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How Can Cost-Benefit Analysis Better Measure the Impact on Well-Being?

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This paper discusses the relationship between cost-benefit analysis (CBA) and well-being and provides recommendations how CBA can better measure the impact of policy on well-being. This amounts to four general recommendations for CBA-practice: a more comprehensive overview of effects, more attention to future generations, more attention to distributional effects and more attention to effects on the rest of the world. These recommendations are illustrated by examples from Dutch CBA-practice. This paper demonstrates that the notion of well-being is useful for improving the measurement and policy relevance of CBA-practice. This paper stresses also that CBA is a much more heterogeneous tool of economic analysis than generally thought and that CBA-practice differs substantially all over the world and for different policy areas. Further research is needed on CBA-practice, on the merits of CBA for different policy areas and on the comparison of CBA with alternative evaluation methods.

1. Introduction

In particular during the last decade, the concept of well-being has become popular for guiding government policy beyond GDP (see Stiglitz, Fitoussi and Sen, 2009; CES-recommendations, 2014 and Brundtland-report, 1987). Also a whole range of statistical monitors have been developed to monitor and compare well-being in countries all over the world. The concept of well-being stresses the importance of dimensions of welfare other than income and consumption (e.g. health, housing and security), distributional effects including equal opportunities and capabilities, impact on future generations and impact on people in the rest of the world.

Following a request from the Dutch Parliament¹, this paper discusses cost-benefit analysis in view of the concept of well-being. For politicians and policy makers, like those in the Netherlands, the link between CBA and well-being is a major issue, but this is thus far absent in the CBA literature and CBA

¹ The current Dutch cost-benefit guidelines were published in 2013 (Romijn and Renes, 2013). In 2019, the Dutch Parliament asked the government to investigate whether these guidelines were still up-to-date and whether CBA can be used to evaluate the impact of policy on well-being. In 2020 the Ministries of Economic Affairs and Finance wrote a report identifying the major challenges for CBA for measuring the impact of policy on well-being. This report also recommended to update the CBA-guidelines or to publish a supplement on CBA and well-being. In 2022, such a supplement was published by the two official CBA watchdogs, CPB Netherlands Bureau for Economic Policy Analysis and PBL Netherlands Environmental Assessment Agency (Bos, Hof and Tijm, 2022). This article is a translated and substantially revised version of that supplement.

textbooks (e.g. Boardman et al., 2014) or limited to discussing CBA in comparison to indicators of subjective well-being (see Sunstein, 2018, ...). Filling this hole in the current CBA literature is therefore the major value added of this paper.

Section 2 will discuss the relationship between CBA and well-being in general terms. First, CBA in theory and practice is described, then the notion of well-being and well-being indicators and then their relationship. For understanding the relationship with well-being, describing CBA in theory and practice is important for two reasons. Firstly, CBA is a much more flexible and heterogeneous tool of analysis than generally thought. For example, CBA can range from a very simple CBA to a very sophisticated and comprehensive CBA and CBA includes also cost-effectiveness analysis. A second complication is that CBA-practice differs substantially all over the world and for different policy areas and this is also not commonly known. These issues are therefore also briefly discussed and illustrated by examples from Dutch CBA-practice and in some other countries.

Section 3 will discuss how CBA can better measure the impact of policy on well-being. This actually amounts to four general recommendations for CBA-practice: a more comprehensive overview of effects, more attention to future generations, more attention to distributional effects and more attention to effects on the rest of the world. These recommendations are illustrated by examples from Dutch CBA-practice.

Conclusions are drawn in section 4. In order to assess the merits of CBA for evaluating the impact of policy on well-being, ideally these merits should be compared with those of alternative methods of evaluation, like multi-criteria analysis, impact analysis, public score card and subjective well-being methods. This is outside the scope of this paper, but some general and tentative remarks on these relative merits of CBA are nevertheless provided.

2. What is the relationship between CBA and well-being?

2.1. What is CBA in theory and practice?

What is CBA?

A cost benefit analysis (CBA) provides an ex ante or ex post overview of the advantages and disadvantages of a policy proposal for society from a long term perspective and mostly in monetary terms (see Boardman et al., 2014 and Sunstein, 2018). As a consequence, a comparison can be made of the costs and benefits of the proposal: do the benefits to society exceed the costs, is this difference small or big, how certain is this difference, who benefits and who bears the costs and how does this all compare to other policy proposals?

For national policy proposals, the overview will generally pertain to various groups of stakeholders like central government, local government, consumers, employees, business and different regions. Depending on the topic and purpose of analysis, the geographical scope can be differentiated and may also include the consequences for neighbor countries or even the world. For local policy

proposals, the geographical scope of analysis can be limited to the consequences for local stakeholders.

CBA can support public decision-making on a broad range of policy issues. CBA is traditionally most applied to policy issues linked to infrastructure, like water management, transport and energy. For social policy, CBA is in particular important for health care to compare the cost-effectiveness of various treatments and medicines. In the USA, since Ronald Reagan in the 1980s, CBA is obligatory for deciding on regulations on environmental, occupational and health risks: new regulations are only allowed when the benefits to society exceed the costs². In the European Union CBA is not common for such regulations: generally an impact assessment without any quantification and monetization of effects suffices. On occasions, CBAs are also made to analyze whether a country or city would organize a major event like the Olympic Games or World championships soccer.

By showing the costs and benefits for various groups of stakeholders, CBA can also serve as an input for deciding who should pay for the costs of infrastructure like water works or a road. For example, for projects of national public interest, national government should pay, for projects of only local public interest, local government should pay and for private benefits private parties may be asked to contribute.

A Dutch CBA on transport infrastructure

CBA-practice, and in particular Dutch CBA-practice, can be illustrated by a CBA of extra lanes for the highway near the Dutch city Utrecht. This example is about one of the most common applications of CBA, i.e. road transport. It is also a case in which the trade-off with nature was a major topic for public debate and heated protests by Dutch citizens.

This CBA compares the direct financial costs of extra lanes of about 800 mln euro (in discounted value) with eight different types of effects (see table 2.1). These effects can be positive or negative for well-being. Because the future is uncertain, two future scenarios are distinguished for the next four decades: low economic growth and high economic growth.

Table 2.1 CBA Extra lanes for the highway near the Dutch city Utrecht (Decisio, 2014)

Costs (-) and benefits (+)	Which scenario?	
	Low growth	High growth
Financial costs: investments, maintenance and operating costs	-838	-840
1. Savings in travel time	256	1085
2. Traffic-safety	-37	-133

² However, CBA practice for US regulations may be quite different and may more amount to a global impact assessment than to a cost-benefit analysis mostly in monetary terms : “many agency CBAs lack basic process transparency, meaning disclosure about their creation and their role in the decision-making process may not be adequate. In addition, most CBAs continue to lack transparency about policy impacts, often failing to quantify and monetize costs and benefits. ... even among CBAs that monetize costs and benefits, most do not make their data, models, and underlying sources readily available.” (Cecot and Hahn, 2019).

3. Air quality	-5	-11
4. Climate: CO2-emissions	-7	-16
5. Noise	-2	-1
6. Excise duties	106	253
7. Agglomeration-effects	38	163
Net benefits in monetary terms	-489	500
8. Memorandum item: Nature	- ?	- ?

In terms of euros, savings in travel time is by far the largest effect. However, in the low growth scenario these savings in travel time are clearly not sufficient to compensate for the direct financial costs. In the high growth scenario, savings in travel time are four times as large than in the low growth scenario and sufficient to cover the direct financial costs.

Next to savings in travel time seven other effects of extra lanes are shown: traffic safety, air quality, CO2-emissions, noise, excise duties, agglomeration effects and nature. This last effect could not be expressed in monetary terms and is therefore presented as memorandum item¹.

It is often assumed that a CBA provides a straightforward recommendation for public policy. However, a key-feature of this CBA is that it does not provide a clear advice on whether extra lanes are a good investment for Dutch society. The net benefits of extra lanes to Dutch society are negative in case of a low growth scenario. In case of a high growth scenario, net benefits in monetary terms are 500 mln euro, but this disregards the negative effects on nature. The net benefits to Dutch society are then only positive in case the negative effects on nature are valued at less than 500 mln euro.

Table 2.2 Key-figures used in CBA Extra lanes for highway near the Dutch city Utrecht (Decisio, 2014)

Discount rate	
general	5.5
irreversible effects: air-quality and emissions	4.0
Savings in travel time, euro per hour	
business travel per person	28
commuting per person	10
leisure time travel per person	8
transport by truck per truck	52
Traffic safety, costs per victim in mln euro	
deadly victims	3.0
victims in hospital	0.3
other costs	0.3
Air quality (including fine particulars and nitrogen)	
car in urban area	6
truck in urban area	57
CO2-emission, euro per thousand kilometer	
car in urban area	7
truck in urban area	17

In order to translate the effects into euros various national key-figures on the willingness to pay and costs have been used (see table 2.2). This pertains e.g. to the value of savings in travel time, deadly victims in traffic and the nuisance of noise. The costs and benefits refer to many different years and there are aggregated by using the nationally agreed discount rate; for most effects this was 5.5%. This implies that effects pertaining to later years get a substantially lower value than those in earlier years. According to recent Dutch research (Wijnen et al., 2022), the value of deadly traffic victims should not be 3 mln euro but 6 mln euro. Using this more recent key-figure will mainly deteriorate the net benefits in the high growth scenario, but this will not change the general conclusions of this CBA.

CBA principles and well-being

In order to understand the link between CBA and well-being, it is important to recall six basic CBA principles:

1. Not only financial costs and benefits are included, but also other costs and benefits for society, in particular externalities, benefits of public services and leisure time;
2. Long term costs and benefits are included, but those in the more distant future get (much) less weight due to discounting;
3. Costs and benefits are mainly in monetary terms, based on market prices, shadow prices (revealed preferences, contingent valuation) or costs (actual, opportunity, costs of prevention, costs of compensation);
4. Major effects not in monetary terms should be presented prominently in the overview table on costs and benefits;
5. Principle of 1 euro is 1 euro for aggregating various costs and benefits, irrespective of who is involved and whether he or she is poor or rich and whether it is a loss or a gain;
6. A positive net balance of costs and benefits generally involves some losers; so, the net balance in CBA does not measure Pareto improvements of welfare. Instead, the criterium of potential compensation of losers (Hicks-Kaldor) is used; this implies that no actual compensation is required. It should be noted that in CBA practice, policy alternatives may include some kind of compensation for losers, e.g. noise barriers for a road.

Why CBA practice also matters for the link with well-being

CBA practice differs in many respects, and this matters also a lot for the link with well-being. Some examples can clarify this³.

Many different types of CBA exist. A CBA can be quick-scan CBA or a very comprehensive CBA; in the latter case, generally more effects are distinguished and more efforts are made for solid estimates in monetary terms. A quick-scan CBA will therefore be less comprehensive in its coverage of effects on well-being. This will be further discussed in section 3.1.

Cost-effectiveness analysis (CEA) can also be regarded as a specific type of CBA; the distinctive feature of CEA in comparison is that the effect on the primary purpose need not be translated into

³ Other examples: two basis scenarios plus sensitivity analysis or just one baseline scenario (UK, USA), more than one alternative is considered and compared?, may compilers of CBA deviate from official guidelines and key-figures (comply or explain-rule, NL).

monetary terms. As a consequence, a CEA is less normative than an ordinary CBA as it does not put a price tag on the benefits for the principal purpose. For example, for strengthening dikes the extra safety is the primary purpose. In an ordinary CBA, these benefits including the expected savings in material damages and human lives are also expressed in monetary terms. In an CEA, policy measures can be compared e.g. in terms of their costs in meeting a specific level of extra safety and there is no need to put a price tag on human lives. Similarly, for evaluating new medicine, ordinary CBA but also CEA can be used. In an ordinary CBA a price tag should be put on the effect on the quality adjusted lives saved (QALYs), but in a CEA this is not necessary.

Discount rates and key-figures like those in the table above determine how effects in a CBA are valued and aggregated into net discounted benefits. They determine to a substantial extent what counts, who counts and by what weight. As a consequence, the relationship of CBA with well-being is influenced to a great extent by these discount rates and key-figures. The devil can then be in such detail. For example, major differences exist in the discount rates used in different countries for CBA and they may also change substantially over time. In the Netherlands, in 2020 the standard discount rates was reduced from 5.5% to 2.25%. Another case in point are CO₂-prices used for CBA, which differ substantially between different countries. A less well known example is the value of saving travel time, this is important for assessing the merits of all kinds of transport infrastructure. In the Netherlands a national average is used; this implies that the travel time of people living in Amsterdam or those in regions in the countryside are given the same price target (weight) and that this also applies to the travel time of students and employees. In the UK, the current practice is that the value of saving travel time near London is much higher than outside London. This practice is a major reason why in the UK most public investments in transport infrastructure refer to London and hardly any to regions like Scotland and Wales (Coyle, 2021).

Also several other examples of why CBA-practice differs between countries and may matter a lot for calculating costs and benefits for society can be provided, e.g. major differences in the time horizon used for infrastructure projects, differences in whether a correction is made for the marginal excess burden of taxation (see Bos et al, 2019), differences in the use of multiple basic scenarios or differences in whether effects not expressed in monetary terms are presented prominently in the overview table and summary.

2.2. What is well-being?

Well-being is a notion without a uniform definition or interpretation. In this article, we refer to the approach in Stiglitz, et al. (2009), CES-recommendations (2014) and Brundtland-report (1987). These studies define well-being as the current quality of life and the extent to which this may have adverse effects on future generations or people living in the rest of the world. From this perspective, well-being has five distinctive features:

- Well-being provides a more comprehensive perspective going beyond net-material well-being and direct financial economic aspects. It also includes other dimensions of well-being, like health, quality of life and the environment. The concept of well-being stresses the

importance of dimensions of welfare other than income and consumption, e.g. health, housing, security, quality of life and quality of the environment.

- A major dimension of well-being is distribution. Distribution is important from a normative perspective when policy goals exist with respect to poverty and inequality. Distribution is also important from a functional perspective: inequality in opportunities are a barrier for the sources of our future well-being. For example, lack of educational opportunities for major groups of the population (e.g. women, minorities, specific regions) will harm human capital accumulation and lead to a much less productive labour force.
- Well-being does not overlook the interests of future generations. This implies that all major sources of well-being should be accounted for.
- Well-being does not forget the impact of national policy and national economic activities on people living in other countries.
- No need for aggregation and translation of all stocks, flows and effects in monetary terms.

For more than fifty years, a whole range of statistical monitors have been developed to monitor and compare well-being in countries all over the world. In 1972, Nordhaus and Tobin published an estimate for economic-growth in the United States corrected for major items absent in GDP but important for well-being, e.g. leisure time, unpaid household services and pollution. This was taken up later by various authors (e.g. Eisner, extended accounts) and became the source of inspiration for genuine progress indicators (...). Since 1990, the Human Development index is published by the United Nations.⁴ This index consists of three components: gross national income per capita, life expectancy at birth and the median of the expected number of years schooling for a 25-year old. For gross national income the logarithm is taken, as this reflects the decreasing marginal benefits of extra income.

Table 2.3 Overview of well-being indicators

	First year of publication	Number of indicators	Overall indicator?	In monetary terms?
Genuine progress indicator	1972	differs	yes	yes
UN Human development index	1990	3	yes	no
WEF Global competitiveness index	2004	99	yes	no
OECD Better life index	2011	36	no	
UN Sustainable development Goals	2012	17	no	
Worldbank Inclusive wealth accounts	2012	3	yes	yes
RABO-bank Netherlands Well-being index	2016	11	yes	no
WEF Inclusive development index	2017	12	yes	no
Statistics Netherlands Well-being monitor and SDGs	2018	100-300	no	
Coreset of well-being indicators by Dutch Planning offices	2026	?	no	

The table above provides a small selection of well-being indicators all over the world. This overview shows the enormous heterogeneity in these indicators:

⁴ This index was developed in cooperation with Sen, inventor of the capabilities approach and granted the Nobel prize in economics for his work on welfare economics.

- Many different sets exist and are being used (UN, OECD, World bank, WEF, Statistics Netherlands, ...);
- Some have many indicators, others only a limited set;
- Some use a summary indicator (index or in monetary terms), others do not;
- No convergence in international indicator sets seems to occur. Furthermore, the relationship to the international statistical standards on the national economy and the environment, i.e. national accounts (SNA) and environmental accounts (SEEA), is not clear.

2.3. The relationship between CBA and well-being

Cost-benefit analysis and the concept of well-being have different purposes and therefore also different features. They both stress the importance of non-economic and non-financial effects, e.g. pollution and health. Unlike cost-benefit analysis, well-being does not focus on measurement into monetary terms and arriving at one summary yardstick in monetary terms, e.g. net balance of costs and benefits in euros or cost-effectiveness per euro. Well-being can contain dimensions that are generally not included in cost-benefit analysis. Well-being stresses much more the importance of distributional issues and equity, future generations and people living in the rest of the world.

Figure 2. Well-being, CBA, business case and public decision-making

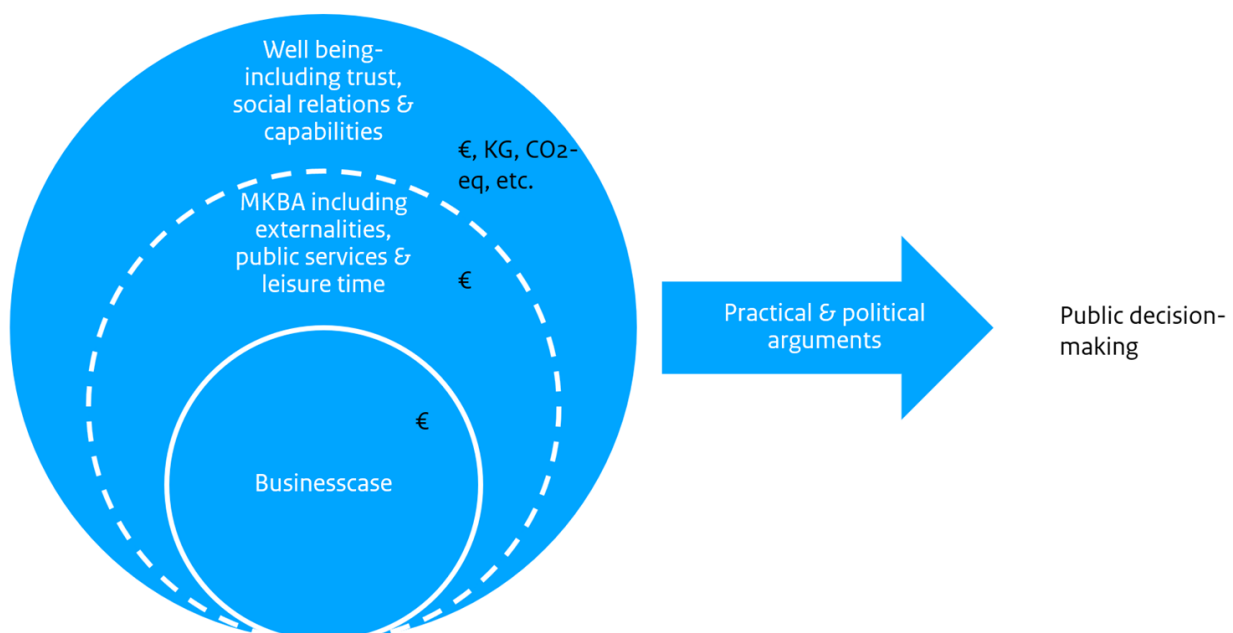


Figure 2 illustrates the differences between financial-economic effects (business case), CBA and well-being.⁵ The figure shows that CBA does not only include the financial effects included in the business case, but also other costs and benefits, like external effects, the effects of public services and the impact on leisure time. A common feature of CBA and the business case is that they express all

⁵ Note that business case and CBA have in common that they are analytical tools focus on deriving a balancing item in monetary terms, while well-being is a notion or a general concept and not an analytical tool or measurement instrument.

effects in monetary terms and use this to arrive at a balancing item.⁶ Well-being can cover issues that are generally outside the scope of CBA, like trust, social relationships, opportunities and political and economic freedom⁷. Furthermore, for well-being there is no need to add up all effects or to translate effects in monetary terms.

Figure 2 stresses that for public decision-making, information on the impact on well-being does not suffice, as all kinds of practical and political arguments are also relevant. Politicians may apply a different weight to the various effects, use all kinds of supplementary information and take account of all kinds of other considerations, e.g. the health of the government budget and political strategies and promises.

The relationship between CBA and indicators for well-being can be summarized as follows. They share a common perspective and have a much broader scope than GDP, consumption or income. But they have different purposes. CBA provides an analysis of the impact of one or some policy measures. No attention is given to the cumulative effects of different policy measures. Well-being indicators are a supplement or alternative to macro-economic indicators like GDP. Any changes in these indicators are not disentangled into those related to policy and other factors and no clear link is made to the impact of specific policy measures. CBA and indicators for well-being are complementary for policy making. For example, well-being indicators can serve to signal problems and CBA can be used to evaluate policy measures to solve these problems

3. How can CBA better measure the impact on well-being?

3.1. More comprehensive overview of effects

In order to properly measure the impact on well-being, CBA should provide a comprehensive overview of effects relevant for well-being. Two types of effects missing in CBA practice could be distinguished. Firstly, effects identified in CBA but not put in monetary terms. This can be for various reasons, e.g. lack of information or lack of time and budget. An example can be biodiversity lost due to a new road crossing a forest. Secondly, effects on well-being but not regularly, or hardly ever, identified as effects in CBA practice. Examples are health effects of cycling or living near parks or the impact of public transport on labour market participation and participation in social activities. A hard borderline between both type of effects does not exist. For example, in the first CBAs on dikes and flood risk in the Netherlands the impact on biodiversity was overlooked, but in such CBAs since 1970 the impact on biodiversity is nearly always mentioned (see Bos and Ruijs, 2021).

Various solutions exist to deal in CBA with such missing effects:

- Present some effects as a memorandum item in CBA, including a quantitative assessment. For example, the impact on biodiversity can be expressed in biodiversity points (see below).

⁶⁶ In case of cost-effectiveness analysis, the key-figure is the costs in monetary terms per unit of impact.

⁷ However, a hard borderline between the scope of CBA and well-being is difficult to determine, as a CBA may include all kinds of policy measures and may include a wide range of effects.

- Changes in housing prices can be used to estimate all kinds of effects on quality of life in monetary terms via hedonic pricing.⁸ Ex post analysis is available on a wide range of effects. This will also be discussed briefly below, using the example of a highway tunnel in a city.
- Present information on some effects as a supplement to the CBA/CEA, e.g. a separate report on the environmental impact and a separate monitor on the impact for some vulnerable groups in society.
- Treat some effects on well-being as a minimum requirement for the alternatives in the CBA/CEA. For example the new bridge should be built with durable materials and use a durable energy resource. Or the new transport system should meet minimum requirements for the accessibility by public transport of some distant regions.

Measuring the impact on biodiversity in CBA

For many CBA, properly assessing the welfare effects of a policy measure on biodiversity is important. This does not only apply to CBA on conservation or stimulation of biodiversity, but also to CBA on other policy areas such as mobility, agriculture and water safety. For example, a new road connecting two cities through a forest is good for mobility but the biodiversity of species in the forest may be affected severely by fragmenting the forest and by increasing traffic, pollution and visitors. For over a decade in the Netherlands a methodology known as biodiversity points is being applied for this purpose (see Bos and Ruijs, 2021). Biodiversity points are quite similar to the quality-adjusted life years (QALY) used for cost-effectiveness analysis of health care treatments. Biodiversity points provide a quality-adjusted measure of the changes in the quantity of biodiversity. It is not based on the preferences and information of consumers or citizens, but is based in a standardized way on the expert-opinion of ecologists. The unit of measurement is not dollars or euros but is the number of biodiversity points.

The use of biodiversity points can be illustrated by a meta-study about the cost-effectiveness of 175 defragmentation policy measures in the period 2004-2018 (see table 3.1). Four types of defragmentation alternatives were distinguished: ecoduct, viaduct, big faunatunnel and small faunatunnel. The major conclusions are:

- Large fauna tunnels and viaducts with shared use of traffic and animals are more cost-effective for stimulating biodiversity than ecoducts (0.08 mln euro per biodiversity point versus 0.18 mln euro per biodiversity point); small faunatunnels are by far the least cost-effective, i.e. on average more than double as costly than ecoducts (0.38 mln euro per biodiversity point).
- The cost-effectiveness differs between ecoducts: the more nature areas are in the direct vicinity, the more cost-effective.
- Buying agricultural land and using this for nature purposes is about as cost-effective for biodiversity than a viaduct or big faunatunnel. However, ecological improvement of existing nature zones is even much more cost-effective (0.02 mln euro per biodiversity point).

⁸ But note that not all welfare effects are reflected by changes in housing prices, e.g. house owners may not well be aware of the major health effects of a high dose of fine particulates.

Table 3.1. CEA meta study on infrastructure defragmentation (Sijtsma et al., 2020)

Defragmentation alternatives	Number of connections	Biodiversity points	Costs (mln euro)	Cost-effectiveness (mln euro per biodiversity point)
1. Ecoduct	26	1074	194	0.18
2. Viaduct	20	195	16	0.08
3. Big faunatunnel	44	427	33	0.08
4. Small faunatunnel	56	95	36	0.38
Total	146	1791	279	0.16
Expanding nature areas (less agriculture)		41000	3080	0.08
Ecological improvement of existing areas		58413	1370	0.02

Including more effects in CBA using the impact on housing prices

including more effects CBA can have a major impact on the net balance of a project. This is well illustrated by a CBA of highway tunneling in the city Maastricht. According to the original CBA, the net balance of the project was 49 mln euro. The major benefits in monetary terms of this tunnel were reduction in travel time and CO2 emissions. Also a small sum of 12 mln euro was added for improvement of the quality of life of people living near the highway. Ex post analysis on the basis of changes in housing prices demonstrated that this was a substantial underestimation of the benefits. These should be 200 mln euro more. Furthermore, all kinds of other benefits are probably also relevant, but were not even mentioned in the original CBA, like the positive impact on health, social effects, real estate development and biodiversity.

Table 3.2 CBA of highway tunneling in the city Maastricht (Tijm et al., 2018)

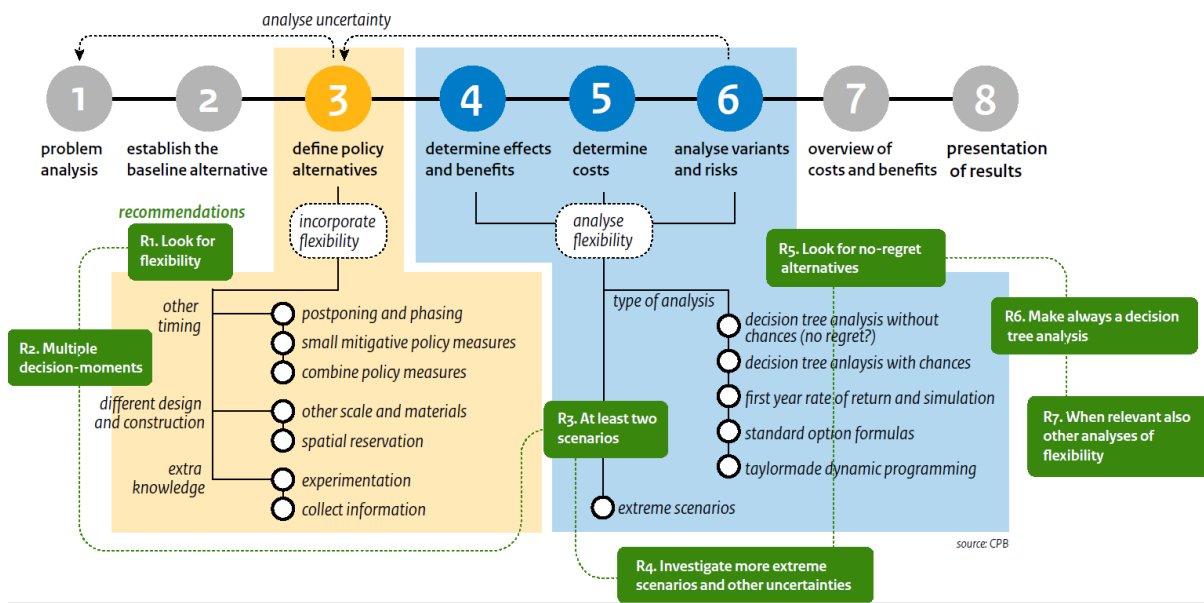
	Original CBA	Revised CBA
Costs of investment and maintenance	725	725
Benefits	774	982+++
Travel time & CO2	762	762
Quality of life	12	220 (tot 2017)
Health		+
Social effects due to barrier of a highway in the city		+
Real estate development		+
Biodiversity		+
Net balance	49	257+++
Memorandum item: Distributional effects		+/-

3.2. More attention for future generations

Long term costs and benefits are included in CBA⁹, but those in the more distant future get (much) less weight due to discounting. In various ways, more attention can be provided to the costs and benefits for future generations:

- Do not only show the net discounted value of the costs and benefits, but show also the evolution of costs and benefits over time, e.g. in a graph.
- Discuss long term risks and uncertainty. This includes discussing risks just beyond the time horizon used in the CBA. For example, in constructing housing in some regions in the Netherlands, the new houses may be very vulnerable to flooding in the long run. Similarly, in a CBA of nuclear energy plants also the risk for future generations of the nuclear waste should be discussed.
- Include stepwise and low regret investment strategies and show the impact of more extreme scenarios and lower discount rates. The figure below shows how the CBA- compilation method in 8 steps in the Dutch national CBA guidelines (Renes and Romijn, 2013) can be adjusted in order to better take account of high risk and uncertainty.

Figure 3.1 Compiling CBA in 8 steps for circumstances with high risk and uncertainty (Bos and Romijn, 2017).



3.3. More attention to distributional effects

CBA should not only show and discuss the total costs and benefits, but also their distribution. Such information serves various purposes:

⁹ See e.g. Bos and Zwaneveld (2017) on CBA used to raise the strength of Dutch dikes.

- Assess the merits of a project including distributional effects;
- Input for financing of the proposal, e.g. private benefits could be financed by their private beneficiaries and local public benefits could be financed by local government;
- Consider some type of compensation for those that have the most negative effects.

Before discussing what could be done to pay more attention to distribution in CBA, three general remarks should be made:

- Many different dimensions of distribution can be relevant, low and high income is only one of them.
- Some distributional effects are relevant for well-being but not for CBA, e.g. equal opportunities in education.
- In economics, who ultimately benefits or bears the costs is often not simple to assess and may require additional analysis, data and modelling and therefore also extra budget and time for compiling such a CBA. When relevant this problem of assessing the ultimate beneficiaries should be explicitly mentioned.

In several ways, more attention can be paid to be distributional issues in CBA:

- If a policy measure is focused on income redistribution or has major distributional effects, this should be explicitly mentioned and discussed, e.g. subsidies for electric cars or solar panels on housing may mainly be received by people with high income.
- Experiment with welfare weights as a type of sensitivity analysis (Pol et al., 2017¹⁰).
- Explicitly discuss employment effects in case of major public investments, even if such employment effects are zero or very small on a national scale. This is useful, as such employment effects are a common source of misunderstanding between economists and policy-makers.
- CBA practice matters for distribution, e.g. standard key-figures on value of time may differ by income or region. This should be discussed when relevant for distribution effects.

3.4. More attention for effects on rest of the world

Most CBAs focus on the effects on the national economy and its citizens. This reflects that the CBA serves to provide an input for national public decision-making. From a well-being perspective, also the effects on the rest of the world are relevant. For compiling CBA this leads to the following recommendations:

- Mention and discuss effects on neighbour countries, developing countries and other countries subject to ETS (e.g. waterbed-effects of pollution, income and employment).

¹⁰ This paper advises for CBA practice “to report net benefits or disposable income changes of public policies if this information supports decision-making and outweighs its transaction costs. Purchasing power analysis and stakeholder analysis provide tools to show distributive effects in CBAs. If these results are insufficient for informed decision-making, distributionally weighted CBA could be considered as a complementary tool for policies that involve major efficiency-equity tradeoffs.” (p. 19).

- When substantial, quantify these effects, put them in monetary terms and provide also a CBA from international perspective. For example, the CBA of the high speed train from Amsterdam to Brussels provided not only a CBA from Dutch perspective, but also a CBA from European perspective (NEI, 1994).

4. Conclusions

This paper discusses cost-benefit analysis (CBA) in view of the concept of well-being. CBA and well-being both stress the importance of non-economic and non-financial effects, e.g. pollution and health. But they have different purposes and therefore also different features. Unlike cost-benefit analysis, well-being does not focus on measurement into monetary terms and arriving at one summary yardstick in monetary terms. Well-being can also contain dimensions that are generally not included in cost-benefit analysis, e.g. issues of fairness and equity.

This paper shows that the notion of well-being is useful for improving the measurement and policy relevance of CBA-practice. This leads to several specific recommendations for CBA practice. In the more extended Dutch version of this paper, more and more detailed recommendations are provided. These recommendations supplement the current Dutch guidelines on cost-benefit analysis (Romijn and Renes, 2013). These recommendations are a mix of clarification, tightening and suggestions for research.

It is recommended to provide quantitative and qualitative information on effects that cannot well be expressed in monetary terms. For example, the effect on the non-use value of biodiversity can be expressed in biodiversity points. Not all dimensions of well-being need to be reported in a CBA. Some dimensions of well-being could be reported as supplementary information, e.g. about equal opportunity in education. More could also be reported in CBA on the impact on distribution, the timing of costs and benefits and the impact on well-being in neighbouring countries and developing countries.

The paper also stresses that different types of CBA have different levels of ambition for measuring the impact on well-being. For example, unlike a complete CBA, a cost-effectiveness analysis does not require to put a price tag on the principal policy effect. Furthermore, in order to better measure in CBA the impact on well-being, also much more ex post evaluation of such effects is necessary (e.g. Ruijven and Tijm, 2022).

This paper has provided a general overview on the relationship between CBA in theory and practice and well-being. In order to better understand this relationship, further work is to be done:

- International comparison of CBA practice: scope of application, different role in policy practice, different methods, discount rate and other key-figures,
- CBA and well-being for specific policy areas: CBA is most popular in some areas and not in others, why? CBA in some policy areas, e.g. CBA of regulations of safety and environmental risks, seem to be only popular in some countries, why?

- Comparison of CBA and other methods of evaluation in view of well-being. What are the strengths and weaknesses of CBA?

A provisional answer to the last question is that CBA is not perfect but a quite flexible and heterogeneous tool of economic analysis. And this paper has also shown that several major weaknesses in view of well-being can be addressed. Furthermore, CBA avoids double counting of effects; this is a major weakness of alternative methods. Another distinctive feature of CBA is that it provides information on the efficiency of policy; most alternative methods do not. Finally, CBA has a well-established methodology, often grounded in economic theory.

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