Launch Event
Guide to Cost-Benefit Analysis of Investment Projects

2 July 2015, Brussels

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Jaspers
Joint Assistance to Support Projects in European Regions

INTRODUCTION

- Scope and objectives of CBA
- Roots and recent developments
- Sectors of application
- The core ingredients
- The CBA Guide over twenty years:1994-2014

Scope and objectives of CBA

*"The purpose of CBA is to provide a **consistent procedure** for evaluating decisions in terms of their consequences"*

Dréze and Stern, 1987 in Auerbach and Feldstein, *"Handbook of Public Economics",* North Holland.

What is CBA?

- Cost-Benefit Analysis (CBA) is **an analytical tool** used to assesses whether a project or a policy is desirable from the point of view of the society as a whole and it is worth implementing.
- Desirability is achieved when **total social benefits of an intervention exceed the total costs of that intervention**.
- **Benefits** are defined as increases in wellbeing and **costs** are defined as reductions in wellbeing.

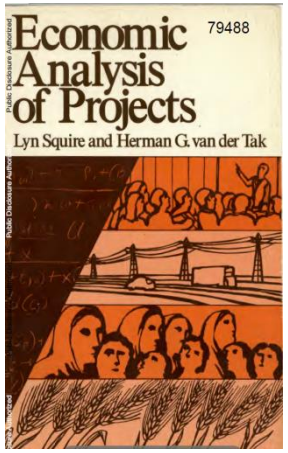
Traditions of CBA (1)

- **France, 1850's**
  - *Ecole des Ponts et chausseès*
  - *Dupuit, Arsène Jules Étienne Juvénal, De la mesure de l'utilité des travaux publics, Annales des ponts et chaussées (1844)*

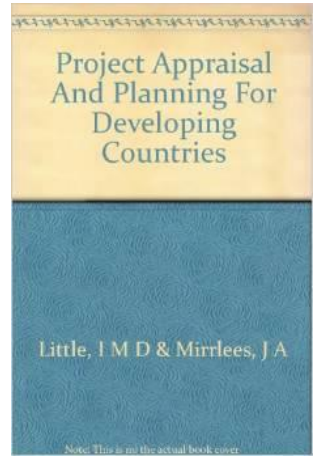
- **USA, 1930's:**
  - *Flood Control Act (1936)*

- **USA, 1950's:** *attempts to codify the benefit-cost rules*
  - *U.S. Army Corps of Engineers, Department of Agriculture, Bureau of Reclamation, Federal Power Commission*
  - *Proposed practices for economic analysis of river basin projects - Green book (1950)*

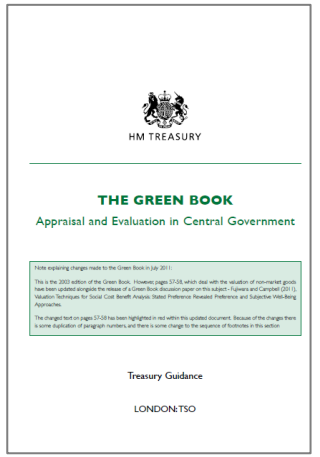
Traditions of CBA (2)



- **UNIDO, OECD, World Bank, 1970's**
  - *Guidelines for project evaluation, UNIDO (1972)*
  - *Project appraisal and planning for developing countries by I.M.D. Little and J.A. Mirrlees, OECD (1974)*
  - *Economic analysis of projects by L. Squire and H.G. van der Tak, World Bank (1975)*

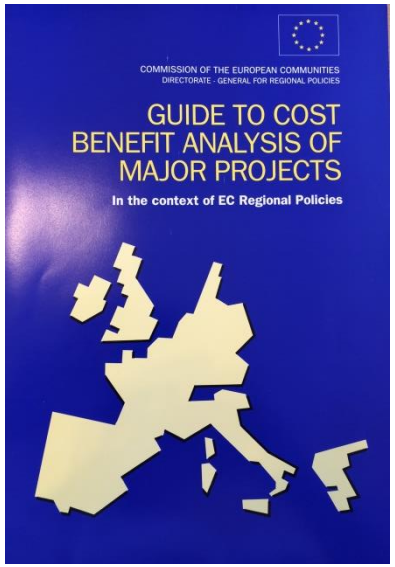


- **CBA in XXI century**
  - *UK, The Green Book – Appraisal and Evaluation in Central Government (2003)*
  - *OECD, Cost-Benefit Analysis and the Environment, Pearce et al. (2006)*
  - *EIB, The Economic Appraisal of Investment Projects at the EIB (2013)*
  - *EC, several editions of the CBA Guide of investment project co-funded by Structural Funds, Cohesion Fund and Instrument for Pre-Accession (now ESI Funds). First edition in 1994 (brief document), the fifth edition published in December 2014.*

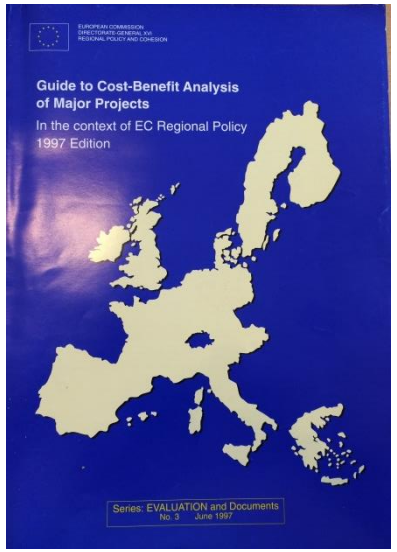


Traditions of EC CBA Guide

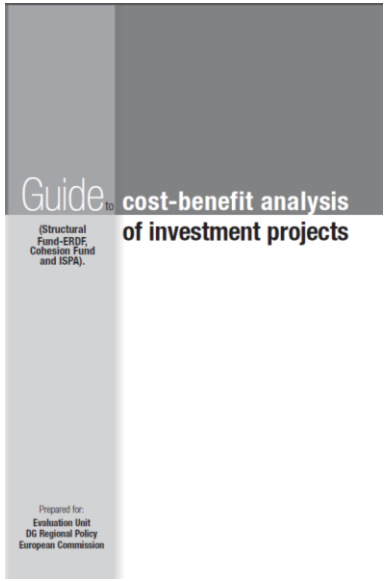
1994: 1st edition, 28 pages



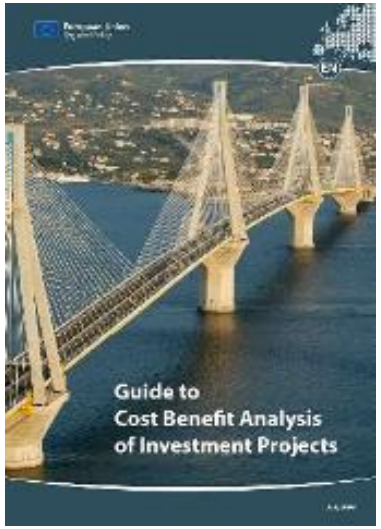
1997: 2nd edition, 84 pages



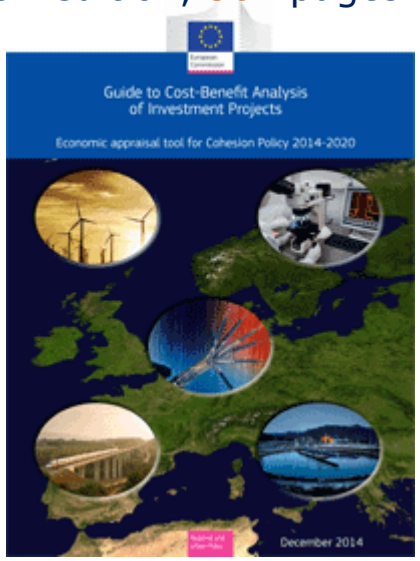
2002: 4th edition, 133 pages



2008: 4th edition, 257 pages



2014: 5th edition, 364 pages



Evidence from the ground

- Some information on CBA international practice are drawn from the results of a survey conducted on ***selected OECD countries*** addressing the actual use, practice and role of CBA in ex-ante project appraisal.

OECD, Government at glance, Forthcoming publication.

Available from July, 6th 2015

http://www.oecd.org/gov/govataglance.htm

Scope and objectives: evidence from the ground

In the **framework of the EU funds**, the purpose of CBA is to ***facilitate a more efficient allocation of resources***, demonstrating the convenience for the society of a particular intervention rather than possible alternatives. In doing so, it provides key support in assessing the contribution to **Cohesion Policy objectives** and to the achievements of **Europe 2020 targets**.

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

- Justification for ***project selection/decision and financing*** (*e.g. Austria, Canada, The Netherlands, Sweden, New Zeland*).
- Tool for ***prioritising investment*** at the central level (e.g. Denmark, UK)
- ***Accountability and Transparency*** tool (e.g. Sweden, UK).
- Technical assessment ***supporting project design*** in the feasibility phase (e.g. Canada, Sweden).
- Tool for ***project monitoring*** (e.g. Sweden, UK)
- Tool for ***policy learning*** (e.g.UK)

Sectors of CBA application:evidence from the ground

Rail *(e.g. Austria, Denmark, Canada, Sweden, Netherlands).*

Urban transport *(e.g. New Zealand, Austria, Denmark, Canada, Sweden, Netherlands)*

Airports, ports and waterways *(e.g. Austria, Canada, Sweden, Netherlands, UK)*

Water supply and wastewater *(e.g. Canada, Netherlands)*

Solid waste management *(e.g. Canada, UK)*

Other environmental projects: risk prevention and mitigation, natural asset conservation, etc. (e.g. *Canada, Sweden, UK)*

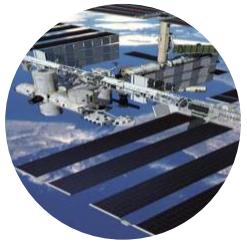
Energy: production, transmission and distribution (e.g. Denmark, Canada, Sweden)

Education *(e.g. Canada, UK)*

Culture and leisure *(e.g. New Zealand, Canada, UK)*

ICT: telecommunications, broadband, ICT applications to businesses and citizens *(e.g. Canada, UK)*

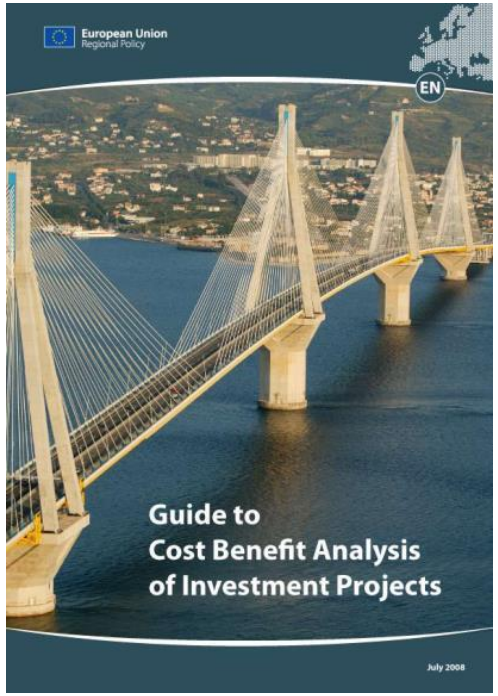
Health *(e.g. Canada, Sweden)*

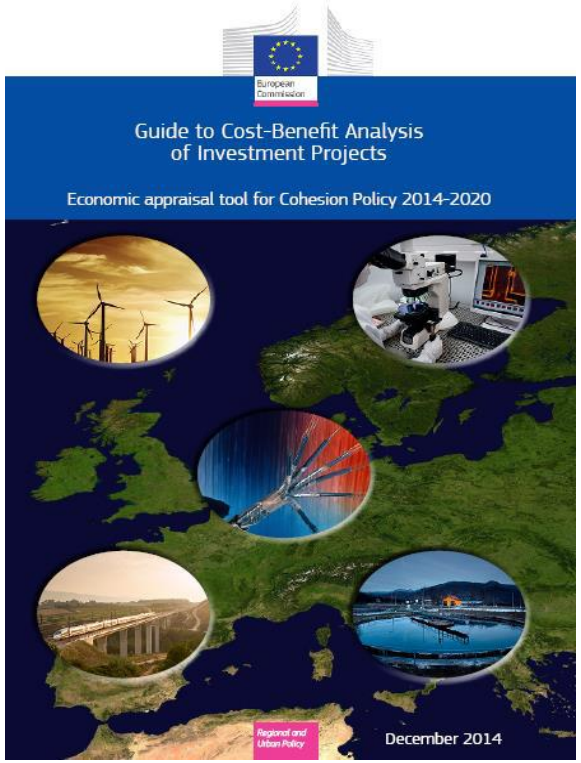


Scientific research (e.g. Canada, UK)

Technological development and innovation: science parks, technological parks, incubators, etc. *(e.g. Canada, UK)*

Sectors of CBA application in the EU28

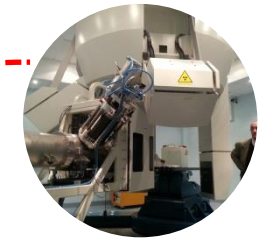




A novelty of the fifth edition: Research, development and innovation

- It is expected that over 2014-2020 period a portfolio of CBAs of ***RDI infrastructures*** will be gradually built within the Member States, following the high priority given to ***research and innovation for the EU growth strategy***.

- RDI infrastructures are ***science and technology facilities*** developed with the main purpose of acquiring new knowledge in a given scientific and technological field.



Innovation infrastructures

Infrastructures for applied research and experimental development

Infrastructures for fundamental research

RDI - financial analysis. Typical items

Investment, operation and maintenance costs, revenues and sources of financing

Investment cost	O&M costs
- Planning and design costs - Land acquisition - Construction costs, possibly disaggregated by civil works and installations, materials, labour, etc. - Energy, waste disposal and other utilities consumed during the construction period - Road access - RDI equipment, including information technologies (particularly for data storage or elaboration) - Intellectual property purchase costs - Testing - Start-up costs	- Materials and equipment - Consulting services - Cost of scientific personnel - Cost of administrative and technical staff - Cost of obtaining and maintaining patents - Energy, waste disposal and other utilities - Promotional campaigns and other outreach expenditure targeted to the general public - Training courses connected to the infrastructure's operation and management - Removal of potential pollutions / brownfield site treatment at the end of the life cycle of the infrastructure

Examples of operating revenues	Examples of financing sources
- Licence revenues gained from patents' commercialisation - Sale of consultancy services - Revenues from industrial research contracts and pre-commercial procurement contracts - Entry fees to the laboratory and for the use of research equipment charged to researchers and businesses - Student/master/PhD fees - Spin-off equity realisations - Research grants involving a transfer of ownership of a specific research output - Sale or rent of new buildings used for the project's objective - Revenues from the target population using the research outputs (e.g. patients receiving an innovative treatment) - Revenues from outreach activities to the wider public (e.g. bookshops' sales, entry fees, etc.)	- National/regional public contributions - National/regional private contributions - EU contribution - Other national/regional funding schemes for RDI activities - Public grants to research, e.g. under the Horizon 2020 framework - Ordinary public transfers

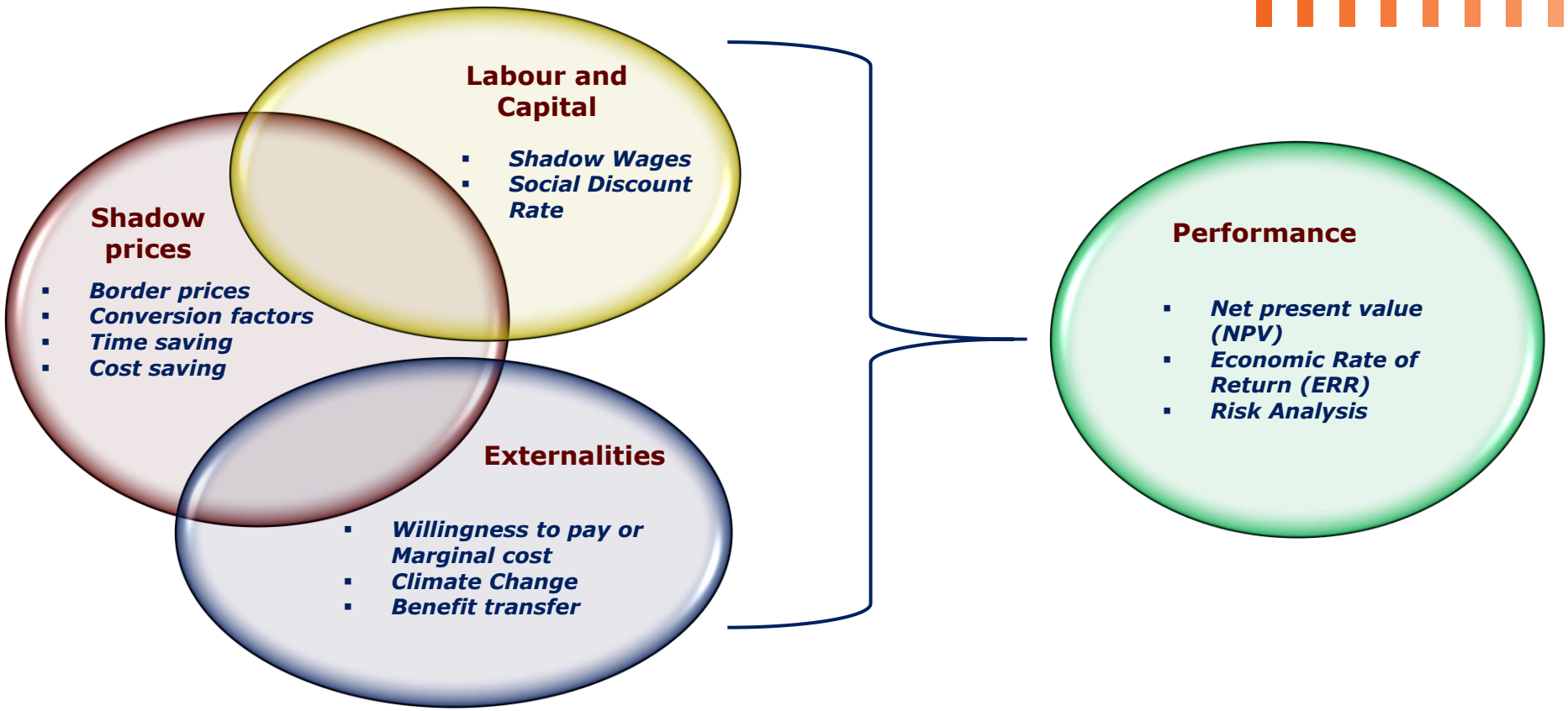
RDI – economic analysis. Typical items

Target groups, benefits and related evaluation approach

Benefit	Evaluation approach	Target groups							
		Businesses		Researchers, young professionals and students			Target population and general public		
		Already existing businesses	Spin-offs and start-ups	Academics and researchers	Researchers within businesses or outside academia	Students	Target population at environmental risk	Target population at health risk	General public
Establishment of more numerous or more long-lived start-ups and spin-offs	Shadow profit		**	*	*	*			
Development of new/improved products and processes	Shadow profit or value of patents	**	**	*	*				
Knowledge spillovers to non-user businesses	Shadow profit or avoided cost	**	*						
Value of scientific publications	Marginal production cost			**	*				
Human capital development	Incremental lifelong salary				**	**			
Social capital development	Qualitative analysis			*	**	**			
Reduction of environmental risk	Avoided cost or WTP	*					**		
Reduction of health risk	VOSL or QALY							**	
Cultural effects	WTP								**

Note: ++ very relevant; + moderately relevant;
VOSL: value of statistical life; QALY: quality-adjusted life year.

Selected ingredients of CBA: evidence from the ground



…BORDER PRICES FOR TRADABLE GOODS

The ***border price rule*** is generally used to estimate shadow prices of internationally marketable goods entering as inputs in the project. It is gathered from the Little and Mirrlees (1974) approach to project evaluation.

The border price method is based on the estimation of the ***trade opportunity cost of goods***, under the assumption that international prices reflect the economic value of imported goods better than domestic prices

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

Amongst the surveyed OECD member, the notion of border prices, which was a core concern of CBA in the 1970s, is applied for instance in Sweden. ***In general shadow pricing through conversion factors is not widespread***.

Border prices represent often the ***appropriate shadow price of tradable goods and tradable sub-components of non-tradable goods***. This approach allows to identify the economic value of goods and it is particularly justifiable when there are market imperfections which distort domestic market prices. For example, ***there is still no effective single market for electricity in the EU***.

…CONVERSION FACTORS as a SHORTCUT

Shadow prices are used to reflect the social opportunity cost of goods and services, instead of prices observed in the market, which may be distorted.

The **standard approach** suggested by the guide is to move from financial to economic analysis.

Transforming inputs market prices into shadow prices is completed through the application of **Conversion Factors**. These are defined as the ratio between shadow prices and market prices.

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

- In several countries, economic analysis is often carried out ***without starting from the financial analysis***.
- This reflects the ***separation*** between funding decisions and appraisal.
- The ***integration*** of financial and economic appraisal in the CBA Guide is similar to the approach of some international institutions.

…TIME SAVING

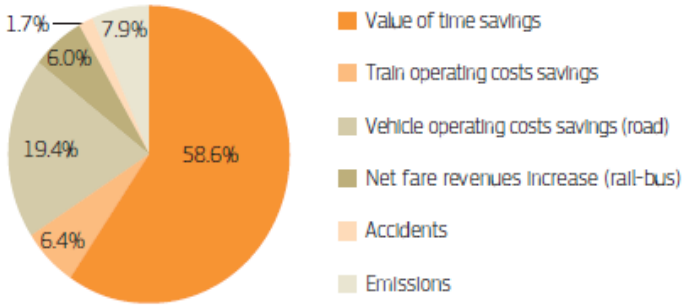
Travel time saving is one of the most significant benefits that can arise from the construction of new, or improvement of, existing transport infrastructure.

Different methods (e.g. revealed preference method, cost saving approach) are possible to value time for passengers, whilst a distinction is usually made between the estimation of work and non-work travel time.

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

- ***All surveyed OECD member takes*** into account time saving in the economic analysis.
- Time saving generally accounts for the ***largest share of benefits***.

Example: weight of the benefit categories in the overall impact of a transport project.



…COST SAVINGS

Cost savings in O&M or investment are typical benefit, of a purely financial nature, of some projects such as the integrated water service**.**

A good practice is that cost savings are ***accounted for and included on the cost side as a negative***, i.e. as decreasing costs and with appropriate conversion factors.

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

All surveyed OECD member takes into account cost saving in the economic analysis.

Integrated solid waste management

Waste water management

…WILLINGESS TO PAY or MARGINAL COST

The ***willingness-to-pay*** (WTP) approach, together with that of the ***willingness-to-accept*** (WTA), can be usefully applied to quantify both the direct benefits and the impacts, negative or positive, of the external effects of the project

Different methods can be adopted to empirically estimate the WTP as a welfare measure. ***Three main methodological categories***: revealed preference methods; stated preference methods; benefit transfer method.

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

For example, ***Canada CBA Guide for Regulatory Proposals*** makes reference to the willingness to pay and willingness to accept concepts as fundamental to value valuing benefits.

…CLIMATE CHANGE

Any CBA should integrate the economic cost of climate change resulting from ***positive or negative variations of GHG emissions*** (e.g. CO2, N2O and CH4).

The proposed approach to integrate climate change externalities into the economic appraisal is based, in part, on the ***EIB Carbon Footprint Methodology*** and is consistent with the ***EU Decarbonisation Roadmap 2050.***

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

The ***social value of CO2 emissions*** is included in the CBA by most OECD surveyed countries.

...BENEFIT TRANSFER

It consists of ***taking a unit value for a non-market good*** estimated in an original study and ***using this estimate, after some adjustments, to value benefits (or costs)*** that arise when a policy or project is implemented ***elsewhere***.

For all types of adjustments, the quality of ***the original study is of paramount importance*** for the validity of the method

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

Some databases have been set up to facilitate benefit transfer:

e.g. Environmental Valuation Reference Inventory (EVRI)

- A Canadian comprehensive storehouse of over ***4,000 international studies*** providing values, methodologies, techniques and theories on environmental valuation.
- Free access is available to all citizens of member countries - ***Australia, Canada, France, New Zealand, UK and USA.***
- Since France and United Kingdom joined the EVRI Club in 2002, ***Europe's representation*** in the database has increased to about ***1,200 study summaries***.

…SOCIAL COST OF LABOUR: SHADOW WAGES

Typically, in an economy characterised by extensive unemployment or underemployment, this may be less than the actual wage rates paid.

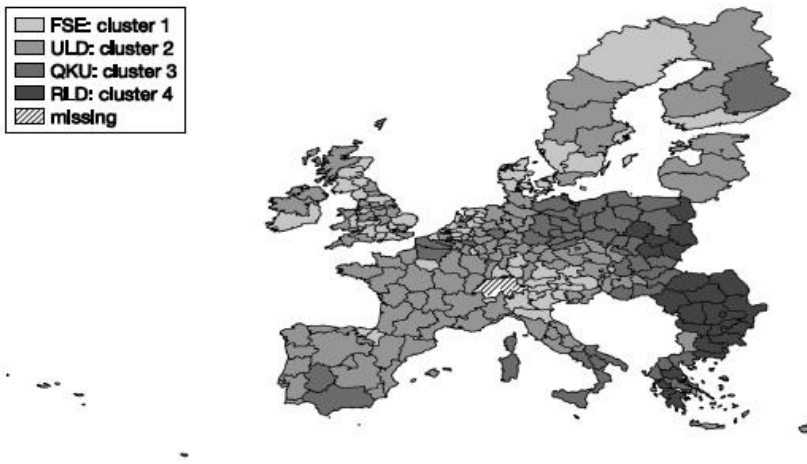
Shadow wage is used to reflect the social opportunity cost of labour (skilled and unskilled workers).

The methodology to estimate the shadow wage at the national/regional level is illustrated in Annex IV of the Guide.

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

Sweden and the UK are amongst the ***few countries using shadow wage rates*** in the economic analysis.

Cluster analysis to identify the four labour market cases



An applied methodology:

Each region is assigned to one of the four labour market conditions by means of a cluster analysis: fairly socially efficient (FSE), quasi-Keynesian unemployment (QKU), urban labour dualism (ULD) and rural labour dualism (RLD)

Florio, M. (2014) *Applied Welfare Economics,* London: Routledge.

…SOCIAL COST OF CAPITAL: the social discount rate

The discount rate in the economic analysis of investment projects, the **Social Discount Rate** (SDR) reflects the social view on how future benefits and costs should be valued against present ones.

5% social discount rate is used for major projects in ***Cohesion countries*** and ***3% for the other Member States.***

Annex II of the Guide discusses the empirical approaches used for SDR estimation and provides examples of estimates at country level**.**

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

Not all surveyed OECD member states have a standard SDR. Where adopted, it is ***computed at central level*** and recommended to all players who are expected to comply with them. It is occasionally substituted by financial signals.

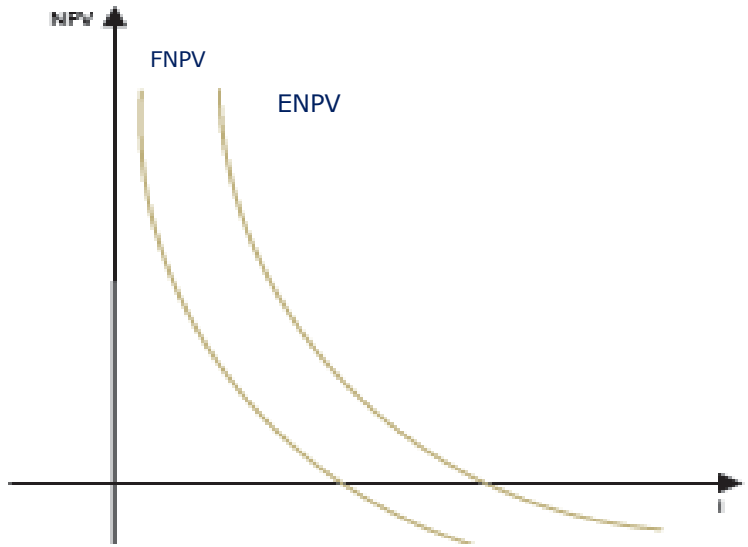
The ***social rate of time preference*** is adopted in e.g. France, Germany, Italy, Portugal, Slovak Republic, Spain, UK, USA.

Economic Performance Indicators: NPV and ERR

It is possible to measure the economic performance of the project by calculating the following indicators:

- ***Economic Net Present Value*** (ENPV): the sum of the discounted net flows of a project.
- ***Economic Rate of Return*** (ERR): the discount rate that zeroes out the net present value of flows of costs and benefits of an investment;
- ***B/C ratio***: the ratio between discounted economic benefits and costs.

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.



…RISK ANALYSIS

Risk assessment is mandatory for any CBA (Art. 101 of Regulation N. 1303/2013).

Recommended steps for assessing the project risks are:

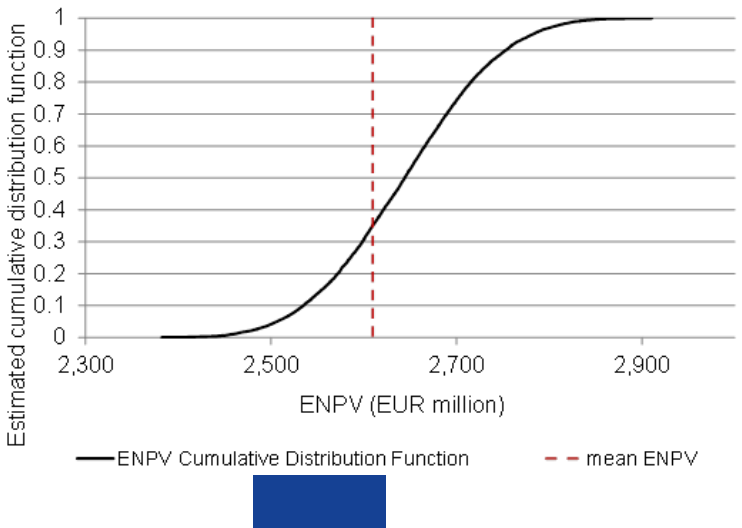
- sensitivity analysis
- qualitative risk analysis
- probabilistic risk analysis
- risk prevention and mitigation.

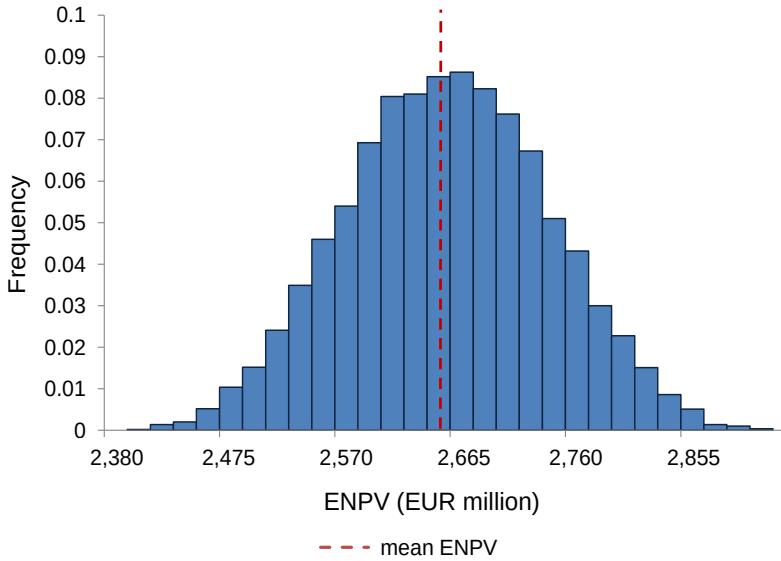
Qualitative risk analysis

EC, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014.

The treatment of uncertainty is often ***limited to scenario and sensitivity analysis***. A proper risk analysis regularly performed in UK and ***more occasionally elsewhere***. Sweden, the Netherlands and the UK apply risk analysis with the use of ***Montecarlo simulations***.

Example of cumulated and punctual probability distribution of the ENPV





CBA guide: an intellectual enterprise

- CBA has a ***long standing academic and professional tradition***, and is still expanding its scope.
- International institutions have been in the ***forefront of project evaluation.***
- The European Commission was a latecomer, but know it is a ***worldwide trendsetter*** in CBA applications.

CBA guide: an intellectual enterprise

- The true EU added value is the opportunity of ***mutual learning*** across the governments of 28 Member States, and beyond.

- The Guide as ***an intellectual enterprise:*** a step forward for ***better investments to 2020***.

CBA RESEARCH: NEW IDEAS AROUND THE WORLD…

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THANK YOU

COMMENTS ARE WELCOME