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Benefit–Cost Analysis of Transportation

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Benefit–cost analysis (BCA) is the standard procedure to assess projects and policies in the transport sector. The method involves the identification, measurement, and monetary valuation of all effects of the project. This includes the financial costs of implementation and operation of the project and intangible effects such as travel time benefits and gains, environmental impacts, and changes in accident risk. The project is identified as desirable if aggregate benefits exceed aggregate costs. The values of effects occurring in the future are converted to present values using a discount rate. Although the method provides reliable indicators of the worth of the project, it is often criticized due to its focus on issues of economic efficiency and failure to address other social objectives.

Benefit–cost analysis is the most common method to evaluate the worth of a transport project and to compare alternative projects. Transportation agencies and policy makers in most countries use a version of this method to support decisions. The popularity of the method is explained by its relative simplicity and by its strong links with economic theory. The rationale of BCA is that a project generating net benefits is worth undertaking. This relies on the postulate that a project has social value if the people who are made better off are able to potentially compensate the people who are worse off and still be better off. The method also presupposes that it is possible to assign a monetary value to all (or at least to the large majority of) benefits and costs of the project. As the evaluation of public projects is based on their effects on the whole society, the method is sometimes referred to as social benefit–cost analysis.

The financial costs of the project are an essential component of the analysis and include the initial costs of construction of transport infrastructure or application of transport policies and the operating costs throughout their lifetime. These costs are assessed through the market value of the resources used (including labor and capital). Changes in vehicle costs (such as fuel and maintenance) can also be valued by referring to the market price of the relevant goods. The estimation of the effects of a project in the consumption of these goods should, however, consider several factors, such as changes in travel patterns following the project.

The assignment of a monetary value to other costs and benefits is less straightforward, as most of them are intangible and not traded in the market. The usual procedure in these cases is to obtain a measure of people's preferences, measured as willingness to pay or accept marginal units of the units of the effects of the project. These preferences can be estimated directly by surveys (stated preference methods) or by assuming that the market prices of goods and services related to the effects indirectly reveal people's preferences over these effects (revealed preference methods).

The assessment of travel time savings or losses is a component of most BCA in the transportation sector. The usual approach is to estimate average travel times before and after the implementation of the project for several types of individuals, trip purposes, and times of day or week. The changes in travel times are then multiplied by unit monetary values of travel time for each type. These unit values are often predetermined, based on recommendations of previous studies or on official standards. In other cases, values can be linked to wages or to other market prices. The evaluation of the aggregate travel-time benefit or cost also requires a forecast of travel demand after the project or policy is implemented, considering induced and suppressed trips and changes in transport mode, routes, or other choices of the individuals in the transport market.

The assessment and evaluation of the effects of the project are also complex in the case of external costs and benefits, that is, impacts on individuals who are not users of the project.

This is the case with environmental impacts, which include local and global air pollution, noise, land use, community severance, and effects on wildlife. The quantification of these impacts is not simple, as the effects are uncertain or depend on many contextual variables (for example, meteorological conditions affecting the dispersion of pollutants). The assignment of a monetary value to the effects also depends on factors such as people's perceptions about the extent of the effects, their impact on human health, and the existence of altruistic preferences toward the effects on other individuals or on nonhuman beings. The monetary valuation of environmental effects is often supported by surveys or by hedonic analyses. In the latter case, it is assumed that the housing market is a proxy for costs such as local environmental pollution. Differentials in local rents or house prices can then be treated as indicators of the price of different levels of local air pollution or noise.

The evaluation of safety issues presents similar problems, as there is a high degree of uncertainty in the effects of projects in risk levels. The monetization of property damages is relatively simple, as they can be linked to a market value. However, the assignment of monetary values to human injuries, fatalities, and lives lost is controversial, due to the sensitivity of the issue. These values are usually inferred from the costs incurred to prevent accidents or from cost of medical treatment or productivity and income losses following accidents.

The BCA method treats the effects of the project occurring in the future by applying a discount rate that converts them to present value. This approach is based on the hypothesis that a monetary value is worth more in the present than in the future. The choice of the discount rate to use in the assessment of a given project is not consensual. The most common method is to use current interest rates for borrowing money. The analysis also needs to specify the period in the future after which benefits and costs become irrelevant or are impossible to estimate.

Criticisms

The use of BCA in transportation has been subject to criticism because of a perceived failure to address noneconomic concerns and ethical issues. Most of the arguments deal with the fact that by measuring benefits and costs through people's willingness to pay, the welfare of individuals with lower ability to pay is given a lower weight. The use of a single measure to assess projects, based on net benefits, is also criticized because it addresses only objectives of economic efficiency and does not consider other social objectives, such as equity in the distribution of costs and benefits among different individuals or income or ethnic groups. Due to these limitations, in recent years BCA has been increasingly used alongside other methods, the most important of which is multicriteria analysis.

- monetary value
- discount rate
- transport policy
- transport infrastructure
- costing
- transportation
- marketing value

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See Also:

- Environmental Impacts
- Ethical Issues
- Multiple Criteria Decision Making/Aiding
- Risk Analysis/Assessment
- Travel Demand Forecasting

Further Readings

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