EUROPEAN TRANSPORT CONFERENCE
7 – 9 SEPTEMBER 2022

DO WE NEED A NEW APPROACH TO APPRAISAL? LESSONS FROM A COMPARISON OF GUIDELINES FOR THE APPRAISAL OF TRANSPORT INFRASTRUCTURE INVESTMENT

Jonas Horlemann
Technical University of Munich, TUM School of Engineering and Design, Chair of Urban Structure and Transport Planning

The transport sector in Europe and worldwide is facing major challenges: emissions need to be reduced drastically and rapidly while maintaining an adequate level of transport activity to ensure mobility needs and access for everyone. Are transport appraisal methods prepared to analyse and assess projects and policies to meet these challenges? To discuss this, I conduct an abstract comparison of appraisal guidelines from select European countries to identify three building blocks of transport appraisal: forecasting, evaluation of marginal impacts, and economic cost-benefit-analysis (CBA). Given the above challenges, each of these building blocks is associated with a puzzle which I term the “Transformation Problem”, the “Intervention Problem”, and the “Welfare Analysis Problem”.

1. INTRODUCTION

The transport sector in Europe and worldwide is facing major challenges, especially those of carbon neutrality and social inclusion: emissions need to be reduced drastically and rapidly while maintaining an adequate level of transport activity to ensure mobility needs and access for everyone. Especially, carbon emission reduction targets have now been translated into binding regulation for the transport sector, for instance in national climate protection laws. At the EU level, the European Climate Law sets a binding reduction target of 55 percent by 2030, compared to 1990 levels. By 2050, climate neutrality has to be achieved (European Union, 2021).

To achieve these emission reductions, a wide set of policies and transport infrastructure investments will be necessary. Hence, the question arises which set of policies and infrastructure projects are the most effective, provided there is a constrained budget.

Traditionally, economics tells us a story of the free market leading to an efficient allocation of scarce resources. However, transport infrastructure can be described as a natural monopoly due to the subadditivity of costs. Additionally, there are societal goals of social inclusion, for instance minimum standards for accessibility for every person in every region, which are not achieved by the free market. These observations make the case for government intervention through transport infrastructure funding. Ultimately, questions arise such as: Is this intervention reasonable? Does it make the world better? Does it increase economic welfare? This type of reasoning leads to the problem being framed as an “intervention” which needs “ex ante assessment”. This is

done in the context of transport appraisal which refers to methods to analyse and justify government interventions in the transport sector.

Hence, appraisal methods are an important part of transport infrastructure planning: Guidelines often influence existing planning processes by providing tools for comparing project options. At a later stage of planning and financing, appraisal methods are used to calculate the “value for money” and thus to justify a project in relation to its costs. If an intervention is not increasing economic welfare, the project is not considered “beneficial” and is usually abandoned.

The goal of this contribution is to discuss whether this perspective is appropriate to address the challenges of carbon neutrality and social inclusion described above. Since appraisal guidelines play a relevant part in planning and evaluating measures, I will focus on them. Is a rethinking of appraisal needed to address the new challenges described above?

2. CATEGORIZATION OF NATIONAL GUIDELINES

To begin the analysis in this paper, current national guidelines for the assessment of transport projects are collected and categorized. The analysis is restricted to guidelines that are accessible online. The geographic scope is Europe with all 27 member states of the European Union. Furthermore, the United Kingdom and Switzerland are included in the analysis.

First, the guidelines were identified via desk research. Some of them were already known to me or have been developed by practitioners who are part of the BeneVit project team at TUM (BeneVit, 2022), for instance the Standardised Appraisal Method for Public Transport Infrastructure Investment in Germany (Intraplan & VWI 2022). Other guidelines were identified by a search on government websites and by using internet search engines. Additionally, guidelines listed in existing comparisons (Mackie & Worsley, 2013; Odgaard et al., 2005; Beria et al., 2012) were selected. The focus was on publicly available national guidelines that are of high practical relevance as they form the basis for decisions on concrete projects. For each guideline, the most recent version was selected (as of August 2022) and translated by translation programs if needed.

Second, the guidelines were categorized based on their indicators and their type of value synthesis. To categorize guidelines, HEATCO (Odgaard et al., 2005, p. 10) used the categories CBA (monetary assessment in a cost-benefit-analysis), MCA (multi-criteria-analysis including non-monetary weights assigned to effects), QM (quantitative measurements of effects on a cardinal scale, but no weights for aggregating these to a decision criterion), and QA (qualitative assessment of effects on an ordinal scale). A similar categorization is used in this paper. However, it is refined by dividing it into classes of indicators and classes of value synthesis.

In terms of indicators, the following categories are distinguished:

- M (monetary): some or all effects are assigned a monetary value
- QM (quantitative measurements): some or all effects are measured on a cardinal scale without assigning a monetary value for assessment
- QA (qualitative assessment): some or all effects are assessed on an ordinal scale

Next, the type of value synthesis is categorized. By value synthesis, any procedure of aggregating monetary, quantitative and/or qualitative indicators into a single decision criterion is understood. The following categories are distinguished:

- CBA (cost-benefit-analysis): aggregation of monetary benefits and costs according to the theory of welfare economics and cost-benefit-analysis by avoiding double-counting of effects; calculation of traditional cost-benefit-indicators, e.g. benefit-cost-ratio, net present value
- CBA+: monetary indicators are aggregated in an economic CBA; if additional qualitative or quantitative analyses are conducted, the respective indicators are presented alongside CBA results without further aggregation to one final decision-indicator
- MCA (multi-criteria-analysis): weighting of indicators to calculate a single indicator for decision-making

The categorization in Table 1 focuses on the recommendations of each guideline for large infrastructure projects. In line with the principle that appraisal should be proportional to investment volume, some guidelines include simplified methodologies for small projects. These are not considered in the analysis here.

Table 1 Overview and categorization of national guidelines for transport appraisal

Country	Guideline	Year	Indicators	Value synthesis
Croatia	Smjernice za CBA za projekte prometnica i željeznica (*CBA Guidelines for Road and Railway Projects*)	2016	M	CBA
Cyprus	Manual for pre-selection and appraisal of public investment projects	2016	M, QM, QA	CBA+
Czech Republic	Rezortní metodika pro hodnocení ekonomické effektivnosti projektu dopravních staveb (*Departmental guideline for the evaluation of economic effectiveness of transport construction projects*)	2021	M	CBA
Denmark	Manual for samfunds- økonomisk analyse – Anvendt metode og praksis på transportområdet (*Manual for socio-economic analysis – Applied method and practice in the field of transport*)	2022	M, QM, QA	CBA+
Finland	Liikenneväylien arvioinnin yleisohje (*General instructions for the evaluation of traffic routes*)	2020	M, QM	CBA+

France	Référentiel méthodologique pour l'évaluation des projets de transport (*Methodological reference for the evaluation of transport projects*)	2020	M, QM, QA	CBA+
Germany	Standardisierte Bewertung von Verkehrswegeinvestitionen im Öffentlichen Personennahverkehr - Version 2016+ (*Standardized Appraisal of Infrastructure Investments in Public Transport*)	2022	M, QM	CBA [1]
Germany	Bewertungsmethodik für den Bundesverkehrswegeplan (BVWP) (*Appraisal Method of the Federal Transport Infrastructure Plan*)	2015	M, QM, QA	CBA+
Ireland	Common Appraisal Framework For Transport Projects And Programmes	2021	M, QM, QA	CBA+
Italy	Linee Guida Per La Valutazione Degli Investimenti In Opere Pubbliche (*Guidelines for the evaluation of investments in public works*)	2017	M, QA	CBA+
Latvia	Metodiskie norādījumi autoceļu projektu izmaksu – ieguvumu analīzes sagatavošanai (*Methodological instructions for the preparation of cost-benefit analysis of road projects*)	2019	M, QA	CBA, MCA
Malta	Guidance Manual for Cost Benefit Analysis (CBAs) Appraisal in Malta	2013	M	CBA
Netherlands	Leidraad OEI + Amendments (*Overview Effects Infrastructure Guideline*)	2000/ 2004	M	CBA
Poland	Niebieskie Księgi dla projektów w sektorze transportu publicznego, infrastruktury drogowej oraz kolejowej (*Blue Books for projects in the public transport, road and rail infrastructure sectors*)	2016	M	CBA
Slovakia	Metodická príručka k tvorbe analýz nákladov a prínosov (CBA), Version 3.0 (*Methodical guide to the creation of cost and benefit analyses (CBA), Version 3.0*)	2021	M	CBA
Sweden	Analysmetod och samhällsekonomiska kalkylvärden för transportsektorn: ASEK 7.0 (*Method of analysis and socio-economic calculation values for the transport sector: ASEK 7.0*)	2020	M, QM, QA	CBA+
Switzerland	NIBA: Nachhaltigkeitsindikatoren für Bahninfrastrukturprojekte (*Sustainability Indicators for Railway Infrastructure Projects*)	2016	M, QA	CBA+
Switzerland	NISTRA – Nachhaltigkeitsindikatoren für Strasseninfrastrukturprojekte (*Sustainability Indicators for Road Infrastructure Projects*)	2019	M, QA	CBA, MCA
UK	Transport Analysis Guidance (TAG)	2021	M, QM, QA	CBA+

For the countries Austria, Belgium, Bulgaria, Estonia, Greece, Hungary, Lithuania, Luxembourg, Portugal, Romania, Slovenia, and Spain, no national guideline could be accessed online. Hence, the overview given in Table 1 is not comprehensive, especially since some countries may have guidelines in ministries or government agencies that are not available online. Alternatively, they may use some methodology to assess and prioritize projects for a national infrastructure plan, but the methodology is not presented as a guideline and thus not included in Table 1. Or they may apply EU CBA guidance (European Commission, 2014) or national concretisations of the EU guide for large infrastructure projects. However, for the discussion below, a complete overview is not necessary. The practice of transport appraisal is usually in line with CBA methodology and therefore, from a theoretical view, quite similar. The differences in data requirements, parameters, methodologies to calculate indicators, or national specificities are not the scope of this paper. Readers interested in this are referred to Mackie & Worsley (2013) and Beria et al. (2012). Rather, the idea is to discuss more fundamental questions.

This high-level categorization of appraisal guidelines reveals that

- a CBA is part of all guidelines,
- often, additional quantitative or qualitative indicators are reported alongside CBA results to capture the distribution of economic impacts or estimate effects that are difficult to monetize,
- some guidelines refrain from prescribing a formal procedure of value synthesis for the whole assessment, e.g. by specifying weights for aggregating indicators into a single decision criterion. Their focus is on a comprehensive analysis and presentation of a project's impacts to decision-makers. Therefore, rather than aggregating indicators into a decision criterion, all impacts are presented in a summary table, with the implicit weighting of impacts left to the decision-makers. This is the case in the United Kingdom, for instance. Nevertheless, CBA and its underlying welfare economic theory still sit at the heart of transport appraisal.

3. BUILDING BLOCKS OF SELECT GUIDELINES

In this section, building blocks of transport appraisal are characterized to discuss afterwards, whether these are suited to address the challenges of the future. To this end, three guidelines are selected that represent current best practice in transport appraisal.

Firstly, the German "Standardisierte Bewertung" (Intraplan & VWI, 2022) is selected due to its high degree of standardization and its relevance in the German context of local public transport infrastructure planning. It is an appraisal procedure by the Federal Transport Ministry, and it is mandatory for local railway infrastructure projects that are co-funded by the federal government under the so-called GVFG law

(Bundesrepublik Deutschland, 2022). Its main goal is to proof the economic efficiency of projects that are eligible for GVFG funding in accordance with the budgetary principles of efficiency and frugality. The high degree of standardization was chosen to ensure nation-wide comparability of projects. However, the standardization as well as the aggregation of all effects into a single decision criterion, the monetary benefit-cost-ratio, leave little flexibility for capturing local justifications of certain schemes.

Secondly, the French "référentiel méthodologique" (Ministère de la Transition écologique et solidaire, 2020) is chosen due its broader focus: The guideline places high value on quantitative and qualitative analyses of all effects. Additionally, the monetary CBA is part of an overall structure consisting of a strategic analysis, a comprehensive analysis of social, ecological, and economic effects, and a synthesis. Even though the monetary CBA is a major part of the appraisal, there are numerous methodological sheets that provide guidance and inspiration for additional analyses. For instance, the integration of public transport schemes with major redesigns of the urban environment or the accessibility improvements for select inhabitant groups and areas can be analyzed. However, it is not known to me whether these analyses can outweigh a poor value for money in a decision-making process, for instance, when deciding on a public transport scheme that might be justifiable for its impacts beyond those captured in a CBA. Additionally, the French framework is especially interesting due to its assumptions of a carbon neutral transport system in the reference case.

Lastly, the UK Transport Analysis Guidance (TAG) (Department for Transport, 2021) is selected due to its comprehensive web-based documentation, long development history, and sophisticated methodology being a reference for other national guidelines. The welfare economic foundation of transport appraisal seems to be best documented in TAG. It also seems to be the most advanced guidance in relaxing the assumption of perfect competition on secondary markets, making the case for the assessment of wider economic impacts. Even though a monetary CBA is a major part, the overall appraisal is presented in a summary table including monetary, quantitative, qualitative, and distributional effects without aggregating them into a single decision criterion.

Table 2 Overview of select appraisal guidelines

	German "Standardi-sierte Bewertung"	**French "Référentiel Méthodologique"**	**UK WebTAG**
What is being appraised?	Local public transport infrastructure projects funded under the GVFG law, mainly municipal rail infrastructure	Major infrastructure projects as defined in the "Code des transports"[2], e.g. road, railway, waterways, airports, and projects with investment costs above 83 million Euro (before taxes)	Transport interventions, mainly road and rail, but also aviation and active modes

Why is it being appraised?	Requirement for funding, proof of economic efficiency	Requirement for funding, comprehensive information, optimisation of planning, value for money assessment	Requirement for funding, comprehensive information, optimisation of planning, value for money assessment
How is it being appraised?			
1. Forecast	Assumption of a representative forecast year shortly after the opening year of the specific project, modelled travel demand forecast for that representative year, standardized appraisal parameters for the year 2030	Travel demand forecast with growth factors for travel demand up to 2070, assumptions of carbon neutrality (fleet, prices, emission factors, modal shift) in the reference case	Travel demand forecast with at least two modelled years recommended, interpolation in between
2. Identification of project impacts	Static comparison of cases (with-scheme vs. without-scheme), assumption of identical effects over the whole project lifetime	Comparison of cases (with-scheme vs. without-scheme)	Comparison of cases (with-scheme vs. without-scheme)
3. Indicators	Monetary + quantitative indicators that are given a monetary value to be included in the BCR[3]	Monetary, quantitative, qualitative	Monetary, quantitative, qualitative
4. Assessment	Economic CBA: BCR, BCD[4]	Economic CBA (NPV[5], BCR et al.) embedded in a comprehensive qualitative and or quantitative analysis framework to capture all relevant project impacts	Economic CBA (NPV, BCR) with additional quantitative and qualitative indicators without aggregating results to a final decision criterion

These three guidelines represent a spectrum of current transport appraisal methods in European countries. Differences arise obviously in national parameters, the degree of standardization as opposed to allowing some flexibility for specific characteristics of a project, the additional integration of quantitative and qualitative indicators and analyses providing further insights for decision-makers, and the assumptions of the reference case, e.g. the assumptions of a climate-neutral scenario in France. Apart from that, the appraisal methods are quite similar on an abstract level. This is no surprise due to the firm mainstream economic theory underpinning cost-benefit-analysis: the assessment of welfare changes in comparison with a counterfactual situation, i.e. the reference case. And the judgment of efficiency according to the

Kaldor-Hicks criterion, stating that an intervention is beneficial once the beneficiaries could potentially compensate for all economic costs involved in a project.

This abstract comparison shows that current transport appraisal methods consist of the following three building blocks:

1. a *forecast* of the future in terms of transport demand and other transport-related developments (fleet structure, prices, emission factors, etc.),
2. a comparison of a project case against a reference case to determine *marginal project impacts*,
3. an *economic CBA*, sometimes enriched by additional qualitative or quantitative analyses and indicators, or sometimes embedded in a broader multi-criteria-analysis framework.

Moreover, the appraisal methodology is usually applied to single projects. At least in Germany, the intervention is so narrowly defined that it only captures the investment eligible for GVFG funding by the federal government. This narrow definition does not encourage thinking in integrated concepts, for instance in push- and pull-packages that are more effective than single interventions assessed and funded separately from different sources. This is not necessarily a problem of the method itself, but rather of funding schemes and their incentives. Nevertheless, the following questions arise:

- Would the current methods be suitable for a new approach in transport infrastructure planning that is targeting the problems of carbon neutrality and social inclusion by planning schemes of push- and pull-measures and minimum standards of accessibility?
- Could new methods and appraisal frameworks initiate a shift in funding programs and foster integrated planning by combined project- and policy-packages covering more than just one transport mode to reach the targets defined by climate protection laws?

I argue that the current appraisal methodology has difficulty dealing with these new approaches to transport planning and I will identify and describe the various conundrums next.

4. PUZZLES

When we think of achieving a carbon neutral transport sector, each of the building blocks characterized above presents a puzzle. This is summarized in Figure 1.

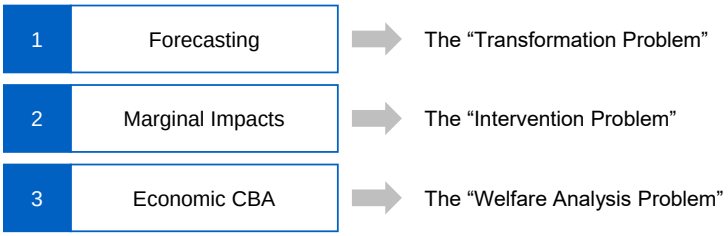

Figure 1 Three building blocks of transport appraisal and the puzzles associated with them

4.1 The "Transformation Problem"

Transport demand forecasting is usually done by extrapolating current travel patterns into the future. For this purpose, transport models are calibrated with current travel data. Then, any expected network changes and/or changes in trip frequency, trip distribution, and mode choice are considered to estimate the most likely development of travel demand in the reference case. Eventually, the outcome of the travel demand analysis is assessed with forecast values of travel time, carbon prices, etc. Thereby, transport analysis and appraisal seek to achieve the best possible estimate of future development.

However, achieving a carbon neutral transport sector is transformative: It will consist of different travel patterns, less energy consumption, less motorized travel. This is what I term the "Transformation Problem": The question is not how the future will develop based on extrapolated trends from the past. The questions are: How do we design a trajectory towards the very specific and binding target for the transport sector to become climate neutral by 2050? Are we on track now? Which projects and policies do we have to implement to achieve the binding targets 10 / 20 / 30 years from now? Is forecasting the right instrument to do that?

Maybe we should change the perspective and look backwards from the end. Then we could identify projects and policies that would get us back on track and we could identify those which are most cost-effective. To date, transport appraisal methods lack ideas and tools that give insight into

- how we can achieve the desired future in the most cost-effective way
- while maintaining accessibility
- and without losing people and companies along the way.

But there is research on using backcasting approaches in the transport sector (e.g. Wiederkehr et al., 2004; Banister & Hickman, 2013). Perhaps, transport appraisal methods could be inspired from that.

4.2 The "Intervention Problem"

Current transport appraisal methods assess how a scheme will 'fit' into the extrapolated future. Their underlying question is: Given the projected future

development, what are the impacts of the scheme, and are these beneficial or not? The focus, then, is on getting the effects of the intervention right and the instrument to do so is a comparison of with- and without-cases[6] to identify marginal project impacts.

For this purpose, the assumptions made in the without-case are critical. These usually consist of two parts: Firstly, a project-specific definition of the reference case which includes all expected changes in the absence of the intervention, for instance replacement investments or network extensions that will be implemented by the forecast year. Secondly, assumptions of the reference case relate to future parameters and values for the appraisal, for instance the share of electric vehicles, emission factors, or transport demand changes and modal shift due to climate policy. I am only interested in the second part because its assumptions are not supported by concrete measures to achieve them.

Appraisal guidelines have started to introduce such kind of assumptions about the development of the transport sector to become climate neutral by 2050. For instance, the French appraisal guideline (Ministère de la Transition écologique et solidaire, 2020) presumes a certain share of electric vehicles, carbon and fuel prices, emission factors, and modal shift in the reference case. Ultimately, all these are assumed to be exogenous to individual projects. However, the question arises whether policies for climate neutrality in the transport should be backed by more than just assumptions for a reference case. The question is how to best achieve a carbon neutral transport sector and not if a project is beneficial given that carbon neutrality has already been achieved.

Furthermore, transport appraisal seems to be so methodically focused on ‘getting the impacts of the intervention right’ that there is a danger of ignoring policy-packages. Transport planners have long argued for policy-packages consisting of integrated push- and pull concepts to be more effective than single interventions (e.g. Givoni, 2014; Banister, 2008).

This is what I term the “Intervention Problem”: Transport appraisal methods are designed to isolate the marginal effects of a single project or intervention by means of a comparison between the with- and the without scheme. This leads to two issues:

- We need to plan, assess, and implement infrastructure projects only in combination with other policies and projects. This will help curb dynamic feedback loops and avoid getting trapped in an ever-increasing cycle of increasing travel distances while travel time budget stays essentially constant (Metz, 2008).
- Achieving a carbon neutral and inclusive transport sector is such a major challenge that we should not just assume it as an exogenous development in the reference case. I suggest we need tools to identify and assess different paths to meet the challenges (see section 4.1).

Therefore, I argue that transport appraisal should not focus as much on isolating the marginal impacts of single interventions, but rather on assessing paths of transforming the transport sector.

This is summarized in Figure 2: Travel demand is typically forecast from today's situation until the opening year or some time after the opening year when travel patterns have adjusted. The "Transformation Problem" describes that forecasts may not result in travel patterns that are consistent with a needed transformation of the transport sector. The "Intervention Problem" describes that appraisal is interested in isolating the marginal effects of single interventions. This delineation leads to transformations being assumed in the reference case, exacerbating the "Transformation Problem" that forecasted travel patterns and carbon neutral consistent travel patterns increasingly diverge.

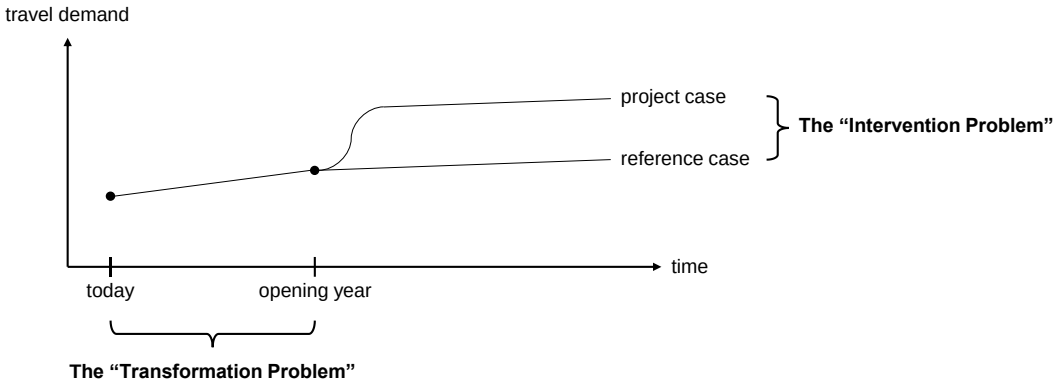

Figure 2 Graphical representation of the "Transformation Problem" and the "Intervention Problem"

4.3 The "Welfare Analysis Problem"

A possible way to solve the "Transformation Problem" and the "Intervention Problem" could be to appraise coherent policy-packages. These could consist of infrastructure measures that make one mode of transport more attractive (pull measures) and accompanying measures that make other transport modes, routes, or travel behaviour less attractive (push measures). However, in terms of the assumptions of welfare economics, push measures could lead to welfare losses. The transport analysis typically relies on revealed preferences modelled by a transport model, and all else equal, increases in generalized costs lead to lower consumer surpluses and a deadweight loss. As consumer surplus – e.g. due to travel time reductions – is usually the major component of benefits in a CBA, it cannot be outweighed by monetized carbon emission reductions from push measures.

So why should we implement policies that potentially lead to losses in welfare? One possible way to check if implementing these policies is beneficial would be sticking

entirely to the present framework as characterized by the building blocks above. One would impose extremely high restrictions on travel demand by increasing the generalized costs so long as the transport sector in general were carbon neutral. Then, once new technologies are ready for market, one would relax the assumptions gradually. In this framework, the reference case would be a highly restrictive scenario, imposed upon the transport sector externally by climate protection laws. This would be the starting point for analyzing whether projects increase welfare. Making these restrictions in the reference would involve high losses of consumer welfare, but it would be assumed away as an exogenous necessity. The appraisal would then use its existing building blocks of comparative statics and welfare analysis and would check for each intervention if it is welfare increasing compared to the reference case. Methodically, this would be a way to keep the current framework while addressing the emerging questions of carbon neutrality.

However, I argue that this is not useful in making informed judgments about different trajectories of transformation. An appraisal tool is helpful if it shows different options of achieving the goal of transformation towards carbon neutrality to decision-makers. It is not helpful, if it just assumes this being an exogenous development.

Furthermore, welfare effects are interchangeable and emission increases by a project can be outweighed by transport user benefits (e.g. travel time, operating costs) in a CBA. This procedure does not ensure that binding targets of transport emission reductions are actually achieved.

To sum up, this is what I term the “Welfare Analysis Problem”: Within the current framework of transport appraisal, the packages of measures that are needed to achieve carbon neutrality in the transport sector could come at high welfare losses. Nevertheless, transport planning should not focus on welfare metrics given the binding emission targets for the transport sector. If the paradigm of transport planning shifted towards “decide and provide” rather than “predict and provide, as long as there are welfare gains”, we would need some other metrics and tools, for instance as part of a multi-criteria-analysis as opposed to mere economic welfare assessment.

Lastly, the social dimension is becoming increasingly important when considering projects and policies to transform the transport sector. First, this relates to the distribution of impacts of a scheme. Aggregate welfare measures with their focus on economic efficiency do not show who is benefitting and who is not, and appraisal guidelines have started to address this issue by presenting additional qualitative indicators on the distribution of certain impacts, for instance in the UK TAG. Second, social inclusion is key when transforming the transport sector. This issue calls for a focus on accessibility, i.e. “access” to basic needs and the “ability” to fulfil them by means of transport. There is a danger of this being overlooked in other appraisal guidelines when the focus is on welfare measures of economic efficiency.

5. CONCLUSION

This contribution provides a non-conclusive list of appraisal guidelines from European countries. From these, three guidelines are selected that comprise a spectrum of current transport appraisal practice. On an abstract level, three building blocks of appraisal are characterized: Forecasting, evaluation of marginal impacts, and economic CBA. Each of them presents a puzzle when we think about the transformation towards a carbon neutral and inclusive transport system:

- The “Transformation Problem”: Forecasting will not lead to travel patterns consistent with the challenge of transformation towards a climate neutral transport sector.
- The “Intervention Problem”: Analysing and assessing marginal effects of an intervention will not indicate what policy-packages are needed to achieve a carbon neutral reference case.
- The “Welfare Analysis Problem”: Measuring and aggregating welfare effects of economic efficiency will not ensure that certain emission thresholds and accessibility standards are met.

Overall, the question is not how a scheme will fit into an *extrapolated* future, an investigation in line with a paradigm of “predict and provide, as long as benefits exceed costs”. Rather, the question is how to achieve a *desirable* future in terms of carbon neutral and socially inclusive transport.

While this contribution does not suggest solutions or even alternative frameworks, I see the benefit in discussing the methodological challenges on an abstract level, not yet on a detailed level of calculating indicators, estimating parameters, gathering databases etc.

I argue that the current and future challenges of transport policy and planning call for a new approach. A new agenda for transport appraisal could focus on

1. conducting assessments on a strategic level as an alternative to project-level CBA or at least before conducting project-level CBA,
2. assessing packages (push- and pull-measures) rather than single projects,
3. assessing the contribution of packages to specified targets rather than assuming these targets as an exogenous development in the reference case,
4. using different tools and metrics to address the problems described, for instance backcasting, methods for designing policy-packages, and multi-criteria-analysis.

ACKNOWLEDGEMENTS

This research emerged from the 'BeneVit' project on innovative approaches to transport assessment. BeneVit is part of the Munich Cluster for Mobility in Metropolitan Regions (MCube) and is funded by the German Federal Ministry of Education and Research as part of the Clusters4Futures initiative.

BIBLIOGRAPHY

REFERENCES

Banister, D. (2008). The sustainable mobility paradigm. *Transport Policy, 15*(2), 73–80. https://doi.org/10.1016/j.tranpol.2007.10.005

Banister, D., & Hickman, R. (2013). Transport futures: Thinking the unthinkable. *Transport Policy, 29*, 283–293. https://doi.org/10.1016/j.tranpol.2012.07.005

Beria, P., Giove, M., & Miele, M. (2012). A comparative analysis of assessment approaches. Six cases from Europe. *International Journal of Transport Economics, 39*(2), 185–217.

Bundesrepublik Deutschland (2022). *Gemeindeverkehrsfinanzierungsgesetz – GVFG* (Municipal Transport Financing Law). https://www.gesetze-im-internet.de/gvfg/GVFG.pdf (23.08.2022)

Department for Transport (2021). Transport Analysis Guidance (TAG). https://www.gov.uk/transport-analysis-guidance-tag (23.08.2022)

European Commission (2014). *Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020*.

European Union (2021). Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law').

Givoni, M. (2014). Addressing transport policy challenges through Policy-Packaging. *Transportation Research Part A: Policy and Practice, 60*, 1–8. https://doi.org/10.1016/j.tra.2013.10.012

Intraplan & VWI (2022). *Standardisierte Bewertung von Verkehrswegeinvestitionen im Öffentlichen Personennahverkehr – Version 2016+ (Standardized Appraisal of Infrastructure Investments in Public Transport), prepared on behalf of the Federal Ministry for Digital and Transport.* https://bmdv.bund.de/SharedDocs/DE/Artikel/E/schiene-schienenpersonenverkehr/gemeindeverkehrsfinanzierungsgesetz-gvfg.html (23.08.2022)

Mackie, P., & Worsley, T. (2013). *International Comparisons of Transport Appraisal Practice*, Overview Report.

MCube (2022). *BeneVit, Innovative Bewertungsmethoden für nachhaltige Verkehrsinvestitionen (Innovative Appraisal Methods for Sustainable Transport Infrastructure Investment)*. https://www.mcube-cluster.de/en/projects/weiterentwicklung-von-bewertungsverfahren-fuer-nachhaltige-verkehrsinvestitionen/ (23.08.2022)

Metz, D. (2008). The myth of travel time saving. *Transport Reviews, 28*(3), 321–336. https://doi.org/10.1080/01441640701642348

Ministère de la Transition écologique et solidaire (2020). *Référentiel méthodologique pour l'évaluation des projets de transport (Methodological reference for the evaluation of transport projects)*. https://www.ecologie.gouv.fr/evaluation-des-projets-transport (23.08.2022)
Odgaard, T., Kelly, C., & Laird, J. (2005). *HEATCO, Developing Harmonised European Approaches for Transport Costing and Project Assessment, Deliverable 1, Current practice in project appraisal in Europe*.

Republique francaise (2022). *Code des transports*. https://www.legifrance.gouv.fr/codes/texte_lc/LEGITEXT000023086525/ (23.08.2022)

Wiederkehr, P., Gilbert, R., Crist, P., & Caïd, N. (2004). Environmentally Sustainable Transport (EST): Concept, Goal, and Strategy – The OECD's EST Project. *EJTIR, 4*(1), 11–25.

GUIDELINES FROM TABLE 1

Croatia:
Republika hrvatska ministarstvo pomorstva, prometa i infrastrukture (2016). *Smjernice za CBA za projekte prometnica i željeznica*. https://promet-eufondovi.hr/wp-content/uploads/2017/08/Smjernice-za-CBA-za-prometnice-i-zeljeznice.pdf (23.08.2022)

Cyprus:
World Bank (2016). M*anual for Pre-Selection and Appraisal of Public Investment Projects*, Government of Cyprus. http://www.dgepcd.gov.cy/dgepcd/dgepcd.nsf/D5D27721041F947AC22581F60043F7F0/$file/Cyprus%20-%20PIM%20Manual%20-Version%203%200_%20April%202018.pdf (23.08.2022)

Czech Republic:
Sudop Praha (2019). *Departmental Guideline for the evaluation of economic effectiveness of transport construction projects*. https://www.sfdi.cz/soubory/obrazky-clanky/metodiky/2017_03_departmental-methodology-full.pdf (23.08.2022)

Denmark:
Transportministeriet (2015). *Manual for samfundsøkonomisk analyse på transportområdet - Anvendt metode og praksis i Transportministeriet*. https://www.transportministeriet.dk/media/ycybjfyq/manual-for-samfundsoekonomisk-analyse-paa-transportomraadet-netversionpdf.pdf (23.08.2022)

Finland:
Väylävirasto Trafikledsverket (2020). *Liikenneväylien arvioinnin yleisohje*. https://vayla.fi/suunnittelu/hankkeiden-suunnittelu/vaikutusten-arviointi/liikennevaylat (23.08.2022)

France:
Ministère de la Transition écologique et solidaire (2020). *Référentiel méthodologique pour l'évaluation des projets de transport*. https://www.ecologie.gouv.fr/evaluation-des-projets-transport (23.08.2022)

Germany (Standardisierte Bewertung):
Intraplan & VWI (2022). *Standardisierte Bewertung von Verkehrswegeinvestitionen im Öffentlichen Personennahverkehr – Version 2016+ (Standardized Appraisal of Infrastructure Investments in Public*

Transport), prepared on behalf of the Federal Ministry for Digital and Transport. https://bmdv.bund.de/SharedDocs/DE/Artikel/E/schiene-schienenpersonenverkehr/gemeindeverkehrsfinanzierungsgesetz-gvfg.html (23.08.2022)

Germany (BVWP):
Dahl, A., Kindl, A., Walther, C., Paufler-Mann, D., Roos, A., Waßmuth, V., Weinstock, F., Röhling, W., & Mann, H.-U. (2016). *Methodenhandbuch zum Bundesverkehrswegeplan 2030, FE-Projekt-Nr.: 97.358/2015, Entwurfsfassung für das Bundesministerium für Verkehr und digitale Infrastruktur*. https://www.bmvi.de/SharedDocs/DE/Anlage/G/BVWP/bvwp-methodenhandbuch.pdf?__blob=publicationFile (23.08.2022)

Ireland:
Department of Transport (2021). *Common Appraisal Framework For Transport Projects And Programmes*. https://www.gov.ie/en/organisation-information/800ea3-common-appraisal-framework/ (23.08.2022)

Italy:
Ministero delle Infrastrutture e dei Trasporti (2017). *Linee Guida Per La Valutazione Degli Investimenti In Opere Pubbliche*. https://www.mit.gov.it/sites/default/files/media/notizia/2017-07/Linee%20Guida%20Val%20OO%20PP_01%2006%202017.pdf (23.08.2022)

Latvia:
Latvijas Valsts Celi (2019). *Metodiskie norādījumi autoceļu projektu izmaksu – ieguvumu analīzes sagatavošanai*". https://lvceli.lv/wp-content/uploads/2021/04/METODISKIE-NORADIJUMI-autocelu-projektu-izmaksu-ieguvumu-analizes-veiksanai-Izmaksu-parrekins-uz-2020.-gada-cenam_.docx (23.08.2022)

Malta:
Government of Malta, Parliamentary Secretary for European Funds (2013). *Guidance Manual for Cost Benefit Analysis (CBAs) Appraisal in Malta*. https://eufunds.gov.mt/en/Operational%20Programmes/Useful%20Links%20and%20Downloads/Documents/Guidance%20Manual%20for%20CBAs%20Appraisal_May2013.pdf (23.08.2022)

Netherlands:
Ministerie van Verkeer en Waterstaat & Ministerie van Economische Zaken (2000): *Evaluatie van Infrastructuurprojecten, Leidraad voor Kosten-Batenanalyse, Deel I: Hoofdrapport*. https://www.mkba-informatie.nl/index.php/download_file/force/107/195/ (23.08.2022)

Ministerie van Verkeer en Waterstaat & Ministerie van Economische Zaken (2000): *Evaluatie van Infrastructuurprojecten, Leidraad voor Kosten-Batenanalyse, Deel II: Capita Selecta*. https://www.mkba-informatie.nl/index.php/download_file/force/107/195/ (23.08.2022)

A list of official amendments from 2004 to the OEI guidelines is available on this website: https://www.mkba-informatie.nl/mkba-voor-gevorderden/richtlijnen/ (23.08.2022)

Poland:
Ministerstwo Funduszy i Polityki Regionalnej (2016): *Niebieskie Księgi dla projektów w sektorze transportu publicznego, infrastruktury drogowej oraz kolejowej*. https://www.pois.gov.pl/strony/o-programie/dokumenty/niebieskie-ksiegi-dla-projektow-w-sektorze-transportu-publicznego-infrastruktury-drogowej-oraz-kolejowej/ (23.08.2022)

Slovakia:
Ministerstvo dopravy a výstavby Slovenskej republiky (2021). *Metodická príručka k tvorbe analýz nákladov a prínosov (CBA) v rámci predkladania investičných projektov v oblasti dopravy pre programové obdobie 2014-2020*. https://www.mfsr.sk/files/archiv/uhp/3370/76/CBA_1.pdf (23.08.2022)

Sweden:
Trafikverket (2020). *Analysmetod och samhällsekonomiska kalkylvärden för transportsektorn: ASEK 7.0, Kapitel 19 English summary of ASEK Guidelines*". https://bransch.trafikverket.se/contentassets/4b1c1005597d47bda386d81dd3444b24/asek-2021/19_english_summary_a7.pdf (23.08.2022)

Switzerland (NISTRA):
Bundesamt für Strassen ASTRA (2019). *Handbuch NISTRA 2017*. https://www.astra.admin.ch/dam/astra/de/dokumente/fachdokumente_fuernationalstrassen/handbuch_enistra.pdf.download.pdf/Handbuch%20eNISTRA%20(Version%202017).pdf (23.08.2022)

Switzerland (NIBA):
Bundesamt für Verkehr BAV (2016). NIBA: *Nachhaltigkeitsindikatoren für Bahninfrastrukturprojekte, Leitfaden zur Bewertung von Projekten im Schienenverkehr und elektronisches Rechentool eNIBA*. https://www.bav.admin.ch/dam/bav/de/dokumente/leitfaeden/eisenbahn/niba-leitfaden.pdf.download.pdf/niba-leitfaden.pdf (23.08.2022)

UK:
Department for Transport (2021). *Transport analysis guidance (TAG)*. https://www.gov.uk/transport-analysis-guidance-tag (23.08.2022)

NOTES

[1] The German Standardized Appraisal uses a two-step procedure to arrive at a single monetary decision indicator. First, quantitative indicators are calculated and weighed in a multi-criteria-analysis using standardized decision weights. Then, the results of the multi-criteria-analysis are assigned a fixed monetary value to include them in the monetary CBA.

[2] Republique francaise (2022). *Code des transports*. https://www.legifrance.gouv.fr/codes/texte_lc/LEGITEXT000023086525/ (23.08.2022)

[3] BCR: Benefit Cost Ratio

[4] BCD: Benefit Cost Difference

[5] NPV: Net Present Value

[6] In this paper, I use the terms reference case and without-case interchangeably.