

Cost-Benefit Analysis

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CBA is a way of thinking



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Main CBA questions for evaluator

- assess whether the project is worth co-financing (from an economic point of view);
- assess whether the project needs co-financing (from a financial point of view).



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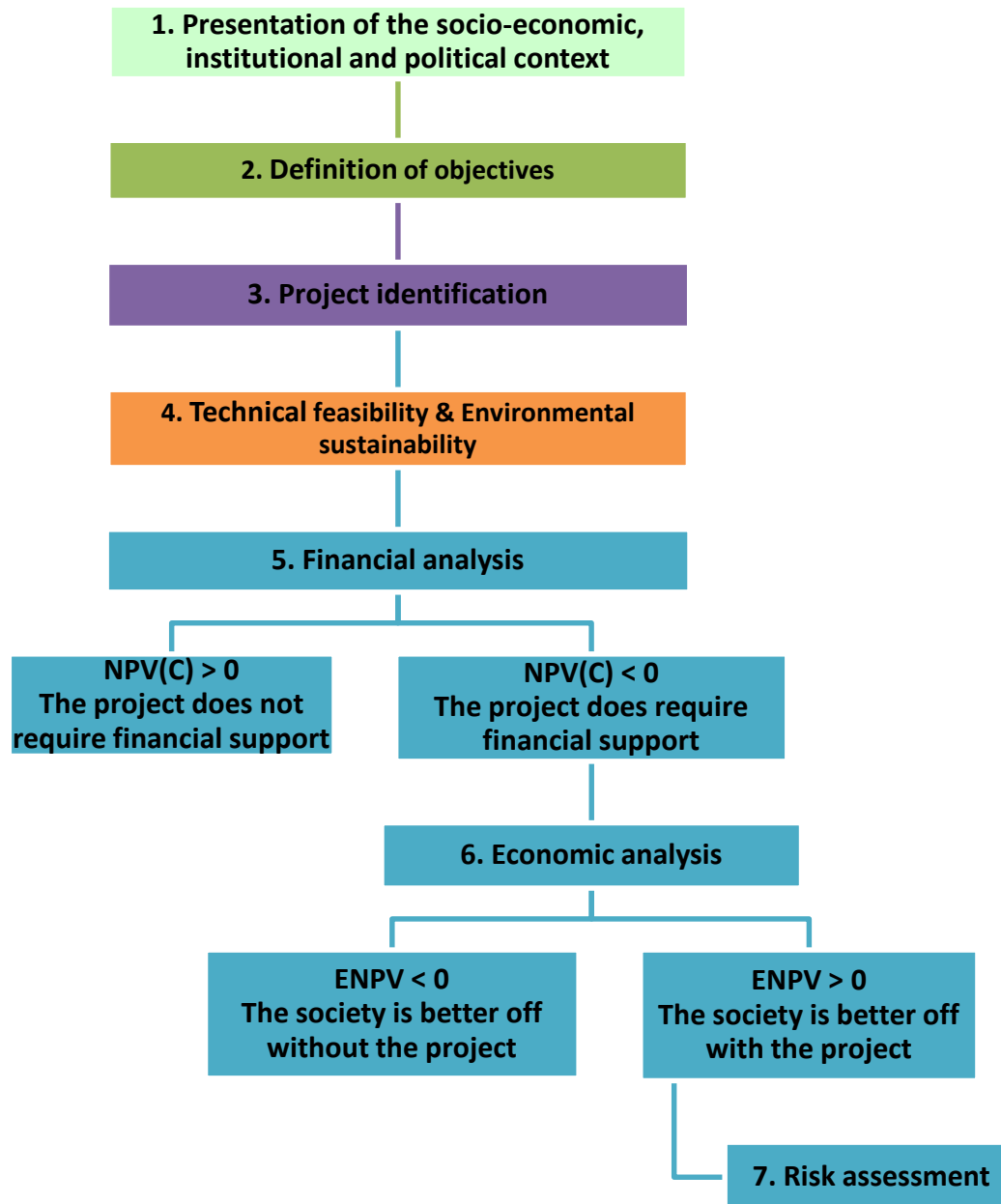
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Definition: CBA is an evaluation methodology to assess public projects

Objectives: CBA identifies

- the best feasible alternative;
- the financial resources needed to realise the project;
- the project impact on the area where it will be implemented;
- project risks and its financial and economic implications.





Option identification

- „Business as usual“ (BAU scenario) / „do-nothing“
- „Do-minimum“
- „Do-something“



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Feasibility analysis

Feasibility analysis aims to identify the potential constraints and related solutions with respect to technical, economic, regulatory and managerial aspects.

- demand analysis
- available technology
- the production plan (including the utilisation rate of the infrastructure)
- personnel requirements
- the project's scale, location, physical inputs, timing and implementation, phases of expansion and financial planning
- environmental aspects.



Option selection

- establish a long list of alternative actions to achieve the intended objectives;
- screen the identified long list against some qualitative criteria (e.g. a set of scores to be established in light of overall policy orientations and/or technical considerations - to be duly justified in the analysis) and establish a short list of suitable alternatives;
- establish option rankings and select preferred options based on their net present values in financial and economic terms.



Methodology of CBA: Financial analysis

Important aspects:

- **only cash inflows and outflows are considered** (depreciation, reserves and other accounting items which do not correspond to actual flows are disregarded);
- the determination of the project cash flows should be based on **the incremental approach**, i.e. on the basis of the differences in the costs and benefits between the scenario with the project (do-something alternative) and the counterfactual scenario without the project (BAU scenario) considered in the option analysis;
- the aggregation of cash flows occurring during different years requires the adoption of an **appropriate financial discount rate** in order to calculate the present value of the future cash flows.



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Steps of the financial analysis

1. Total investment costs
2. Total operating costs and revenues
3. Financial return on investment cost: FNPV(C) and FRR(C)
4. Sources of financing
5. Financial sustainability
6. Financial return on the national capital: FNPV(K) and FRR(K).



Investment costs

- Fixed investments,
- Start-up costs,
- The changes in working capital over the entire time horizon (current assets – current liabilities).
- Reference period (time horizon)
- Residual value (2 methods):



Calculation of residual value

- by computing the residual value of all assets and liabilities, based on some standard accounting depreciation formula;
- **by computing the net present value of cash flows in the remaining life-years of the project.**



Reference period

Table 2.1 European Commission's reference periods by sector

Sector	Reference period (years)
Railways	30
Roads	25-30
Ports and airports	25
Urban transport	25-30
Water supply/sanitation	30
Waste management	25-30
Energy	15-25
Broadband	15-20
Research and Innovation	15-25
Business infrastructure	10-15
Other sectors	10-15

Source: ANNEX I to Commission Delegated Regulation (EU) No 480/2014.

- Depends to the useful economic life of the infrastructure
- Longer than 30 years not recommended.



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Determination of operating costs and revenues

Operating costs include all the costs to operate and maintain (O&M) the new or upgraded service. Typical O&M costs include: labour costs for the employer; materials needed for maintenance and repair of assets; consumption of raw materials, fuel, energy, and other process consumables; services purchased from third parties, rent of buildings or sheds, rental of machinery; general management and administration; insurance cost; quality control; waste disposal costs; and emission charges (including. environmental taxes, if applicable).

Cost of financing (i.e. interest payments) must not be included within the O&M costs.



Determination of operating costs and revenues

Variable costs	<ul style="list-style-type: none"> • energy (electricity, heat) • fuels, materials and other consumables • emission fees (for emissions to air and water) • disposal of waste outputs produced in waste treatment facilities (only in case of projects dealing with individual components of a larger waste management system) • transportation costs
Fixed costs	<ul style="list-style-type: none"> • technical and administrative personnel • maintenance and repair - insurance- services



Determination of operating costs and revenues

The project **revenues** are defined as the '*cash in-flows directly paid by users for the goods or services provided by the operation, such as charges borne directly by users for the use of infrastructure, sale or rent of land or buildings, or payments for services*' (Article 61 (Operations generating net revenue after completion) of (EU)

Regulation 1303/2013).

- operating cost-savings generated by the operation shall be treated as net revenue unless they are offset by an equal reduction in operating subsidies'.
- Transfers or subsidies (e.g. transfers from state or regional budgets or national health insurance), as well as other financial income (e.g. interests from bank deposits) shall not be included



Determination of operating costs and revenues

Typical sources of revenues are:

- the application of charges to users, either in the form of collection and disposal fees or taxes;
- the sale of sub-products such as compost, recycled materials, refuse-derived fuel or solid-recovered fuel;
- the sale of the energy recovered such as heat and electricity, including, as the case may be, green certificates or bonuses for electricity produced from renewable waste fractions.



Specific cost recovery issues

Compliance with the **polluter-pays principle** requires that:

- applied user charges and fees recover the full cost, including capital costs, of environmental services;
- the environmental costs of pollution, costs of resource depletion, and preventive measures are borne by those who cause pollution/ depletion;
- charging systems are proportional to the social marginal production costs which include the full costs, including capital costs, of environmental services, the environmental costs of pollution and the preventive measures implemented and the costs linked to the scarcity of the resources used.



Specific cost recovery issues

Compliance with the full-cost recovery principle includes that:

- tariffs aim to recover the capital cost, the operating and maintenance cost, including environmental and resource costs;
- the tariff structure maximises the project's revenues before public subsidies, while taking affordability into account.



Calculation of the financial indicators

Return on investment

1. Net present value (NPV (C))
2. Internal rate of return (IRR (C))

Return on invested capital

1. Net present value (NPV (K))
2. Internal rate of return (IRR (K))



Sources of financing and sustainability

- Determination of contribution from the Funds
- Financial sustainability of the project
 - Aspects of loan financing;
 - PPP and cost-recovery;
 - Impact of affordability level.



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Table 2.2 Financial analysis at a glance

	FNPV(C)	SUSTAINABILITY	FNPV(K)
Investment costs			
Start-up and technical costs	-	-	
Land	-	-	
Buildings	-	-	
Equipment	-	-	
Machinery	-	-	
Replacement costs	-	-	..*
Residual value	+		+
Operating costs			
Personnel	-	-	-
Energy	-	-	-
General expenditure	-	-	-
Intermediate services	-	-	-
Raw materials	-	-	-
Other outflows			
Loan repayments		-	-
Interests		-	-
Taxes		-	
Inflows			
Revenues	+	+	+
Operating subsidies		+	
Sources of financing			
Union assistance		+	
Public contribution		+	..**
Private equity		+	-
Private loan		+	

* Only if they are self-financed by the project revenues. Otherwise, if new sources of financing (either equity or debt) are needed to sustain them, these sources must be displayed within the outflows at the time they are disbursed.

** Operating subsidies shall not be accounted in order to avoid double counting with the operating costs outflow.



Economic analysis

The Economic analysis shall include:

- Fiscal corrections
- Conversion of market to accounting (shadow) prices
- Evaluation of non-market impacts and corrections for externalities

Financial revenues in the form of user fees, charges and tariffs shall be excluded from the economic analysis, and replaced with estimation of the direct effects on users, either through 'willingness to pay' or accounting prices.



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Fiscal corrections

- *Indirec taxes* should be eliminated
- *Direct Taxes* related to labour should be included
- *Pure Transfers* such as social security payments should be omitted.
- *Taxes aiming at correcting externalities* should be omitted if the related externalities are included

NUMERICAL EXAMPLE

VAT on construction material 10%

then the related conversion factor is $1/(1+0,10)=0,9090$



From market to shadow prices

Objective – to make adjustments for market distortions (by applying conversion factors)



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Examples of market distortions

- A land intensive project, e.g. an industrial site, where land is made available free of charge by a public body, while it may otherwise earn a rent.
- An agricultural project that depends upon water supply at a very low tariff, heavily subsidised by the public sector.
- An energy intensive project which depends upon the supply of electricity under a regime of regulated tariffs, when these tariffs are below long run marginal costs.



Assessment of external effects

Objective – determine external costs and benefits that have not been evaluated in the financial analysis

- Resource savings: avoided waste to landfill
- Resource savings: recovery of recyclable materials and production of compost
- Resource savings: energy recovery
- Visual disamenities, noise and odours
- Variation in GHG emissions
- Health and environmental hazards
(variation in contamination of air, water and soils)



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Economic indicators

Calculation of the economic performance indicators:

- Social discount rate
- Economic Net Present Value (**ENPV**) (ENPV should be more than 0)
- Economic Rate of Return (**ERR**) (ERR should be more than 5 %);
- Benefit/Cost ratio (**B/C**) (B/C ratio should be more than 1);



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Sensitivity analysis

Critical variables - those variables for which a variation of ± 1 % of the value adopted in the base case gives rise to a variation of more than 1 % in the value of the NPV



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Risk analysis

- Sensitivity analysis;
- Qualitative risk analysis;
- Probabilistic risk analysis;
- Risk prevention and mitigation.



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Risk analysis

Regulatory risks:

- Changes of environmental requirements, economic and regulatory instruments (i.e. introduction of landfill taxes, bans on landfilling)

Demand risks:

- Waste generation lower than predicted
- Waste flow control/delivery insufficient

Design risks:

- Inadequate surveys and investigation
- Choice of unsuitable technology
- Inadequate design cost estimates

Land acquisition risks:

- Procedural delays
- Land cost higher than predicted

Administrative and procurement risks:

- Procedural delays
- Building or other permits
- Utility approvals



Risk analysis

Construction risks:

- Project cost overruns and delays in construction schedule
- Contractor related (bankruptcy, lack of resources)

Operational risks:

- Waste composition other than predicted or having unexpectedly large variations
- Maintenance and repair costs higher than predicted, accumulation of technical breakdowns
- Process outputs fail to meet quality targets
- Failure to meet limits of emissions produced by the facility (to air and/or water)

Financial risks:

- Tariff increases slower than predicted
- Tariff collection lower than predicted

Other:

- Public opposition



Cost-benefit analysis of major projects 2014 - 2020

Main changes compared to the period 2007-2013:

- Main economic benefits per sector to be considered;
- Simplified economic analysis in special cases: cost-effectiveness analysis;
- Simplified risk assessment with a focus on qualitative analysis and risk prevention and mitigation;
- Main risks per sector to be considered.

