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# PRACTICE OF COST BENEFIT ANALYSIS IN TRANSPORT INFRASTRUCTURE PROJECTS IN THE EUROPEAN UNION

### Summary

The goal of this paper is to compare different EU methodologies used for appraisal of investments in transport infrastructure in order to address the problem of direct and indirect effects measurement. European methodology for CBA assessment includes recommendations for inclusion of not only direct but also some indirect effects. For instance VoT, cost of accidents, use of infrastructure, environmental effects should be measured and used as factors in CBA analysis. Currently the problem of inclusion of additional wider economic benefits (like employment and growth effects) is being discussed. At the same time national appraisal practices vary and are often distant from the suggested model. In this paper the scope of current cost benefit assessment in infrastructure projects in various EU countries is discussed. National practices are further compared and their strong and weak points are enumerated which could be a basis allowing for better inclusion of social benefits and costs into transport infrastructure assessments.

**Keywords**: infrastructure projects appraisal, Cost Benefit Analysis, appraisal methodologies

## Introduction

The goal of this paper is to compare different EU methodologies used for appraisal of investments in transport infrastructure in order to address the problem of optimal inclusion of direct and indirect effects into appraisal methodologies.

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For instance value of time, cost of accidents, use of infrastructure, environmental effects should all be measured and used as factors in CBA analysis. At the same time national appraisal practices vary and are often distant from the optimal model. In this paper the scope of current cost benefit assessment in infrastructure projects in various EU countries is discussed. National practices are further compared and their strong and weak points are enumerated which could be a basis allowing for better inclusion of direct/indirect effects and resulting social costs and benefits into transport infrastructure assessments.

In assessing the transport infrastructure project, it is essential to clearly specify the goals they are designed to achieve. In the European Union typical appraisal in infrastructure projects is based on CBA (cost benefits analysis). Although there is an EU level official guide on CBA assessment[2] there are many differences between national practices in the way those guidelines are translated into national methodologies. Major variations could be found in regard to[3]:

- Choice of investment variants/scenarios;
- Treatment of costs;
- Inclusion or exclusion of certain cash flows in calculation of NPV;
- Discount rate and time horizon adopted;
- Method for NPV (or ENPV) calculation;
- Assessment of residual value of the investment.

CBA is a method of choice within EU because it allows for analysis of not only direct effects on the investor but also of effects from the broader – social perspective. The heart of method is calculation of net costs and net benefits of the investment which includes both investors and society perspectives. The result of this type of assessment leads to calculation of net present value (both financial and economic).

## 1. Components of appraisal methodologies

Appraisal methodologies usually follow the general pattern established by EU guidebook on CBA. General project description is followed by establishing

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[2] *Guide to cost-benefit analysis of investment projects Structural Funds, Cohesion Fund and Instrument for Pre-Accession*, http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide2008_en.pdf (22.06.2014).

[3] P. Mackie, *Harmonised guidelines for projects assessment at EU level – HEATCO experience*, EVA-TREN 1st Experts' Workshop on transport and energy appraisal in Europe: Theoretical basis in perspective, Lausanne, November 7, 2006.

relevant appraisal time horizon, description of set of indicators used (e.g. NPV, FNVP, ENPV, BCR, IRR, ERR, FRR, FIRR, EIRR, PP, PI, other) and decision as to the discount rate. Important is also the question about pricing method used – fixed prices over whole appraisal period vs. market prices. Another important research area covers scenarios and specifically – what is typical range of scenarios being apprised? E.g. base, optimistic, pessimistic, worst-case, other? Finally risk and uncertainty analysis needs to be considered – if uncertainty is taken into account is there a sensitivity analysis? What are the methods used for risk assessment – quantitative (e.g. variance-covariance, Monte Carlo, Optimism Bias) or qualitative (e.g. risk maps, risk lists, risk matrixes, SWOTS)?

The key element of appraisal procedure is inclusion or rejection of various cost and benefit categories. The general project viability is established by comparing net costs and net benefits with discounting used to apply the concept of changing value of money over time allowing for calculation of ENPV (equation 1).

$$ENPV = \sum_{t=0}^{n} \frac{NB_t - NC_t}{(1+r)^t} \qquad \text{eq. 1}$$

where: r is assumed discount rate, NB is a net benefit from the project and NC is net cost of the project.

In order to arrive at the result it is crucial to establish the values of component cash flows which result in benefits or costs. Because what matters are not only individual benefits and costs of investor the social effects need to be considered. Apart from own costs of investor this should add to the valuation costs of infrastructure use, costs of users, externalities and congestion costs. Those additional social components are included by adjusting NB or NC element by different components constituting social costs/benefits of transport activity which are influenced by new infrastructure construction.

The first of those items is change in infrastructure costs. Infrastructure costs are composed of four elements. Firstly direct cost incurred for construction in construction phase have to be accounted for. Then there are additional costs related to operational phase – those are renewals, maintenance and operating costs of infrastructure manager. Infrastructure renewals represent periodical actions of major scale aimed at restoring infrastructure to its original condition. Infrastructure maintenance costs represent periodical actions on reduced scale, often only partial repairing of infrastructure. Infrastructure operating costs are routine expenditure necessary to maintain operations (cleaning, removal of snow, etc.). Secondly change in user costs has to be taken into calculation. This represents change in costs incurred by infrastructure users like fuel consumption, wear and tire of vehicles and other related expenses. Thirdly value of time (VoT) has to be considered. VoT for passengers are time savings resulting from faster movement between origin and destination caused by better interconnectivity, reduced congestion and improved average speeds resulting from the existence of new infrastructure. VoT for goods transport represent same savings but in regard to goods. Usually value of time for passenger transport is higher than for goods transport. Fourthly environmental impacts have to be included. Those are represented by changes in pollution and noise levels. Pollution factor represents reduced/increased emissions resulting from expected changes in traffic and speed. Noise factor deals with possible increased/decreased noise levels as compared to non-investment option. Finally accidents are taken into estimates. Accidents in transport could result in life loss or health damage as well as material damages.

The comparative review of those factors influencing project appraisals across selected EU countries is given in table 1. The choice of Poland, Germany, UK, Spain, Sweden and the Netherlands is dictated by the needs of representativeness. At the one hand there are countries with a well-established appraisal procedures and countries who have adopted appraisals only recently (Poland). On the other there is enough geographical dispersion in this sample to compare procedures from different European backgrounds. Finally the countries where appraisal procedures are used by practice in more mandatory way are selected (Sweden, Germany) as well as countries were most innovations in appraisal techniques originate (UK). The resulting cross-country comparison allows for identification of major differences on the European level.

Table 1

Transport infrastructure appraisals in selected European countries

| Component | Poland | Germany | UK | Spain | Sweden | Netherlands |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Appraisal horizon | 25 years including construction period. If data allows should be extended | The period covered is determined on a project-to--project basis, ranges from 10 to 100 years | 60 year-period is considered typical | Varied, 25 years as default | 40–60 years | Up to 100 years |
| Indicators | Socio-economic ENPV, ERR, BCR and financial assessment: FNPV/C, FRR/C, BCR/C | Annualised benefits and cost | Net Present Value (NPV) | For socio-economic assessment ENPV (Economic Net Present Value). For financial assessment: FNPV or FNPV/C | BCR, NPV and RNPSS (The ratio of NPV and public sector support) | NPV and IRR |
| Discount rate | Real at 5%, nominal at 8% | 3% | 3–3.5% | Real at 5.5% for economic and 5% for financial assessment | 3.5% | 5.5% |
| Pricing | Constant prices | Constant prices | Market or constant prices | Constant prices | Market Prices | Market prices |
| Uncertainty | All factors which percentage change of 1% results in at least 1% change in ERR or 5% change in ENPV should be considered. Analysis of factors should be done separately for socio-economic valuation and financial valuation | No specific procedure | Sensitivity analysis | All factors which percentage change of 1% results in at least a 5% change in ENPV should be considered. Analysis of factors should be done separately for socio-economic valuation and financial valuation | Sensitivity analysis – required only for projects with high cost of investment | Sensitivity analysis |
| Risk | Rarely conducted, mostly qualitative risk assessment | No specific procedure | Optimism bias and Monte Carlo | Qualitative | No specific procedure | No specific procedure |
| Construction costs | Investment cost which include all direct expenditure required for implementing the project | Investment cost which include all direct expenditure required for implementing the project | Investment cost which include all direct expenditure required for implementing the project | Investment cost which include all direct expenditure required for implementing the project | Investment cost which include all direct expenditure required for implementing the project | Investment cost which include all direct expenditure required for the project |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Renewals | Included | Investment in infrastructure may reduce renewal measures otherwise necessary to preserve the transport infrastructure without investment | Not included | Not included but could be assessed depending on infrastructure type | Not included | Included in maintenance costs |
| Maintenance | Included | Included | Included | Included | Included | Included |
| Operational costs | Included | Not addressed specifically but could be included under maintenance | Included | Included jointly with maintenance costs | Included – often as part of maintenance | Included |
| Users operational costs | Economic costs for different vehicle categories (passenger cars, LGV, HGV, HGV with trailers and buses). Unit price based on average speed and road characteristics | Calculated as savings on vehicle standby and operating cost due to faster journeys, shorter distances, enhanced utilisation of vehicle capacities | Not included | Economic costs for different vehicle categories (passenger cars, LGV, HGV, HGV with trailers and based on average speed and road characteristics | Included and detailed into sub-categories (depreciation, interest on capital, repair and maintenance costs, material costs, fuel and lubricants and tires) | Included as generalised travel costs |
| VoT for passengers | Calculated in division by user type (business, commuting, leisure). Vehicle occupancy rate should be included. Unit prices are based on results of HEATCO project. Total value is arrived at by multiplying unit price by number of passenger-hours per day per 1 km | Time savings in the sense of journey time reductions that result from transport infrastructure investment when the expected demand for transport can be met with less time required in the "with" scenario than in the "without" scenario | Included and based on different values for 'employers' time and 'own' time (or working and non-working time) | Calculated in division by user type (business, commuting, leisure). Vehicle occupancy rate should be included. Unit prices are based on results of HEATCO project | Based on user type (work/non-work). For work trips the Hensher model is used. Non-work valuation is based on willingness to pay measured by stated preference/contingent valuation | Included and differentiated between trip purpose but not between modes |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| VoT for goods | Calculated in division by vehicle type (HGV, LGV, HGV with trailer) or by trip purpose | No specific procedure | No specific procedure | Calculated in division by vehicle type (HGV, LGV, HGV with trailer) | Calculated using time savings, out of pocket costs and operating costs of mode | Calculated in division by mode of traffic |
| Pollution | Included together with noise and calculated based on the unit cost of environmental damage caused by each transport vehicle | Calculation based on specific energy consumption figures and current emission factors | Calculated as impact on air quality in terms of either the total volume change in emissions of a particular pollutant from a particular source or the total number of households likely to be affected | Computed with hedonic prices or contingent valuation. Recommended values based on HEATCO project | Calculated using impact pathway approach and avoidance costs | Included as unit cost for different type of pollutant emission |
| Noise | Included together with pollution | Measured as noise exposure in built-up areas and outside built-up areas. Tests are carried out to determine noise level and depending on the extent to which the target levels are exceeded, noise exposure is valued with an avoidance cost | Quantified according to the number of people/households affected by an increase or decrease of noise levels measured in average decibels (dB(A)) | Computed with hedonic prices or contingent valuation. Recommended values based on HEATCO project | Measured in equivalent noise levels dB(A). Valuation is established through hedonic pricing and adjusted hedonic price method | Included as unit cost per noise emission |
| Cost of life loss | Included for casualties and health loss values based on unit price | Accident damage is captured via accident rates, which place the number of accidents in relation to vehicle mileage, and accident cost unit rates, which state the severity of each accident | Measured as the individual's willingness to pay for reduced risk of death. In addition estimates include gross lost output, medical and ambulance costs | Included for casualties and health loss values based on unit price | Personal loss is calculated using stated preference/contingent valuation. Values for injuries are calculated using the Bush Index. | Included for fatalities and costs of hospitalised people |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Cost of material loses | Not included | Included only for impact of increased traffic safety on property damage | Not included | Not included | Only costs of damage to vehicles | Included |

Source: own elaboration based on: *Die gesamtwirtschaftliche Bewertungsmethodik Bundesverkehrswegeplan* 2003, BMVI 2003; www.rijkswaterstaat.nl (22.06.14); G. De Rus, *Evaluación Económica de Proyectos de Transporte*, Ministerio de Fomento, Madrid 2010; P. Mackie, T. Worsley, *International Comparisons of Transport Appraisal Practice Overview Report*, London 2013; *Niebieska księga dla infrastruktury drogowej*, JASPERS dla MRR, Warszawa 2008; *Instrukcja oceny efektywności ekonomicznej przedsięwzięć drogowych i mostowych*, IBDiM, Warszawa 2005; P. Bickel, R. Friedrich, A. Burgess, P. Fagiani, A. Hunt, G. de Jong, J. Laird, C. Lieb, G. Lindberg, P. Mackie, S. Navrud, T. Odgaard, A. Ricci, J. Shires, L. Tavasszy, HEATCO (Developing Harmonised European Approaches for Transport Costing and Project Assessment), *Deliverable 5 – Proposal for Harmonised Guidelines*, 2005.

## 2. Differences in general appraisal frameworks

Appraisal procedures differ between EU countries in regard to general appraisal framework. This includes: time horizon, indicators used, pricing and discounting and the way risk and uncertainty analysis is conducted.

Time horizon of the appraisal determines the value of social element of net benefits and net costs as compared to initial investment expenditure. The longer time is considered the more the effect of social costs and benefits outweighs the effect of investment cost. In Holland the horizon year could be as long as 100 years. In Poland it is 2035 but if data is sufficient should be extended as far as lifetime of given infrastructure object. In Sweden typical appraisal period is between 40–60 years, In Spain it is 25 years. In the UK 60 year operating life is assumed. For Germany timeframe is defined by lifetime of infrastructure components which could range from 10 to 100 years. Regarding the method of assessment they are all centred around various variants of NPV. In the UK it is NPV and BCR, in Spain ENPV (Economic Net Present Value) for overall project efficiency and FNPV or FNPV/C for financial efficiency. In Sweden BCR, NPV and RNPSS (The ratio of NPV and public sector support), in the Netherlands NPV and IRR with focus on NPV. In Poland ENPV or FNPV/C based method is used. In German BCR based on annualized costs/benefits streams in forecast years is used. Rates used to discount cash flows resulting from net costs and benefits vary across Europe. In Poland it is either 5% real or 8% nominal rate, in Germany

3% in the UK initially 3% and after 30 years – 3.5%. In Spain 5.5% is used for economic assessments and 5% for financial assessment, in Sweden 3.5% and in the Netherlands 5.5%. The decision to use fixed or market prices is critical in the sense of forecast predictability. In Poland, Germany, Spain and UK fixed prices are required. In Sweden and the Netherlands market pricing dominates appraisals. Both procedures have advantages and weaknesses. Constant pricing allows for comparability between investments while market prices offer values closer to reality. The weakness of market pricing is need to properly predict their future levels.

Another general feature of appraisals which needs to be addressed is treatment of risk and uncertainty. Although need to account for variation in investments is widely recognized the uncertainty analysis is not compulsory in some systems. For instance in Sweden it is only required for projects with high social cost of investment. In Poland and Spain sensitivity analysis is advised as a measure of uncertainty for all factors which percentage change of 1% results in at least a 5% change in ENPV bur analysis of factors should be done separately for socio-economic valuation and financial valuation. The German procedures do not address uncertainty directly but they call for sensitivity tests for demand and modal shift risks. In the Netherlands 3% risk premium is adopted in discount factor. The risk analysis which should follow uncertainty analysis is often skipped. Even more often uncertainty analysis is considered a replacement of risk analysis and confused with it. Theoretical frameworks for risk assessment in national appraisal documents call for two groups of methods: qualitative and quantitative. If probability distributions of risk factors could be established than quantitative risk assessment should be conducted. Otherwise qualitative risk assessment should be applied. In practice risk is treated on a very general level. Quantitative methods are seldom used in practice due to the problems with distributions of probabilities. But even qualitative assessments often deal with very few factors and recognize only basic types of risk. Major risks which result from the process of investing in infrastructure project are: delay in construction, cost overrun, insufficient quality and loss of public many as a result of guarantee failure[4]. Typically only two first items are addressed in national appraisal methodologies

Probably the most advanced risk analysis procedure is offered by UK project appraisal guidelines which propose risk and uncertainty assessment in three steps:

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[4] P. Borkowski, *Metody obiektywizacji oceny ryzyka w inwestycjach infrastrukturalnych w transporcie*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2013, s. 284.

sensitivity analysis, scenarios and Monte Carlo analysis[5]. UK procedure accounts for the problem of optimism bias – i.e. systematic overestimation of benefits and underestimation of costs on the part of appraisers. This bias should be explicitly accounted in the appraisal. Appraisers accordingly to UK guidelines should adjust for optimism bias in the estimate of infrastructure costs by estimating the capital cost of each option and then applying adjustments to these estimates, based on the evidence taken from comparable completed projects.

## 3. Calculation of net benefits and net costs associated with infrastructure

The cost of infrastructure is attributed to initial investment expenditure, renewals, maintenance and operating expenses. While the first item is rather straightforward in calculation as it represents actual cost of infrastructure construction the remaining represent delayed cash flows and could be only forecasted. Renewals constitute periodical works which are supposed to bring infrastructure to its original condition. The sensitive area in renewals calculation is average renewal interval. It should represent real renewals for particular infrastructure type and location. In practice artificial idealized renewal interval is often used or renewals are not included in appraisals at all (UK, Sweden, Spain). This is caused by lack of full knowledge about particular renewal schedule. Moreover even if some renewal schedules exist they do not have to be followed in practice. Calculation of maintenance costs is more widely accepted in all national appraisals. Yet often they are confused with renewals and/or treated as one cost category. Even more frequently they are confused with operating costs or as in Spain or Sweden – it is believed that separation of maintenance from operations is not possible and both items are bundled together. Decisions on maintenance costs should be reflected in the life of the assets and, in general, in their operating conditions. In practice operating conditions – like weather, AADT (*average annual daily traffic*) which shows real use of infrastructure – are artificially considered constant across all projects evaluations.

5 B. Flyvbjerg, *Procedures for Dealing with Optimism Bias in Transport Planning: Guidance Document*, UK Department for Transport, London 2004.

## 4. Calculation of net benefits and net costs associated with user

Change in costs for users is addressed in some national methodologies. In case of the Netherlands they are included in modelling as generalized travel costs. In Sweden certain elements of user operational costs are included directly: depreciation, interest on capital, repair and maintenance costs, material costs, fuel and lubricants and tires. In most countries flat unit price per vehicle or vehicle-km is used. Further differentiation may deal with type of vehicle. This system is applied in Spain and Poland where values are calculated as economic costs for different vehicle categories (for example in road transport the following categories are considered: passenger cars, LGV, HGV, HGV with trailers and buses). Unit price is typically dependent on average speed and road characteristics (terrain, road condition). In Germany the concept of standby cost is used instead. Savings on vehicle standby and operating cost due to faster journeys, shorter distances, enhanced utilization of vehicle capacities are measured in comparison to no-investment scenario.

Users could also benefit from decreased time of travel. VoT (value of time) ideally should be calculated in division by user type (business, commuting, leisure) with vehicle occupancy rate included. Within EU unit prices for time value are mostly based on results of HEATCO project. Different method (employed in Germany) is to use declared willingness to pay whereas time savings are derived from a willingness to pay analyses. Willingness to pay is also utilized in partial assessments in Sweden for evaluation of work trips where Hensher model is used, and evaluated through wage rate studies and stated preference/contingent valuation. Non-work valuation is based on willingness to pay measured by stated preference/contingent valuation.

Life and health loss are also figures considered in appraisals. In order to measure life value HEATCO figures are commonly accepted across Europe but there are variations in calculations depending on risk characteristics of particular infrastructure. For instance in road sector risk of accident factor depends on: road type, road condition, location (urban vs. rural), AADT and existence or not of certain solutions (e.g. type of intersection, signals etc.). This is further corrected by factors representing probability of different type of accidents on different road types which are in turn derived from statistical analysis of accidents over past 5 years (case of Poland). In Spain this is further corrected by factors based on the severity of an accident. In Germany the Department for Transport values the reduction of the risk of death between investment and non-investment variants with further amendments for medical and ambulance costs. Sweden has adapted measure of life and health loss based on stated preference/contingent valuation. Values for injuries are calculated using the Bush Index and societal costs include medical treatment, legal and court costs and administration, emergency services and net production loss.

## 5. Calculation of net benefits and net costs associated with environment

Within current CBA methodologies environmental issues are considered part of appraisal procedures. The difficulty in assessment of environmental impacts is that various environmental effects are not separated. For instance pollution and noise factor are frequently calculated together based on the unit cost of environmental damage caused by each transport operation. In national methodologies calculation of pollutant emissions is based on specific energy consumption figures and current emission factors for each mode and here various techniques are adopted in different EU countries.

In Germany the differentiation is done according to standard passenger and freight vehicle. In the UK pollution is calculated as impact on air quality in terms of either the total volume change in emissions of a particular pollutant from a particular source or the total number of households likely to be affected by these changes. In Sweden impact pathway approach and avoidance costs (calculated as cost of environmental damage removal) is used. For many countries simple unit prices per ton of emission of particular pollutant are used. The actual value of 1 ton of pollutant is either established by national studies or adopted from the previously mentioned results of HEATCO project (e.g. Spain).

Apart from pollution noise factor is frequently included in national appraisals. Recent studies across Europe have yielded a range of values, which lie in the range of EUR 20 – EUR 30 per household per decibel per year. The median value from those studies is EUR 23.5 per household per decibel per year (2001 prices)[6]. In Sweden noise experienced both in dwellings and other locations is measured in equivalent noise levels dB(A). Valuation is established through hedonic pricing and adjusted hedonic price method. Swedish procedure is interesting from

[6] L.C. den Boer, A. Schroten, *Traffic noise reduction in Europe: Health effects, social costs and technical and policy options to reduce road and rail traffic noise*, Delft, August 2007.

European perspective because it accounts for unconscious health effects which is not applied in other EU countries. Unconscious health effects are real effects that residents are not aware of, and hence not reflected in housing prices In Germany noise exposure is measured and difference between pre investment and investment calculated. In the UK this factor is quantified according to the number of people/households affected by an increase or decrease of noise levels measured in average decibels.

## Conclusions

The way net benefits and net costs are included in projects is subject to different treatment in national methodologies. Although general appraisal rules presented in EU guidelines are obeyed there is significant level of variability in regard to inclusion/exclusion of certain cash flows which constitute benefit/cost categories. The differences start at the general level with various timeframes, discount rates and sets of indicators used. There is surprising lack of uniformity in treatment of risks and uncertainties and in development of scenarios for evaluations. The most similarities could be found in the area of benefits and costs associated with environmental damage or health/life loss. Some groups of costs are not accounted for at all in some national setups – e.g. some of the infrastructure related expenditure like renewals. User costs measurement follows either simplified unit pricing (in this case there is at least some degree of comparability as often same figures developed within research work of HEATCO project are used). But new innovative proposals are usually not compatible with other measurements. The German and Swedish appraisal procedures could be singled out as those who try to adapt to changes in project procurement practice and propose new measures. This comes with a price of non-comparability with other studies but is probably the way to change appraisal in the future. Assessments change and more and more indirect effects are being considered as important factors. One must remember that indirect effects are currently as per CBA definition outside of CBA analytical framework due to the risk of double counting. But with their visible increasing role in practical assessments the change in appraisal procedures is inevitable. At the time being huge dispersion of appraisal frameworks results in extreme differences in project net value estimates. Cross-European comparison shows that there is no uniform EU wide practice a but there are certain appraisal elements in different methodologies which are interesting and worth introducing into other national appraisal rulebooks improving quality of appraisals. But then there is a problem of transferability as some of the more innovative proposals are based on detailed data which is often not collected in other countries.

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## PRAKTYKA OCENY KOSZTÓW I KORZYŚCI W TRANSPORTOWYCH PROJEKTACH INFRASTRUKTURALNYCH W UNII EUROPEJSKIEJ

### Streszczenie

Europejska metodologia oceny efektywności inwestycji infrastrukturalnych przewiduje przeprowadzenie oceny kosztów i korzyści takich projektów z uwzględnieniem ich wymiaru społecznego w fazie przygotowywania projektu do realizacji. Oprócz bezpośrednich korzyści i kosztów w realizacji projektów powinny być więc także uwzględniane efekty pośrednie, często trudne do oszacowania, jak wartość czasu, oddziaływanie na środowisko naturalne, koszty wypadków, zmiany kosztów eksploatacyjnych pojazdów i infrastruktury. Coraz częściej mówi się także o konieczności włączenia do oceny kosztów i korzyści projektów infrastrukturalnych tzw. szerszych efektów ekonomicznych (efektów aglomeracji, wpływu na wzrost gospodarczy, zatrudnienie). Analiza praktyki krajów europejskich udowadnia, że podejścia do oceny kosztów oraz korzyści odbiegają od modelowego. Celem artykułu jest porównanie praktyki oceny projektów infrastrukturalnych w transporcie realizowanych w wybranych krajach Unii Europejskiej. W konsekwencji zidentyfikowania zalet i wad różnych przyjmowanych procedur oceny, co umożliwia wskazanie kierunków przyszłej ewolucji metod oceny projektów infrastrukturalnych w transporcie.

*Tłumaczył Przemysław Borkowski*

**Słowa kluczowe**: ocena projektów infrastrukturalnych, analiza kosztów–korzyści, metodologia oceny projektów inwestycyjnych w infrastrukturze