated to land use and regional development), together with social and environmental costs, have to be taken into account.

These costs and benefits for society evaluated in monetary terms can be converted into a socio-economic rate of return for a given project.

5.2. Financial Analysis

The financial analysis for a project is calculated taking into account only the actual costs and the monetary revenues and is expressed as a rate of return on investment or on equity.

The heart of the evaluation of financial viability is a cash flow model, showing the yearly or semi-annual distribution of all project-related expenses and revenues under several funding options.

The results of the financial viability evaluation (Return on Equity, Debt/Cover Ratios, e.g.) serve as a base for decision in respect of eligibility of the project for limited recourse project finance after taking into account the governmental support available. The impact of changes in assumed conditions or input data should be appropriately assessed by a series of sensitivity tests.

The investment financing activity can only be performed with the help of target software run on a computer providing manageability of the immense quantity of data records and producing an output corresponding to the expectations of the international financial institutions both in content and form.

Unlike the majority of the project finance models developed to the PC platform INNOFINance is based on a database (Microsoft Access) – an ideal instrument for project finance modelling not only in the economically stabilized countries, but also in the developing areas, where the shortage on sound financial data and forecasts makes the analysis of several cases very important.

5.3. Socio-Economic Analysis for PPP Road Project

The decisions of the policy-makers are based on the results of socio-economic analysis, while the financiers consider only the financial viability of an operation (see *Table 2*).

Table 2. Comparison between socio-economic analysis and financial analysis

Comparison	Socio-economic analysis	Financial analysis
Point of view	Public, society	Private, project
Objective	Maximize public benefits	Maximize private benefits
Types of effects	All benefits and costs to society (including external costs, excluding transfer payments)	All receipts and outlays that affect the financial position of a company (excluding external costs, including transfer payments)
Time horizon	Lifetime of project	Time of private involvement
Taxes, subsidies	Excluded	Included
Prices used in valuation	If market prices fail to give a comprehensive picture of the value to society, these prices are to be replaced by economic prices	Actual, domestic market prices
Evaluation method	Cost benefit analysis, Multi-criterion analysis e.g.	Return on equity, debt/cover ratios, cash-flow analysis e.g.

A wide range of external effects is incorporated into a traditional socio-economic cost-benefit analysis of a project. The project may yield an appropriate economic rate of return to the community while being unable to attract private investors and lenders, due to its weak revenue generating potential and lack of financial viability (low return on equity accompanied with high risk e.g.).

In this case, a PPP frame approach (leading to appropriate risk allocation, involving eventual public financial support) gives better position for more complex parties (governments, political parties, financing institutions, and all the industries involved in public services or facilities of any sort) making the project viable.

The conceptual identification of positions, motivations and further characteristics is not only possible but helps all partners to understand better the structure, the rules and roles given in the procedure they are involved. Use of the gaming perspective in PPP issues seems to enhance 'fair play'.

There are continuously developed methods to meet the needs of the public sectors, the private sectors and domestic and international financial institutions together with a view to sharing the risks and rewards associated with such activities.

6. Conclusion

As already reviewed, cost-benefit analysis (CBA), multi-criterion analysis (MCA) or a mixture of the two are the most frequently used methods for assessing the impacts of road projects.

MCA method came out, as traditional CBA for road project appraisal did not cover versatile policy purposes in the evaluation process and as a result it failed to satisfy decision-making efficiently.

Particularly some socio-economic and environmental impacts from road projects must be included in the decision process, however the CBA did not consider them successfully.

Therefore some scholars began to consider several items for decision-making, and then a conceptual framework was made such as socio-economic analysis (SA) etc.

The SA is the basis for the collective approval of projects mainly used by the public sector. Project and priority selection should be based on this analysis.

As regards socio-economic aspects explore on the one hand ways to improve transparency of evaluations and reliability of assessment of impacts that cannot be converted into monetary terms, and on the other, make progress on the knowledge of the infrastructure impact on the national and local development.

On the other hand, the financial evaluation (FA) aims at ensuring the financial practicability of the project mainly used by the private sector. It determines who bears the initial costs and how they will be repaid.

Money has to be paid for; there must be return on capital.

The gap between SA and FA is significant when the project is socio-economically sound but financially unjustifiable.

To bridge this gap the result of FA must be positive: the expected (private) benefits must (sufficiently) exceed the expected (private) cost (including risk).

Solutions to bridge the gap for road projects on the basis of PPP principal, public sector's reasonable measures are needed (subsidy, user charges, shadow tolling etc.).

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