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SDC How-to-Note

Financial and Economic Analysis of Projects with a focus on Cost Benefit Analysis (CBA) and Cost Effectiveness Analysis (CEA)

Documents mentioned in the text can be found in the SDC Field Handbook

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Part 1 - Basic explanation

1. Introduction

1.1. Purpose of this How-to-Note

This How-to-Note provides an overview and explains the basic concepts of financial and economic analysis focusing on two frequently used methodologies: Cost-Benefit Analysis (CBA) and the Cost-Effectiveness Analysis (CEA).

As part of result-based-management CBA and CEA are important means to improve the effectiveness of SDC's interventions through the improved linking of results and resources. They should thus be increasingly integrated into planning and reporting tools whilst maintaining the pragmatic approach emphasised in this How-to-Note.

This document explains why financial and economic analyses of projects are useful and important in development cooperation. Staff and partners at the SDC head office and cooperation offices (programme managers, decision-makers, financial staff and in particular project implementers) need to acquire a basic understanding of financial and economic analysis in order to be able to decide without an excessive amount of effort in which cases what kind of analysis makes sense and how to carry it out.

After reading Part 1 of this How-to-Note (Basic explanation), the reader will understand the basic concepts of financial and economic analysis, and will be able to organise the implementation of a CBA or CEA. Part 2 (Advanced explanations) enables readers with more advanced knowledge and some experience with financial and economic analysis to carry out a simple CBA or CEA themselves using existing examples and to reverse-engineer them. Given that the devil is in the detail and each CBA or CEA has its particularities, learning by doing or at least regularly scrutinising CBAs or CEAs by consultants and colleagues is the best way to become more familiar with them. In any case, the greatest merit of carrying out a CBA or CEA is that it obliges the programme officer responsible for a project to think through the logic of the project and identify all benefits and costs, whether they are quantifiable or not.

The SDC started financial and economic project analysis in 1996 in a step by step approach. In particular, since 2011 a backstopping mandate on CBA and CEA has supported operational units. In parallel major efforts have been made and experience gained in several regions (for details see Annex 9). This How-to-Note updates the first How-to-Note published in 2011 on the basis of these experiences.

It is suggested that interested readers contact Quality Assurance, the employment and income network and backstoppers for the most appropriate examples for inspiration.

1.2. Scope of the How-to-Note

This document only provides an overview of the financial and economic analysis of projects and programmes with a focus on CBA and CEA as the most relevant for SDC's needs. Other examples of working tools can be found in Annex 10. Economic terms used in this document are explained in the glossary in the Annex 1.

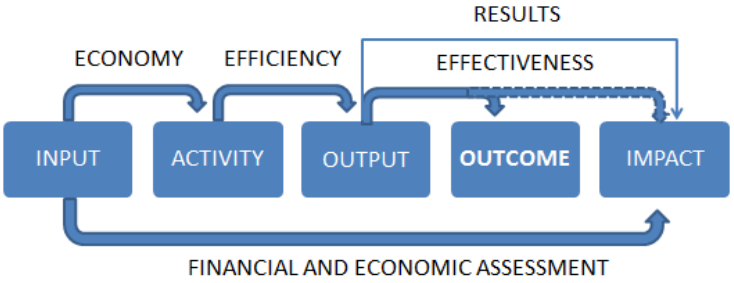
2. Why the need for financial and economic analysis?

The SDC receives its funds from the treasury of the Swiss government and therefore ultimately from Swiss taxpayers. It is legally obliged to use such funds and assets in an orderly, effective, cost-efficient and economical manner in compliance with the objectives of

the project in question[1]. Thus, cost awareness and value-for-money considerations ("Is the investment worth it?[2]") are guiding principles.

Financial and economic assessments help define more clearly the most important outcomes of interventions. Such assessments should be carried out throughout the whole project cycle. The overall underlying concept within the project cycle management (PCM) is illustrated in the result chain below.

Graph 1: Financial and Economic Assessments within the project cycle



Project *economy* and *efficiency* ("Are we doing the things right?") are discussed in the document "Project Cycle Management PCM - Basic considerations for the economical use of funds". Some of its answers are necessary to be able to assess a project's *effectiveness* ("Are we doing the right things?"), which is the aim of financial and economic analysis.

Measuring project effects: 'With vs. without' project or 'before vs. after' comparison

CBA compares the situation *without* the project to the situation *with* the project. Therefore, only additional costs and benefits are considered. These costs and benefits should be exclusively attributable to the project. According to widely recognised theory on results measurement, the 'with vs. without' comparison should be done with control groups (counterfactuals). However, for various reasons, this often proves to be difficult in practice when external factors cannot be controlled, e.g. existence of other donors, or when the control-group approach would be unethical, or for cost reasons. Another approach is to compare the situation before the project is carried out to the situation after the project has been completed (also called 'before vs. after' comparison). A limitation of this approach is that the time involved may have a considerable influence on the perception of both situations (e.g. changing economic, political, climatic context).

Financial and economic analyses improve the project cycle at different moments (see chapter 3 below), in particular during:

- the designing/planning phase of a project or a programme in order to get an indication of its viability;
- its implementation in order to find out what works and what does not;
- reviews and preparations in order to make a decision regarding a possible subsequent phase.

The SDC expects all projects at least to *assess* the appropriateness of one of the possible methods of financial and economic analysis referred to in this How-to-Note. All methods require defining the costs and benefits of a project or programme, and – in the majority of cases – to quantify them. Such quantification can be challenging as the SDC's projects are

[1] *Art. 1 of Instruction 306-0-E on the Control and Independent Financial Audit of SDC Activities*

[2] Using the term "investing" is justified as the return on investment may not be financial for the SDC but is expressed as outcome and impact, e.g. improving livelihoods, reducing poverty, etc.

complex and quite heterogeneous. Nevertheless, when designing result chains and log frames, quantifying costs and benefits in an iterative process results in the need to constantly refine an intervention's impact hypothesis. In addition, a sound financial and economic analysis is not only a supporting element in the approval process of projects and programmes but an excellent communication tool, e.g. as a means to persuade potential partners to up-scale or support a project.

In many projects and programmes scientifically sound quantification measurements are not possible. A balance between scientific robustness and the effort needed to attain a satisfactory robustness must be maintained. This does not mean therefore that all SDC staff must be able to perform a financial and economic analysis themselves. They can refer to various experts, both in-house and external, consult colleagues who then comment on practices, or make use of the backstopping mandate and forthcoming training offers.

Nevertheless, the basic concepts and methodologies must be understood by all SDC staff to enable them to:

- *assess* whether or not a financial and economic analysis makes sense;
- *decide what method* is appropriate;
- *ask* the right questions to get the required answers;
- *mandate* a financial and economic analysis;
- *read results,* i.e. understand its indicators and evaluation criteria; and
- *comprehend the implications* of a financial and economic analysis.

This How-to-Note attempts to achieve just that.

Moreover, it provides guidance to motivated SDC staff who attempts to deepen their knowledge in this field by carrying out financial and economic analyses on their own. The text therefore distinguishes between the *analyst* (internal or external), who does the work, and the *decision-maker*, who asks for the financial or economic analysis and thus needs to formulate specific questions to be answered by the analyst. Hence, the analyst and the decision-maker can be one and the same person but not if the analysis is mandated.[3] This paper mainly addresses decision-makers. However, the analyst will also find the necessary information to enable them to work on their own analysis. Of course, by reading a how-to-note only once, no-one becomes an expert.

3. Financial and economic analysis in the SDC's PCM

A financial and economic analysis is helpful at different moments in the project cycle and is therefore to a certain extent mandatory (see Annex 2 for more information and examples). The most relevant stages are:

- **Entry proposal**: Cost-efficiency and cost-effectiveness considerations are required to assess and compare different intervention strategies of an entry proposal.
- **Credit proposal**: The credit proposal should include a financial and economic analysis. It is one of the elements that help to assure that invested resources lead to the envisaged results. If an analysis is not feasible this needs to be justified and basic considerations are still required.
- **End-of-phase report (EPR)**: The EPR should include financial and economic reflections on achieved outcomes. This helps to identify project components that should be abandoned or modified and may indicate potential areas for replication or up-scaling.

[3] Annex 8 provides model ToR for mandating analysts (to be adapted to the context and specific case).

Already a very moderate analysis or an analysis of only one project component is important and provides useful criteria adding to the plausibility of a proposed intervention or result statement. This also applies especially to reform projects in the government or health sectors (see section 5.3).

4. The difference between financial and economic analysis

There are two major types of analysis: financial and economic. The difference between the two is the perspective,

A **financial** analysis is only concerned with actual *direct* monetary flows from and to an *individual* actor, thus taking an individual perspective. A lot of the necessary data can therefore be retrieved from the financial reports and/or by the financial staff. However, depending on the context the individual actor may be a farmer, an education or health provider, a private firm or a government agency, or may even be a group of individuals within a society such as landowners or a cooperative.

Financial analyses answer questions such as: Is the project financially acceptable to the interested parties? Do the interested parties (particularly private ones) have a sufficiently strong financial incentive to participate? What will be the costs and benefits to private investors or to participating farmers and landowners? In addition, financial analyses may give indications on how the returns and costs of a project are distributed among the different interested parties.

An **economic** analysis is concerned with the costs and benefits to *society as a whole*, regardless of who pays and who gains, thus taking the perspective of the society in question. Often, a country as a whole is taken as the society but it could just as easily be a region or a community. An economic analysis incorporates *indirect* effects. On the one hand it takes the costs of negative externalities, e.g. environmental damage, into account, on the other it includes the benefits of positive externalities.

For example: an individual's vaccination for a communicable disease does not only decrease the likelihood of that individual's own infection but also decreases the likelihood of others becoming infected through contact with that person. A financial analysis would only look at the costs and benefits of the individual, while an economic analysis would consider the positive effect that vaccination has for the community.

The difference between financial and economic analysis will become more apparent in the rest of this How-to-Note and is further illustrated in chapter 7: "Cash flow and value flow tables". (In addition, an example of a financial analysis and economic analysis of an intervention is provided in Annex 4). It showcases a vegetable-processing enterprise and is used through the rest of this How-to-Note to illustrate different analysis methods and their assessment criteria.

5. Basic considerations for the financial and economic analysis of projects

5.1. Ex-ante and ex-post?

Ideally, a financial and/or economic analysis is applied before an intervention is started (ex-ante). It helps to project outputs and impacts, thus making it a valuable tool for planning and consequently for decision-making.

Obviously, uncertainty is an inherent aspect of projections in ex-ante analysis: Accurately identifying or precisely valuing and comparing costs and benefits is always difficult. Thus, future costs and benefits cannot be measured but only estimated. Fortunately, a major component of financial or economic analysis is to test the sensitivity of selected variables, e.g. by exchanging assumptions on estimated costs (see chapter 9). This sensitivity analysis

complements the SDC's risk analysis. Where there are assumptions there are risks. The sensitivity analysis points to the most important risks of a project. Such information can be extremely useful for decision-makers and should always be asked for.

Ex-post analyses look at projects during their implementation or after their completion, e.g. in evaluation reports (allowing target-performance comparison etc.).

5.2. What about discounting? The importance of time

In SDC projects time is of great importance as they run over several years and usually over several phases. Thus costs and benefits of a project occur over the entire life of the project and in the case of benefits even after it has been phased out so they cannot be compared directly. The analyst cannot simply add up costs, add up benefits and compare them without further adjustments.

The relevant question is: How can a value – for a cost or benefit – occurring in some future year be equated with a value occurring in the present? The common approach is to apply an adjustment factor to future values that reflect their present value. This adjustment factor is derived from a generally accepted 'time value of money' and is commonly known as the *discount rate.* For further explanations on the principles of the 'time value of money', discounting and a numerical example, see Annex 3.

In a *financial* analysis, the going rate of interest (interest rate for a commercial loan) is usually the one to use and varies depending on the context. The rate for smallholder farmers will tend to be higher than the rate for well-established, low-risk companies' borrowing from regulated banks. In many cases, for instance when looking at the financial attractiveness of farm investments, the chosen rate will only be a rough approximation of various rates relevant to different individuals. In the case of more established entities operating entirely in the formal sector an estimated average bank lending rate may be appropriate.

There is no formula for deriving a rate. The analyst doing a financial analysis will have to use judgement in choosing an appropriate rate. The discount rate is one of the key variables in a financial analysis and affects its results, especially the project's net present value (see chapter 8.1). As is the case with every variable it can thus be used to manipulate the results, too. To determine whether and how important a variable such as the discount rate is the analyst carries out a sensitivity analysis (see chapter 9).

The same applies to an *economic* analysis, where determining a discount rate is even harder and depends on a number of factors, including society's preference for present consumption (the time value for money). In general the rate tends to be lower than in financial analyses, and experts, e.g. from the central bank, finance ministry, the local representation of the World Bank or IMF, are possible sources for obtaining an approximation. If no so-called social discount rate is available the analyst can pick a rate he or she considers appropriate and then test the sensitivity to alternative rates.

5.3. Cost-Benefit Analysis (CBA) or Cost-Effectiveness Analysis (CEA)?

Financial and economic analyses seek to specify an intervention's costs and benefits. A project's or programme's costs also need to be *quantified* in monetary terms and, ideally, the same is done for its benefits, which usually presents a greater challenge. For example, while it is fairly straight forward to assess the cost of a vaccination in USD, it is a lot harder to quantify its health benefits for the patient (in USD!) and it gets even more complex when estimating the monetary benefits for the community.

Nevertheless, CBAs attempt to define and *quantify costs and benefits* while CEA's don't monetise benefits. The table below shows the two methods in comparison.

Table 1: CBA vs. CEA

	Definition	**Units used for calculation**	Detailed description
CBA	Cost Benefit Analyses assess the monetary value of investments and ongoing expenses versus expected return on investments over time.	Project costs: in monetary value Project outcome: in monetary value	Chapter 6
CEA	Cost Effectiveness analyses compare different intervention strategies based on relative costs and outcomes, without quantifying the benefits.	Project costs: in monetary value Project outcome: in natural units because benefits can't be quantified.	Chapter 10

CBA can be applied whenever it is reasonably feasible to quantify the benefits of a project. In some cases it may be necessary to use quantifiable proxies. The approach is covered in more detail in the following chapters. The second-best approach, when the quantification of benefits is not feasible (or not with reasonable effort), is a CEA covered in chapter 10. Table 2 presents general practical guidance on the application of CBA or CEA according to the sector of intervention.

Table 2: CBA vs. CEA in development projects

Method of analysis / **Sector of intervention**	**CBA**	**CEA**
Income generation, livelihood, economic development	In general no particular problem to apply	Not relevant as CBA can be applied.
Health, education, nature conservation, biodiversity, etc. Most humanitarian aid projects	Depending on the project's focus and scope CBA may or may not be applicable	If CBA cannot be applied then CEA should be considered.
Governance, policy dialogue, institutional development	Difficult to apply. Frequently these sectors of intervention are part of projects that have measurable components (e.g. policy dialogues for improved framework conditions for business). In this case CBA may still be applied to specific project components.	If CBA cannot be applied then CEA should be considered.

In both cases, major value lies already in quantifying costs and benefits as this implies a) identification and definition of benefits and b) thinking through the logic, i.e. impact hypothesis, and result chains.

With SDC projects working on governance as a transversal theme in all projects, most projects will target benefits that are difficult to quantify. As already emphasised on several occasions, benefits that cannot be quantified are nevertheless decision criteria, e.g. negative results from an economic analysis may be overcompensated by anticipated systemic change effects and nevertheless be implemented.

Part 2 – Advanced explanations

6. Cost-Benefit Analysis (CBA)

A CBA is a method that applies a systematic process for calculating and comparing benefits and costs of private or public investments. It is a widely used financial and economic approach for assessing whether the benefits of a particular action are greater than its costs. Thus, depending on whether a financial or economic analysis is requested, a CBA is done from the view point of a project's individual beneficiary, a project partner, a private entity, a government agency or society as a whole. See Annex 4 for an example.

6.1. What are the field of application, purpose and limitations of a CBA?

A CBA can be applied to any project that runs over several years, involves an investment and generates quantifiable benefits. In the agricultural sector for example, CBAs are used for projects such as irrigation schemes or estates with perennial crops and corresponding processing facilities, e.g. palm oil. The basic idea is to find out if the investment in construction and equipment, as well as the yearly maintenance and operational costs of the project are justified in terms of higher production and income, i.e. benefits. A CBA is based on cash-flow and value-flow tables (see chapter 7,). It is usually complemented by other types of analysis and is *never the only decision-making criterion* used in the SDC.

A CBA has two main purposes:

1. To determine whether a planned investment or decision can meet the viability criteria that are considered sufficient and thus whether or not it is justified and feasible;
2. To provide a basis for comparing projects when different options are considered. [4]

The main result of a CBA is the benefit-cost ratio (BCR). However, two other important assessment criteria are generally used and calculated when doing a CBA: the net present value (NPV) and the internal / economic rate of return (IRR / ERR). All of them are derived out of cash flow and value flow tables (see below) and are further explained in chapter 8, Assessment criteria [5].

7. Cash flow and value flow tables

The centrepiece of most financial and economic analyses, particularly CBAs, is an input and output table.

7.1. Cash flow table

For a *financial* analysis a project's costs and benefits are accounted for in a *cash flow* table, which lists all the *direct* inputs and outputs that need to be quantified. And, to arrive at an intervention's total costs and benefits they need to be multiplied by market prices (or forecasts of them) and added up. The result is a cash flow table that shows the movement of money into or out of a project, thus comparing costs and benefits of a specific *individual actor* over time. Annex 4 is an example of a financial and economic analysis in a private sector development intervention and includes an example of a cash flow table (see 4a financial CBA). Table 4 (below) is a consolidated version of it, showing only total costs and

[4] For SDC, comparing alternative projects is rather the exception (call for concepts, tender). However, comparing different interventions inside a project may be a valid application, e.g. when choosing a specific value chain.

[5] Formula and technical explanations on NPV, IRR and BCR are given in Glossary

total benefits which sum up to the project's *net* benefit each year. The table is the basis for additional calculations.

Table 4: Consolidated Cash-Flow table[6]

	Years						
Items / years	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Investment	105,000						
Total costs		33,000	33,500	33,500	33,500	33,500	33,500
Total benefits		50,000	80,000	80,000	80,000	80,000	110,000
Net benefits	-105,000	17,000	46,500	46,500	46,500	46,500	76,500

7.2. Value Flow table

In an *economic* analysis the table needs to account not only for direct costs and benefits but for *indirect* effects as well. This so-called value flow table serves the same purpose as a cash flow table and contains similar elements, but it looks at society's costs and benefits as a whole (see Annex 4b economic CBA). Compared to table 4 above it would thus contain additional items and the values in the original items may change. Additional items could be externalities for example. These indirect effects may be difficult to quantify and monetise. Market prices often need to be adjusted to reflect more accurately social or economic values, referred to as 'shadow prices' (see Glossary in the Annex 1). While it may not be worth the time and effort to shadow-price each item individually, it is possible to test the effect of an increased price in some or all of the values by conducting a sensitivity analysis (see chapter 9).

Since an economic analysis looks at the costs and benefits to society a value flow table does not include any type of transfer payments such as taxes, subsidies, loan receipts, and repayment of loans and interest. To society financial transfers are just the reallocation of resources from one party of society (e.g. a private firm) to another (e.g. the government). They do not use up resources, i.e. they are not an economic cost. Hence, in value flow tables, taxes and loan costs are not treated as costs, and subsidies and loan receipts are not added to benefits[7].

Annex 5 contains a table that shows the relationship between the steps in a financial and economic analysis.

8. Assessment criteria

The two most common criteria in both financial and economic analyses are the net present value (NPV) and the internal rate of return (IRR) for financial analysis and the economic rate of return (ERR) for economic analysis. The two measures are interrelated and are derived from the same basic data: the cash flow in the case of financial analysis and the value flow table in the case of economic analysis. The third criteria explained in this How-to-Note, is the benefit-cost ratio, which is the direct result of a CBA. All three criteria take the influence of time into account, i.e. involve discounting (see chapter 5.2).

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[6] The number of years is an example. For each project a decision has to be made on the number of years to be calculated. Usually, the calculation is highly sensitive to this as the full benefits often accrue after the project has ended and at the same time there are no more project costs. Nevertheless, using only 1 or 2 years is an elegant way to deal with attribution. Even though a beneficiary may have lifelong higher earning thanks to the project, not everything can be attributed to the project. The beneficiary's own skills, external factors and many other factors are important as well. The SDC is commissioning more work on how to solve the attribution problem in a reasonable way.

[7] One exception are tariffs or taxes and subsides that influence shadow prices, i.e. their effect on local prices should not be removed if they are expected to persist during the period of the project.

Moreover it is important to keep in mind that not all costs or benefits may be quantified. Additional qualitative information is used in the final decision making on a programme and project. This may even lead to accepting projects that don't fulfil the criteria listed in this chapter, e.g. if public policies are rated positively for the country but quantification would just not be feasible.

8.1. Net present value (NPV)

In the flow tables the annual net benefits of a project are calculated by subtracting total costs from total benefits each year. Taking the influence of time on values into account by discounting[8] annual net benefits to the *present value* of net benefits, the sum of all *present* values is the NPV and indicates how much all future annual net benefits are worth today in monetary terms.

Table 5 (below) uses the example of the consolidated cash flow Table 4 (from chapter 7.1 above) to demonstrate the calculation of the NPV in two different ways, yielding the same result: a) by adding all present values of net benefits and b) by using Excel's NPV formula.

Table 5: Calculating the NPV in Excel (concerning the number of years see as well footnote 6)

	Years						
Items / years	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Investment	105,000						
total costs		33,000	33,500	33,500	33,500	33,500	33,500
total benefits		50,000	80,000	80,000	80,000	80,000	110,000
Net benefits	-105,000	17,000	46,500	46,500	46,500	46,500	76,500
Present value of net benefits (with i =10%)	-105,000	15,455	38,430	34,936	31,760	28,873	43,182
NPV	**87,636**						

a) Adding all present values of net benefits:

Net benefits	-105'000	17'000	46'500	46'500	46'500	46'500	76'500
Present value of net benefits (with i=10%)	105'000	15'455	38'430	34'936	31'760	28'873	43'182
NPV	**87'636**						

b) Using excel's NPV formula for row 1-6 and subtracting the original project investment:

Net benefits	105'000	17'000	46'500	46'500	46'500	46'500	76'500
Present value of net benefits (with i=10%)	-105'000	15'455	38'430	34'936	31'760	28'873	43'182
NPV	=NPV(10%;C6:H6)+B6						

NPV(**rate**; value1; [value2]; [value3]; ...)

The NPV is considered to be one of the most important assessment criteria because it reflects how much the project will earn in present value terms. In the example above the benefits outweigh the costs. Thus there is positive net present value, which means that the capital invested in the project could be paid back, plus interest (10% discount rate), and there is still an additional gain (or risk cushion) of 87,636.

A negative NPV means that the project is financially or economically loss-making and not viable. The discount rate (either the private or the social one) influences the NPV. In typical

[8] The basic formula for discounting is shown in the annex and explained with an example.

cases, choosing a lower rate increases the NPV and choosing a higher discount rate reduces the NPV of a project. The discount rate can have a significant impact on the NPV (to be checked with sensitivity analysis (chapter 9). The analyst has to make clear what rate is used and why.

- *General condition for accepting a project: the NPV must be positive (or zero)*

8.2. Internal Rate of Return (IRR) and Economic Rate of Return (ERR)

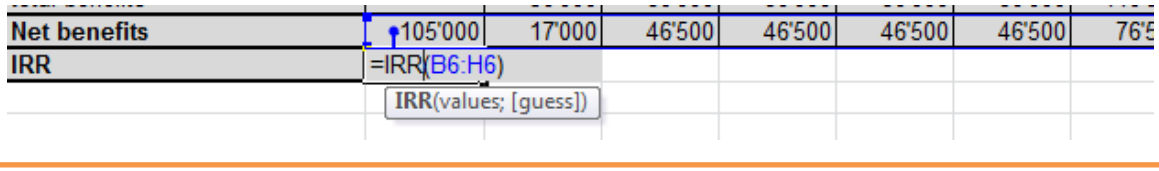
In the previous example of the NPV calculation, the NPV was 87,636 when a 10% percent discount rate was applied. Alternatively, the question could be asked: What discount rate would have to be used to obtain a NPV of zero? In the example above it would be 30.52%. This rate is called the internal rate of return (IRR) for financial analysis and the economic rate of return (ERR) for economic analysis. It is essentially a break-even discount rate, as at 30.52% the NPV becomes zero (below it stays positive). If the discount rate is higher than 30.52% one would no longer want to invest. The IRR is additional information that allows a choice to be made between different projects, everything else being equal, in particular risk and size of the investment. If NPV (a magnitude) and IRR (a yield) give conflicting signals, additional analysis is needed.

Table 6 demonstrates the calculation of an IRR in Excel again using the example of the consolidated cash flow Table 4 (from chapter 7.1). The ERR is derived in the same way, i.e. using Excel's IRR formula. It is just called ERR because it is used in economic analysis.

Table 6: Calculating the IRR in Excel

	Years						
Items / Years	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Investment	105,000						
total costs		33,000	33,500	33,500	33,500	33,500	33,500
total benefits		50,000	80,000	80,000	80,000	80,000	110,000
Net benefits	-105,000	17,000	46,500	46,500	46,500	46,500	76,500
IRR	**30.52%**						

The IRR is calculated by using Excel:



The result: an IRR of 30.52 % indicates that by discounting all net benefits at 30.52% and adding them up would yield a NPV of zero.

The IRR concept is used to produce either a financial IRR or, in the case of economic analysis, an economic rate of return (ERR). The financial IRR of 30.52% indicates from an investor's point of view that for every dollar spent on the project about $0.31 is received in interest per year. It provides a means for comparing alternative uses of funds. The ERR is similarly interpreted except that it shows what society can expect to receive back in consumption benefits for a given investment of its scarce resources.

- *General condition for accepting a project: the IRR must be equal or bigger than the discount rate*

8.3. Benefit-Cost Ratio (BCR)

The BCR is the ratio of discounted benefits (NPV benefits in monetary terms) relative to its discounted costs (NPV costs in monetary terms). The calculation of the BCR is similar to the NPV because it needs the same kind of flow of funds, as demonstrated in table 7 below. However, the result is not a value in monetary terms but a ratio, which allows comparing alternatives with different NPVs.[9]

Table 7: Calculating the BCR with Excel

	Years						
Items / Years	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Investment	105,000						
Total costs		33,000	33,500	33,500	33,500	33,500	33,500
Present value of costs (with i=10)	105,000	30,000	27,686	25,169	22,881	20,801	18,910
NPV costs	250,447						
Total benefits		50,000	80,000	80,000	80,000	80,000	110,000
Present value of benefits (with i=10)	0	45,455	66,116	60,105	54,641	49,674	62,092
NPV benefits	338,082						
Benefit-cost ratio	**1.35**						

The BCR is calculated by dividing the NPV of benefits through the NPV of costs. It is very important to calculate with *gross* benefits and *gross* costs and all costs (investments and recurrent costs) are added together. Netting can inflate and thus distort the BCR.

total costs		33'000	33'500	33'500	33'500	33'500	33'500
present value of costs (with i=10)	105'000	30'000	27'686	25'169	22'881	20'801	18'910
NPV costs	250'447						
total benefits		50'000	80'000	80'000	80'000	80'000	110'000
present value of benefits (with i=10)	0	45'455	66'116	60'105	54'641	49'674	62'092
NPV benefits	338'082						
Benefit-Cost Ratio	=B9/B6						

- The project in the example yields a BCR greater than 1, which can be used as an argument to support the project. *Condition for accepting a project: the BCR must be ≥ 1*
-

8.4. Criteria for reading and interpreting the values

The main criterion derived from financial and economic cost-benefit analysis is the NPV. Additional information is provided by the IRR or the ERR respectively, and the BCR. Generalising the examples in this chapter leads to table 8, which summarises the criteria used to interpret the indicators.

[9] For SDC, comparing alternative projects is rather the exception … see Footnote 4.

Table 8 Criteria for interpreting NPV, IRR and ERR, and BCR

	Red	green
Internal Rate of Return (IRR)	IRR <discount rate	IRR >= discount rate
Economic Rate of Return (ERR)	ERR < discount rate	ERR >= discount rate
Net Present Value (NPV)	NPV < 0	NPV >= 0
Benefit Cost Ratio (BCR)	BCR < 1	BCR >= 1

As a general rule, the colours in table 8 show the value criteria as a basis for making a judgement. If this were the only decision-making criterion, projects with values that are in the left column (red) should be rejected while values in the right column (green) should be accepted. In general all results should be challenged critically by decision-makers by asking for sensitivity analyses. They need both to make sure that their specific questions are answered and to control:

- whether the analysis was done from the asked point of view (financial and/or economic);
- if all relevant costs and benefits were accounted for in the cash-flow and/or value-flow table;
- what prices were used to value the listed costs and benefits (and why);
- what discount rate was applied (and why);
- over what time horizon the analysis was conducted (and why).

Ideally, the analyst also does research into whether benchmarks exist, i.e. for publications on effectiveness in the sector or for similar projects (e.g. on water or health), or on benefit-cost ratio of international organisations' interventions in the sector, etc. However, as every context is different, this needs to be carefully researched and compared.

A separate worksheet in Excel with all assumed values for variables is a good practice when calculations are consequently linked to these variables (see example here: Cost Benefit Analysis – Project Example Spread Sheet [Excel File] or file end of **Annex 4** Changing values (sheet assumptions) then allows a basic sensitivity analysis to be made (kind of trial and error). More sophisticated methods exist of course.

And again: economic and financial analysis are just one source of information of a decision-making project. Other considerations are required including:

- sustainability of the outcomes;
- empowerment, e.g. the involvement of local authorities;
- potential for a broader impact, i.e. up-scaling;
- gender and ethnic equality;
- ownership, transparency and governance;
- political priorities.

9. Sensitivity Analysis

As described in chapter 7 (Cash flow and value flow tables), the analyst identifies and values inputs and outputs associated with a project. The resulting expected values are then used in the initial calculation of the chosen indicator(s), e.g. the NPV, IRR/ERR or BCR as described in chapter 8 (Assessment criteria). However, analysts cannot be sure today about the future. They therefore use available information such as surveys, reports or data relating to past events, to make forecasts, e.g. on future demand for vegetables or the cost of labour.

Analysts may feel more confident about some estimates than others, particularly where they have more experience and more accurate observations of past events and trends on which to base their estimates. However there is always some uncertainty and risk that current trends will not continue.

A sensitivity analysis tests a chosen indicator with different assumptions to see how values change. It identifies critical values, in particular values that change the interpretation of an indicator according to table 8. Thus, the results of a sensitivity analysis can be used in a credit proposal's risk assessment. The three steps below guide the process of a sensitivity analysis:

1. Identify likely major sources of uncertainty for the project and for each source estimate some reasonable alternative values.

   Possible sources are:

   - natural factors such as weather, insects or diseases for agricultural projects;
   - technology and productivity factors related to processing, e.g. effects of alternative technologies;
   - financial and economic factors related to assumed values for inputs and outputs, e.g. exchange rates, oil price, etc.;
   - human factors e.g. related to labour availability and cost as well as management capability.

   The potential importance of any of these sources of uncertainty will depend on the context. Theoretically, the analyst could test the sensitivity of project outcomes to changes in assumptions concerning any input or output or combination of them. In practice, however, the sensitivity analysis will be limited to a few major potential sources of uncertainty for any given project.

2. Carry out a sensitivity analysis for the project using various combinations of different value estimates associated with the major sources of uncertainty.

   Once the factors and alternative values have been identified, it is comparatively simple to carry out the analysis by doing the same calculations as for the original analysis, but with different numbers. For example, in Excel the formula for the NPV stays the same but if cost and/or benefit values and/or the interest rate are changed, this results in an alternative NPV.

   Decision-makers are often interested in knowing how much values can change before a value that is acceptable for a certain criterion becomes unacceptable (compare with criteria in table 8). For example, they may want to know how much costs can increase and/or how much benefits can decrease before a NPV drops below zero or the IRR/ERR drops below the accepted discount rate. Similarly, for projects producing negative NPVs or IRRs/ERRs below the guiding rate, decision-makers may want to know how much costs would have to decrease, or benefits increase, in order to make the project acceptable. This is called a "break-even analysis" and provides useful information.

3. Analyse the parameters for which changes in value assumptions are critical in terms of project outcome:

   Where a reasonable change in an assumption of an indicators value is critical, in the sense that it drastically changes expected outcome, it is desirable to gather additional information. If further information suggests that there is a reasonable chance – perhaps 1 in 20, or whatever is chosen – that the value could change and that this would lead to a change in the decision regarding a project according to table 8 above, this must be stated explicitly. Decision-makers then need to reconsider the project, bearing in mind all other non-financial or non-economic factors (compare with 8.4 Criteria for reading and interpreting the values above). If the project is still to be implemented the result of the sensitivity analysis must be included in the project's risk assessment. Moreover,

decision-makers might decide to change the project design or build in contingencies and safeguards to prevent negative financial or economic outcomes.

This can be a very important input for the risk-assessment parts of the project document and credit proposal. The sensitive parameters show where risk mitigation measures are necessary.

10. Cost Effectiveness Analysis (CEA)

CEA is another useful methodology to evaluate interventions when benefits are defined but cannot be quantified in monetary terms. It is generally more difficult to assess benefits than costs, e.g. the benefits of a forest are more complex to assess than the costs of maintaining it, or the value of a child that finishes basic education is also harder to evaluate in monetary terms than the costs associated with sending that child to school. In these cases, CEA allows comparisons of costs to be made of the various alternatives to attaining a certain objective, e.g. rainforest protection or school enrolment.

Hence, CEA is a form of analysis that compares the relative costs and benefits of two or more interventions that are intended to produce the same outcome. It is distinct from CBA, which assigns a monetary value to the measures of outcomes.

A CEA is expressed in a cost-effectiveness ratio:

$$"cost - effectiveness\ ratio" = \frac{Total\ cost}{Units\ of\ effectiveness}.$$

It divides the total costs of an intervention by the benefit of an invention. Since benefits cannot be quantified monetarily they are measures in units of effectiveness, such as the number of acres of rainforest preserved or the number of school dropouts prevented. The result of this calculation is the cost-effectiveness ratio which indicates how much it costs to preserve one acre of rainforest or prevent one school dropout for example.

Besides environment and education the main and most common fields of application are governance and health. In the latter, the number of quality-adjusted life years (QALY) gained is often used as a measure of effectiveness.

CEA is mainly used in ex-ante evaluations to justify an approach for funding (as compared to alternatives). It is thus most useful when the desired outcome of an intervention is known and there are different approaches to reaching it. In fact, it forces decision-makers to consider alternative strategies to achieving a set goal and helps to identify the intervention that creates the greatest and most durable benefits. However, the analyst needs to exercise extreme caution because different approaches rarely generate absolutely comparable outcomes. Further considerations about applications of CEA are presented in Annex 6

Applying CEA in the health sector".

11. CBA and CEA in other institutions

A number of institutions active in international development and cooperation apply CBA and CEA in a systematic manner as part of their project evaluation strategy, and have developed their procedure manuals for financial and economic analysis of development projects. These include the DFID How-to-Note on economic appraisal, the Asian Development Bank Guidelines for the Economic Analysis of Projects and the WHO guidelines on CEA application.

CBA was an essential tool for USAID's recent reform agenda to make its work more effective both in terms of results and of resources needed for US assistance overtime. Other organisations apply CBA tools in all their development projects. For example, the Millennium Challenge Corporation, a US foreign aid agency, makes its economic rate of return data online available using interactive Excel spreadsheets. Annex 7 provides some examples and links to relevant documents of the work of various development institutions applying CBAs and CEAs. The list is not exhaustive.

12. Concluding reflection: Why it is worth the effort.

Your partner, your collaborator, your colleague submit a project document or entry or credit proposals stating a net present value of

a) USD 4,567,378
b) an IRR of 25.45%
c) a BCR of 1.12.

Are you happy?

Perhaps. As already stated many times, there are many different other decision criteria. Is the project reducing poverty? Who is benefiting? How many? How much? How is inclusion treated? Is it sustainable? Is the project changing systems or just helping a few households for a couple of years?

And: On what assumptions are the results based? What happens if the assumptions are changed? What is the project size (USD 5,000 or USD 5,000,000 total investment is not the same)? Last but not least, it may be useful to inquire whether benchmarks exist for similar projects and sectors, and whether the SDC project scores well or even better in relation to these benchmarks.

Even if the numbers themselves are rough estimates, the process of deriving them is certainly not worthless since it obliges project owners:

- to identify the relevant benefits;
- to quantify the benefits as well and plausibly as possible, thus laying the ground for a solid log frame monitoring system with baselines;
- to gain additional insights into the causalities of the project and to reflect explicitly on attribution of results to the project;
- to explicitly take time into consideration both on the benefits side (even beyond project end if necessary) and on the costs side;
- to make assumptions and thus risks explicit;
- to identify some important risks by performing sensitivity analyses (by varying the assumptions).Parameters should not be used, however, to manipulate values.

to name just the most important benefits of the exercise.

If the process has been carried out professionally, project partners and decision makers will have a much better feeling about the project. The project document will contain planned targets and planned expenditure per year and the updating of the Excel spreadsheet will facilitate monitoring as well as steering.

And this alone is worth the effort.

Annexes

Annexe 1

Glossary

Benefit Cost Ratio (BCR)	Ratio of (discounted) costs to benefits: total discounted benefits divided by total discounted costs.
Cash flow (Net)	Cash flow is the movement of money into or out of a business, project, or financial product, over a specified, limited period of time. Net cash flow refers to the difference between the cash inflows and outflows in a given period.
Cost Benefit Analysis (CBA)	Methodology that compares the evolution of monetised costs and benefits of businesses, programmes or policies over time, and assesses the profitability of the activity.
Cost Effectiveness Analysis (CEA)	Methodology that compares the costs of different options producing the same set of outcomes. CEA can be applied to businesses, programmes and policies. Cost-effectiveness analysis indicates which option produces a desired outcome at the lowest cost.
Cost-effectiveness Ratio	Ratio used in cost-effectiveness analysis where the denominator is a gain or units of effectiveness (i.e. in health: years of life, premature births averted, sight-years gained) and the numerator is the cost associated with the gain (see CEA). Cost-effectiveness ratio = Total cost / Units of effectiveness
Counterfactuals / counterfactual analysis	A counterfactual analysis is a comparison between what actually happened and what would have happened in the absence of the intervention.
Direct costs	Costs directly related to a specific project activity or to produce a particular product/offer a specific service (i.e. salaries, equipment, communication)
Discount rate	The discount rate refers to the interest rate used in discounted cash flow (DCF) analysis to determine the present value of future cash flows. The discount rate in DCF analysis takes into account not just the time value of money but also the risk or uncertainty of future cash flows; the greater the uncertainty of future cash flows the higher the discount rate. High discount rates tend to penalise long-term projects, such as environmental protection, and to favour short-term projects and projects with quick-benefits.
Discounted benefits	Future project/company benefits translated into present-day value using the technique of discounting (see 'Discounting')
Discounted costs	Future project/company costs translated into present-day value using the technique of discounting (see 'Discounting')
Discounting	Translates future costs and benefits into present-day values to account for the time value of money. Discounting provides a way to compare the monetary value of costs and benefits received in different time periods to present values. The formula for discounting is: $PV = \frac{FV}{(1+i)^n}$ PV, or present value, is the value at time=0. FV, or future value, is the value at time=n. i is the discount rate. n is the number of years in the future that the future value will be received.
Economic analysis	Economic analysis measures the effects of a project on the welfare (social, economic, environmental, institutional, etc.) of a specific community (country, region, village, etc.). While the financial analysis is based on market prices, the economic analysis is based on shadow or economic prices (prices that are adjusted to eliminate the effect of external interventions such as subsidies, taxes, exchange rate corrections, etc.)
Ex-ante Analysis	Analysis done before the project starts
Ex-post Analysis	Analysis done after the project was terminated
Externality	Effects of factors external to the project, which can include costs such as pollution or noise. Such costs, if not covered by the private entrepreneur, will incur to the society in question. Sometimes projects also "produce" positive externalities (positive effect that was unplanned or unexpected).

Financial analysis	Measures the profitability of a private project/investment calculated with market prices. This analysis does not take into account costs or benefits that are not paid / received by the enterprise (i.e. excluding externalities)
Indirect costs	Indirect costs refer to central administrative expenses, such as accounting and legal services, that are necessary for the continued functioning of an organisation but cannot be directly allocated to a specific activity.
Initial costs	One-off expenses incurred on the purchase of land, buildings, construction, and equipment used in the production of goods or in the rendering of services.
Intangible benefits	Benefits that cannot be measured directly in dollar terms. Examples of intangible benefits are a community's increased trust in local police or a reduced fear of crime.
Interest Rate (r)	An interest rate is the rate at which interest is paid by a borrower (debtor) for the use of money that they borrow from a lender (creditor). For example, a company borrows capital from a bank and in return the banks receives interest at a predetermined rate (generally set by the central bank) for deferring the use of funds and instead lending it to the borrower. Interest rates are normally expressed as a percentage of the principal for a period of one year.
Internal Rate of Return (IRR)/ Economic Rate of Return (ERR)	IRR is the rate (similar to an internal interest rate) that is generated by a project or an enterprise. It is an indicator of the profitability of the project / enterprise. If the IRR is equal to the discount rate then the discounted costs equal the discounted benefits, that is it would just break-even at that particular rate (see also discounting). The IRR is the discount rate at which the NPV (see NPV) for a project equals zero. This rate means that the present value of the cash inflows for the project would equal the present value of its outflows. In mathematical terms: $\sum_{t=1}^{n} \frac{C_t}{(1+r)^t} - I_o = 0$ *where r = IRR* where: C_t = the net cash receipt at the end of year t I_o = the initial investment outlay r = the discount rate/the required minimum rate of return on investment n = the project/investment's duration in years The ERR differs from the financial rate of return (IRR) in that it takes into account the effects of factors such as price controls, subsidies, and tax breaks to compute the actual cost the project to the economy.
Mutually exclusive projects	Projects are said to be mutually exclusive when they cannot be undertaken simultaneously. An example of mutually exclusive projects would be the option of a manufacturer to (a) expand its existing plant or (b) build a new one on a separate site in order to increase production capacity.
Net present value (NPV)	The sum of all discounted costs and benefits is called the net present value (NPV). This sum reflects how much the project will earn. NPV is usually calculated by adding the present value of future cash flows, residual values, and interest less investment costs, operational costs and future expenses. NPV is dependent on the value of the discount rate used to calculate these costs since the discount rate is used to calculate values over time (see also discounted costs, discounted benefits). The NPV method is used for evaluating the desirability of investments or projects. In mathematical terms:

	$$NPV = \frac{C_1}{I+r} + \frac{C_2}{(I+r)^2} + \frac{C_3}{(I+r)^3} + ... + \frac{C_2 ... I_o}{(I+r)^n}$$ $$NPV = \sum_{t-1}^{n} \frac{C_t}{(I+r)^t} - I_o$$ where: C_t = the net cash receipt at the end of year t I_o = the initial investment outlay r = the discount rate/the required minimum rate of return on investment n = the project/investment's duration in years
Operational costs	Operational costs are the running costs of a business or a project. These costs usually fall into two categories: fixed costs and variable costs. The latter include labour costs, materials, energy, logistics and the purchase of raw materials.
Project ycle management	PCM is a set of tools used in project management, ranging from project identification to project implementation and evaluation, including monitoring, outcome and impact assessment. It articulates the different phases of a project and, being a cyclical course, enables constant verification, monitoring and possible reassessment of the project logic.
Recurrent costs	Regular cost incurred repeatedly, or for each item produced or each service performed, on a recurring or repeated basis.
Residual value of the investment	Residual value is the value of an asset at the end of the period considered in the CBA. For example, if a tractor is purchased at the beginning of a project, the market value of the tractor after 6 years (assuming the CBA is calculated over 6 years) is called residual value.
Sensitivity analysis	Identifies the main parameters that influence the profitability of a project and allows simulations by changing project assumptions one by one or several at a time, including product prices, crop yields, sales, etc.
Shadow prices	Market prices often do not reflect the actual value of a good, commodity or service owing to policy interventions such as taxes or subsidies. Sometimes, there is no market value for a good or commodity. *Shadow prices are used to correct such distortions to prices*. Shadow pricing is a proxy value of a good, often defined by what an individual or society must give up to gain an extra unit of the good. For example, if there is significant structural unemployment and a project employs people who would otherwise be unemployed then an economic analysis might apply a labour cost lower than the ongoing wage to reflect a lower opportunity cost for such labour that otherwise would be unemployed.

Annex 2

SDC requirements for financial and economic analyses of projects

When? (in the SDC PCM)	What? Why? (Explanation, justification)	Degree of obligation	Minimum requirements
Cooperation Strategy (CS) and Monitoring CS	No fully fledged analysis is feasible, but some reflections on the effectiveness of aid should be integrated (see next paragraph on monitoring) In many cases a statement on total investments made versus number of people reached is useful.	Ideally, the monitoring concept indicates how to report on this dimension in the annual report at SDC department level, e.g. enabling plausible aggregation of outcomes to be related to the budget.	Reflections on the relations
Annual Report	Results statements per area of intervention: Wherever possible, cost-benefit or cost-effectiveness reflections should be made or more specific assessments that add to the plausibility and credibility of a result statement	Where feasible	E.g. aggregated outreach 30,000 beneficiaries with a budget of CHF 5 million and a judgement.
Entry proposal	Requirement in the intervention strategy: cost-efficiency, cost effectiveness listed as possible criteria for assessing and comparing different intervention strategies. Example of a minimum requirement of an entry proposal on governance of microfinance institutions: "A fully fledged cost-benefit analysis is not feasible, as the precise number of direct beneficiaries (microfinance institutions) and the countries of interventions are still to be determined. Nevertheless, a rough estimate shows: Total cost of CHF 4m with an impact on at least 160,000 clients is significant outreach. Combined with the potential for systemic change inside 2-3 countries, the cost-benefit relation may be qualified as very good"	Ideally, an ex-ante economic evaluation which needs to be complemented by a summarising qualitative assessment.	Good practice: Separate annex with rough, but plausible estimation (Excel spreadsheet plus interpretation) or justification of why not. Do not forget to mention policy outcomes, systemic changes and a qualitative appreciation of the numbers. Benefits that cannot be quantified are important, too!
Elaboration of the Tender Documentation	Where feasible, cost-benefit or cost-effectiveness ratios should be part of the evaluation criteria. This obliges the bidder to develop a solid set of impact hypotheses, and based on sound assumptions, set-up an ex-ante	Important additional, new evaluation criteria, but never the only one.	

	CBA / CEA. The bidder should also explain how the CBA / CEA model will be followed up / monitored. Depending on the nature of the project cost-benefit relations could replace other financial criteria such as the relation between administrative and fiduciary funds, etc.		
Elaboration of the Project Document	SDC checklist for ProDoc requires reflections on cost-efficiency and where possible cost-benefit (chapter 6 Resources). Needs to be reflected in the logical framework and the monitoring and evaluation system. In particular, the distribution of benefits (and costs) over time enables better reporting on results and steering (reallocation of resources; replication, upscaling, policy dialogue, etc.).	Implicitly mandatory (mandatory for credit proposal).	
Credit Proposal	A statement should summarise the reflections on cost-effectiveness, cost-benefit in chapter 6 Resources and refer to an annex with more detailed calculations or considerations Example: "Employment and income project, cost CHF 4 million, creating a positive net present value of CHF 3.5 million by reaching out to 10,000 low-income households and improving the framework conditions in the selected value chain can be considered as very good, given that the population density is low and most beneficiaries are female headed households."	Mandatory If not feasible, justification required.	Depending on the project, full precision will be too costly. Therefore, the degree of precision needs to be pragmatically chosen.
Progress Reporting by partners	"Chapter 4: Finances and management: Appraisal how efficiently inputs were converted into outputs." As the project document, logical framework, credit proposal and monitoring system have already been designed to take into account cost/benefit reflections (incl. calculations, indicators, etc.), the progress reporting is the logical continuation of the effort. It compares estimations with real values and where necessary proposes need for adaptations. Example: "Activity 3 (policy influence) is so far without tangible result, however we suggest maintaining the effort and spending as the probability of success is 50% and the pay-off would be very high (change in the	Implicitly mandatory: the periodicity of reporting to be verified case by case.	At least annual reporting on cost/benefit reflections. Degree of precision needs to be balanced with resources invested in monitoring and evaluation.

	national system). The net present value of activity 1 is even higher than planned. As project implementation capacity and absorption capacity allow further expansion and thus outreach to more low-income farmers, SDC is asked for additional funds of CHF 500,000 (with a similar positive NPV as in the last half year)." However, as usual the NPV etc. is **not** the only decision criterion.		
End of Phase Report (EPR)	"Chapter 2: Outcomes achieved: An approximate analysis of costs/benefits of achieved outcomes." At the end of the running phase, cost-benefit reflections, assessments and insights gained should provide elements for planning the next phase, e.g. measures to improve data availability or to integrate the result of an ex-ante assessment already in the next credit proposal. Or it should help detect project components to be abandoned or to be continued in a follow-up phase. In addition, it should inform on potential for replication and up-scaling. If this kind of information is not yet available, the draft EPR should therefore try to organise it (e.g. commissioning evaluations to close gaps).	Highly recommended.	Sometimes difficult to do ex-post, but of particular interest ex-ante, thus required as a basis for planning the next phase (if applicable)
Reviews / Beneficiary Assessments	Reviews (internal evaluations) and end-of-phase reports (EPR) have to be connected in a meaningful way. They must be targeted. The scope and focus of a review determine how the five standard criteria of the DAC (OECD) for evaluations are taken up to ascertain results, effectiveness, efficiency, relevance and sustainability. However, reviews should always verify and check project systems and estimate cost-benefit issues, which requires taking the efficiency criteria as a measure of how economically resources/inputs (funds, expertise, time, etc.) are translated into results.	In general mandatory part of every evaluation if effort is reasonable.	In general, an evaluation not making the effort to inform on cost effectiveness and cost/benefit should either not be commissioned or not be paid. However, in some cases the effort may be disproportionate or unreliable, e.g. if data need to be created ex-post. Obviously, this kind of programme may be difficult to be continued or scaled-up.

Annex 3

Example of discounting and compound interest calculation

Values are intimately associated with time. The value of costs and benefits depend on when these costs and benefits occur. Thus, USD 1 of benefits occurring ten years from now is not as valuable in today's terms as USD 1 of benefits occurring immediately. If USD 10 is spent today and USD 15 is received back tomorrow, that may be acceptable. But if USD 10 is spent today and the USD 15 is not received back for 40 years that may not be acceptable. The amounts are the same. The difference is time and people's willingness to accept delays in consumption.

The basic formula for discounting is $PV = \frac{FV}{(1+i)^n}$ and is the reverse calculation of compound interest $FV = PV(1+i)^n$

PV: $present\ value, is\ the\ value\ at\ time = 0$

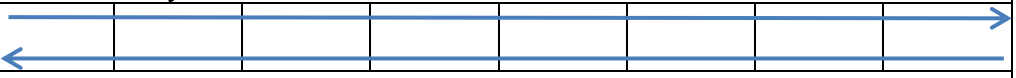
FV: $future\ value, is\ the\ value\ at\ time = n$

i: $the\ discount\ rate$
n: $number\ of\ years\ in\ the\ future\ that\ the\ future\ value\ will\ be\ received$

Examples:

Compound interest: If you place USD 100 (=PV) in a deposit account at an interest rate of 8% per year (=i), at the end of the first year (n=1) you will have 100 * (1 + 0.08) = USD 108 on your account. In 7 years' time (n=7) your investment will be worth 100 * $(1 + 0.08)^7$ = USD 171.40.

Discounting: Similarly, if you earn USD 100 (=FV) in 7 years from now (n=7), the value today of these USD 100 is only USD 58.40 (=PV) at 8% (i=8%) interest.

Year	0	1	2	3	4	5	6	7
With interest	100.0	108.00	116.60	126.00	136.00	146.90	158.70	171.40
	If I have USD 100 today and the interest rate is 8%, my capital will be USD 171.4 after 7 years							
								
	If I will have USD 100 in 7 years and the interest rate is 8%, the value today is USD 58.40							
Discounted	58.40	63.00	68.10	73.50	79.40	85.70	85.70	100.0

Annex 4

Example of the financial and economic analysis of an enterprise for a private-sector development intervention

Example of a vegetable processing enterprise

An enterprise wants to start a new line of vegetable packaging and to sell ready-to-use vegetables on the domestic market. For this vegetable processing factory, the investment consists of buildings and machines for the factory. The operational costs include salaries, materials, energy, logistics and the purchase of raw materials (vegetables from farmers). Revenues are generated from the sale of processed vegetables. The first step is to carry out a financial CBA, followed by an economic analysis.

a) Financial CBA

Detailed information of costs: main building for the enterprise: USD 50,000; additional building for storage: USD 15,000; vegetable cleaning line: USD 25,000; vegetable packaging line: USD 5,000. In addition the new company needs working capital of USD 10,000 to have enough cash to pay salaries and running costs at the beginning.

The operational costs of the enterprise are planned as follows:

- Transport costs of USD 2,500 in the first year followed by constant annual costs of USD 3,000.
- Cost of buying vegetables from producers: USD 25,000 p.a.
- Labour costs (wages): USD 2,500 p. a.
- Maintenance costs of the equipment: USD 1,000 p.a.
- Marketing costs: USD 2,000 p.a.

On the income side, the company expects to sell vegetables to the value of USD 50,000 during the first year and for USD 80,000 p.a. in the following years. The discount rate considered is 10%. At the end of the planning period (6 years) the residual value of the investment is estimated at only USD 20,000 because the equipment will have become old and outdated and the buildings will need to be repaired. The working capital can be recovered at the end of the final year of the planning period.

The CBA table below shows these elements over time (6 years in this example) and the annual cash flow generated by the enterprise (cash flow =inflows minus outflows). The residual value of the investment is the market value of the buildings and machines after 6 years.

Example of financial CBA: Vegetable packaging enterprise

FINANCIAL ANALYSIS (Currency: USD)

Year	*0**	*1*	*2*	*3*	*4*	*5*	*6*
Total additional costs (in USD)	***105,000***	***33,000***	***33,500***	***33,500***	***33,500***	***33,500***	***33,500***
Buildings	50,000						
Cleaning line	25,000						
Warehouse	15,000						
Packaging line	5,000						
Transport costs		2,500	3,000	3,000	3,000	3,000	3,000
Wages (labourers)		2,500	2,500	2,500	2,500	2,500	2,500
Maintenance (and materials)		1,000	1,000	1,000	1,000	1,000	1,000
Marketing		2,000	2,000	2,000	2,000	2,000	2,000
Purchase of vegetables		25,000	25,000	25,000	25,000	25,000	25,000
Working capital	10,000						
Total additional benefits	***0***	***50,000***	***80,000***	***80,000***	***80,000***	***80,000***	***11,0000***
Sales of packaged vegetables	0	50,000	80,000	80,000	80,000	80,000	80,000
Residual value of investment							20,000
Recovery of working capital							10,000
Net additional cash flow	***-105,000***	***17,000***	***46,500***	***46,500***	***46,500***	***46,500***	***76,500***

* Year 0 is a virtual year, serving the purpose of making funds available so that the project can start on 1 January of year one. There are therefore NO operational costs OR revenues in year 0.

Discount Rate

NPV	10%	**87,635.66**
IRR		**30.52%**
BCR		**1.35**

b) Economic CBA

To do an economic CBA of the same project, additional information is needed on price distorting factors such as government policies that influence investments, costs and benefits.

In the case of this vegetable processing enterprise, the following information is relevant for the economic analysis:

- The government provides support for start-up enterprises corresponding to 20% of the initial investment on machines/equipment and 10% on buildings;
- There is a minimum wage in the country that increases the costs of labour for the entrepreneur by 20%;
- There is an import tax on packaged vegetables to protect the domestic market. Due to this tax, the enterprise can increase the selling price of its processed vegetables by 12%.

Based on this information, the project parameters need to be corrected for the economic CBA:

Item	***Financial value*** (in USD)	***Modifica-tion***	***Economic value*** (in USD)	***Comment***
Buildings	65,000	+ 10%	71,500	Cost of buildings in USD: 50,000 + 15,000 = 65,000 plus 10% govt. support = 71,500
Equipment	30,000	+ 20%	36,000	Cost of equipment in USD: 25,000 + 5,000 = 30,000 plus 20% govt. support = 36,000
Labour costs	2,500	- 20%	2,000	The minimum wage makes the labour costs more expensive; the shadow price of labour would be only USD 2,000
Sales of packaged vegetables	50,000 / 80,000	- 12%	44,000 / 70,400	The protection measure at the border gives an additional benefit to the entrepreneur. At shadow prices revenues would be 12% less.

The remaining values are unchanged, i.e. the financial value = the economic value for transport costs, purchase of vegetables from producers, maintenance and marketing costs.

Example of economic CBA – Vegetable packaging enterprise

ECONOMIC ANALYSIS currency = USD

year	*0*	*1*	*2*	*3*	*4*	*5*	*6*
Total additional costs (in USD)	***117,500***	***32,500***	***33,000***	***33,000***	***33,000***	***33,000***	***33,000***
Buildings	55,000						
Cleaning line	30,000						
Warehouse	16,500						
Packaging materials	6,000						
Transport costs		2,500	3,000	3,000	3,000	3,000	3,000
Wages (labourers)		2,000	2,000	2,000	2,000	2,000	2,000
Maintenance (material for)		1,000	1,000	1,000	1,000	1,000	1,000
Marketing		2,000	2,,000	2,000	2,000	2,000	2,000
Purchase of vegetables		25,000	25,000	25,000	25,000	25,000	25,000
Working capital	10,000						
Total additional benefits	***0***	***44,000***	***70,400***	***70,400***	***70,400***	***70,400***	***100,400***
sales of packaged vegetables	0	44,000	70,400	70,400	70,400	70,400	70,400
residual value of investment							20,000
recovery of working capital							10,000
Net additional cash-flow	***-117,500***	***11,500***	***37,400***	***37,400***	***37,400***	***37,400***	***67,400***

NPV	**10%**	**38,775.51**
IRR		**18.67%**
BCR		**1.15**

Interpretation: In this example, the financial analysis is much more profitable than the economic analysis. This is typical for a situation where the state promotes a sector of activities. For the private entrepreneur, the financial CBA is very positive: The project will be implemented without doubt. From the economic perspective, it is likely that the project will also be considered positively as it generates more benefits for society than the costs of the support policies. The private investor will have to ascertain whether the government support is likely to continue, and if not, how the financial analysis would look without government support.

Example of a CBA in the income and employment sector [10]

XLS-Example e+i network.xls

[10] https://blog4dev.webarchive.ch/ei-f2f2013/thematic-modules/psd-training-on-financial-and-economic-project-evaluation/ : Cost Benefit Analysis – Project Example Spread Sheet [Excel File]

Annex 5

Relationship between steps in a financial and an economic efficiency analysis

Financial analyses are straightforward as they only involve actual cash flows and market prices. For economic analysis, additional costs and benefits to society need to be quantified and monetised. Consequently, it may make sense to start with a financial analysis of a project and then use the results of it as a starting point for a value-flow table and an economic analysis. Three types of adjustments need to be made to construct an economic value-flow table from a financial cash-flow table:

- add costs and benefits that are not included in the cash flow table, i.e. indirect effects or externalities;
- revalue costs and benefits in the cash flow table using shadow prices instead of market prices; and
- remove transfer payments from the cash flow table.

Financial analysis (and cash-flow tables)	Economic analysis (and value-flow tables)
1. Identifying and quantifying inputs and outputs	
Direct inputs provided by the financial entity and outputs for which the entity is paid are included.	In addition to direct inputs and outputs, indirect effects are included, i.e. effects which are not included in the financial analysis because they are things that are not bought or sold within the project context. These effects impact on society as a whole.
2. Valuing inputs and outputs	
Market prices are used. For inputs and outputs that occur in the future, future market prices are estimated.	Economic values are used in cases where market prices adequately reflect economic values, i.e. individuals' willingness to pay. In other cases, i.e. when there are no market prices, shadow prices are estimated.
Inputs and outputs are multiplied by market prices to arrive at total costs and returns which are then entered in the cash flow table. Transfer payments (taxes, subsidies, loan transactions, etc.) are added to the cash-flow table.	Inputs and outputs are multiplied by market or shadow prices to arrive at total economic costs and benefits which are then entered in a total-value flow table. Financial transactions that involve money transfers, such as taxes and subsidies that are important in financial cash-flow tables, are not shown.
3. Comparing costs with benefits	
Using cash flow table, calculate chosen measures of project worth or commercial profitability.	Calculate chosen measures of economic efficiency or economic worth, using the information in the total value flow table.
4. Dealing with uncertainty: Sensitivity analysis	
Test results for uncertainty by varying values of key parameters in a sensitivity analysis.	Test results for uncertainty by varying values of key relationships/parameters in a sensitivity analysis.

Applying CEA in the health sector

The cost-effectiveness of an intervention can vary significantly according to the size and scope of the project. Usually in the health sector, where a high number of people are assisted, the cost per outcome drops. For example, if more children can be immunised with the same fixed costs (nurses and clinics), then each additional immunisation will be cheaper. On the other hand, costs can rise as coverage expands if it becomes harder to reach additional patients. Therefore, depending on the comparison undertaken, an analyst might look at the average cost-effectiveness ratio or the incremental cost-effectiveness ratio. The average cost-effectiveness ratio looks at total costs and total results, starting from zero. The incremental ratio compares additional costs and additional results, starting from the current level of coverage or services. For example, in child immunisation intervention, the incremental cost of adding mobile vaccination units might be lower than expanding fixed clinic services, mostly if the unvaccinated children are dispersed and hard to reach. Figure 1 shows alternatives that might be available for expanding the coverage of a current intervention (the *status quo* shown at point "X"). If an option is more effective and less costly, decision-makers should opt for it. More costly and less effective options should be abandoned. The trade-offs are less clear in the empty quadrants. In these cases, the decision-makers must decide whether the possible benefits merit a change in strategy.

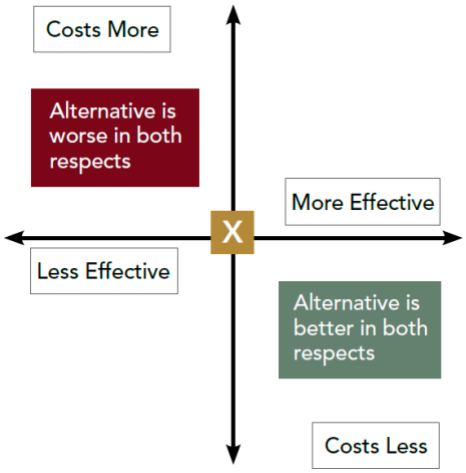


Figure 1 Comparing alternatives to a given health intervention (X). Source: P. Musgrove and J. Fox-Rushby, 2006.

Annex 7

Examples of various development institutions applying CBA and CEA

Organisation	Active in	Application of CBA/CEA	Relevant documents	Links
Asian Development Bank (ADB)	Supporting development projects to fight poverty in Asia and the Pacific	The ADB has been continuously undertaking measures to enhance the effectiveness of its operations. To improve projects both at the preparation and implementation stages, the ADB issued its "Guidelines for Economic Analysis of Projects" in 1997 to enhance project quality at entry. The conduct of proper economic analysis helps ensure the efficient use of development funds and public resources and thereby increases aid effectiveness.	This practical guide is a supplement to the Guidelines for the Economic Analysis of Projects. It provides an overview of recent methodological developments in cost-benefit analysis as well as suggested improvements in the economic analysis of projects in selected sectors through case studies. These case studies illustrate the application of suggested methodologies, taking into account sector-specific needs, as well as difficulties faced by practitioners in terms of data and time constraints during project processing. It also aims to contribute to the ADB's capacity building initiatives as this will be the main reference material for conducting an economic analysis.	Cost-benefit analysis for development: A practical guide
DFID Department for International Development (UK)	Development projects worldwide	CBA/CEA analysis of VFM in all governance programmes to respond to value for money (VfM)	Guidances on measuring and maximising VfM in social transfers Guidance for DFID country offices on maximising VfM in cash transfer programmes DFID 'How to note' on economic appraisal	Guidance on measuring and maximising value for money in social transfer programmes – second edition How to note: A strengthened approach to economic appraisals
Millennium Challenge Corporation (US foreign aid agency)	Fighting global poverty	Systematic application of CBA in all development projects	Economic rate of return (ERR) The Millennium Challenge Corporation is making available its economic rate of return (ERR) data via interactive, downloadable Microsoft Excel spreadsheets. The spreadsheets are unique to each project within a compact. Each spreadsheet includes: a description of the project, including its economic rationale; the expected project impacts, including detailed cost and benefit estimates; a tool allowing users to modify key assumptions and study the effects of those modifications on the project's returns.	Economic Rates of Return Aid Effectiveness: Putting Results at the Forefront
USAID US Agency	Working to end extreme global	CBA application to make their interventions more effective and in	In 2010, USAID embarked on an ambitious reform agenda to make the agency more effective, strengthen the results of its work,	Working more efficiently and effectively through

for International Development	poverty and enable resilient, democratic societies	line with the results	save money and reduce the need for US assistance over time. One essential tool in this effort is CBA.	Cost Benefit Analysis
World Bank	The World Bank Group consists of five institutions whose mission is to fight poverty for lasting results.	CBA used to be one of the World Bank's signature issues. It helped establish the World Bank's reputation as a knowledge bank and served to demonstrate its commitment to measuring results and ensuring accountability to taxpayers.	"Cost-Benefit Analysis in World Bank Projects": This report takes stock of what has happened to CBA at the WB based on analysis of four decades of project data, project appraisal documents and implementation completion and results reports from recent fiscal years, and interviews with current staff at the bank	Cost-Benefit Analysis in World Bank Projects
World Health Organization WHO	UN agency (health)	Application of CEA to development health projects worldwide	Guide to CEA	WHO guide to cost-effectiveness analysis
DGIS and DFID projects	Development projects funded by DGIS and DFID	These documents are the product of a project funded by the UK Department for International Development (DFID) and the Netherlands Directorate-General for International Cooperation (DGIS) for the benefit of developing countries.	Participatory cost-benefit analysis Introduction to cost-benefit analysis	PARTICIPATORY cost-benefit analysis Introduction to cost-benefit analysis
GIZ projects	Deutsche Gesellschaft für Internationale Zusammenarbeit	GIZ conducts projects involving CBA.	Trainer manual on business policy advocacy "Cost-Benefit Analysis (CBA) in Employee Wellbeing Programmes (EWP)"	Business policy advocacy Cost-Benefit Analysis (CBA) in Employee Wellbeing Programmes (EWP)

Annex 8

Standard terms of reference for Cost Benefit Analysis

Context

Financial and economic analyses are an important element of result-based-management for improving the effectiveness of the SDC's interventions by better linking results with resources. They are increasingly integrated into planning and reporting tools. Basic considerations for the financial and economic analysis of projects as well as on two frequently used methodologies, cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA), are explained in the SDC "How-to-Note on Financial and Economic Analysis of Projects with a focus on Cost-Benefit Analysis (CBA) and Cost Effectiveness Analysis (CEA).

However, due to the nature of SDC projects (creation of public goods, long-term effects, outreach to very large target groups, imperfect secondary data, etc.), the consultant has to strike a balance between reasonable effort and scientific robustness of his/her findings. It is therefore recommended to build in sufficient reserves for errors, risks and omitted aspects.

Expected output

1. An economic and financial analysis of the project or at least parts of it
2. Condensation of the most relevant information in:
   a) an Excel spreadsheet, allowing the modification of assumptions and conduct of sensitivity analysis (e.g. separate sheet on assumption and questions of attribution);
   b) an explicit description of how the attribution to the project has been modeled;
   c) a succinct explanation of the underlying assumptions, easy to understand for a non-expert third party;
   d) calculations of the internal rate of return, net present value and discounted and nominal cost-benefit relations and other management ratios considered as relevant in the specific case (as a minimum);
   e) reasonable, plausible explanations concerning estimates (comprehensible for non-expert third parties);
   f) the interpretation and critical evaluation of the findings on 1-2 pages.
3. Capacity building of SDC staff and partners on the use of outputs - if necessary
4. Recommendations on improving the project M&E systems for improved future integration of economic and financial analysis concerns

Activities

Ideally the consultant carries out a fully-fledged economic and financial analysis of the project. However, this will only be feasible in a few cases due to the nature of SDC projects (see above).

We therefore suggest the following step-by-step approach:

1. All SDC projects have logframes and, usually, quantified objectives with indicators and measurement systems (monitoring and evaluation). Based on this and in dialogue with the project staff, the consultant quantifies the most relevant benefits of the project, ideally combined with the corresponding cost (total cost, see 3, below);
2. Establishment of result chains to illustrate the attribution;
3. Calculation and attribution of total project costs (SDC plus other costs such as the in-kind and financial contributions of partners, negative externalities, etc.);

4. Establishment of the flow of funds over time (highlighting investment, divestment, depreciation, liquidation values etc. – if applicable);
5. Report writing, with the inclusion of different explanations and recommendations;
6. 2 to 3-hour crash course on how to interpret the major ratios and use the model (allowing creation of scenarios, revision of calculations, sensitivity analyses, etc.).

Estimated time

- Collection of relevant data: in the context of the rest of the evaluation
- Quantification and monetisation of benefits, if not or not sufficiently available: 1 day
- Establishment of flow of funds, incl. assumptions: 1 day
- Establishment of a results chain or similar to tackle attribution issues: 0.5 day (if applicable);
- Description of assumptions, estimates, attribution, model used (if necessary), etc.: 1 day
- SDC capacity building and project staff: 1 day including preparation (if necessary)
- Drafting of recommendations: 0.5 days

Total: approximately 3-5 days

Literature

Nassir Sapag Chain y Reinaldo Sapag Chain; Preparación y Evaluación de Proyectos, quinta edición, 439 pages; McGraw-Hill Companies, 2003, ISBN-10: 9701042484

Annex 9

SDC experiences with financial and economic analysis

In 2011, the SDC issued a call for a backstopping mandate on CBA and CEA. The mandate involved providing support to the SDC head office and cooperation offices in CBA- or CEA-related matters, such as the formulation of TORs in order to mandate an analysis to a consultant, review consultant reports, support tender evaluations, and provide general guidance on financial and economic analysis. Within the framework of this mandate, a number of CBAs and CEAs (listed in table 9 below) were conducted and can be accessed on request.

Table 9: Selected examples of CBA and CEA from SDC projects

Example no.	***Country***	***Sector***	***Project***	***Type of information in the annex***
1	Mongolia	Agriculture	MPP, Mongolian Potato Project	Different ways of applying CBA to a development project
2	Bosnia	Governance	ILDP, integrated local development project	Analysis of investment sourcing based on strategic planning in the municipality of Cazin with cost-benefit considerations
3	Bosnia	Health, capacity building	Nursing project	Unit-cost analysis with cost-effectiveness considerations
4	Vietnam	Integrated rural development	PSARD	Approach and result of a CBA study conducted in 2011 on the PSARD project
5	South Africa	Agriculture	Post-harvest	CBA done by DAI (US consultancy firm) for the SDC with focus on comparing different technologies for grain storage.
6	Bangladesh	Humanitarian aid	Cyclone shelters	Multipurpose cyclone shelters, discussion on CBA / CEA application
7	Bosnia	Employment	YEP youth and employment	Summary of a CBA study done in 2013/14
8	South Africa	Education		CBA done by DAI (US consultancy firm) for the SDC on an education programme (vocational skills development).
9	Chad	Agriculture	Seuils d'épandage	Feedback to the project within the backstopping mandate
10	Mongolia	Pastoralism	GreenGold	Summary of a CBA done in 2013 in the west of Mongolia.
11	Mozambique	Horticulture	HortiSempre	Concept for a CBA developed in Nampula in 2013 with the project HortiSempre
12	Tanzania	Media	TMF project	Annex that discusses possible CBAs for this project at the financial and economic levels. No calculation included.
13	Vietnam	Integrated rural development	PSARD	Example focusing on data collection for CBA in a concrete case

Since 2011, the SDC's Latin America and Caribbean Division has made a major effort in the field of capacity building. Several capacity building events have been conducted in Central America, Bolivia and Cuba with the participation of SDC local and expatriate staff and in some cases even implementers. Additional, local backstopping capacities have been installed in these countries. A great many of projects have since then benefited from ex-ante evaluations and are available for

reference purposes. Examples are included in entry proposals, credit proposals and project documents. This How-to-Note has benefited greatly from these experiences.

Annex 10

Other working tools and methods

PowerPoint presentation for a training course on CBA

PPT-Training-on-Fina
ncial-and-Economic-P

Working tool and examples of unit costs and their calculation

Unit costs are the costs incurred to produce one unit of a particular product or to provide one unit/item of a specific service.

Unit Costs -
Working tool and ..

Working tool and examples gap analysis

Gap analysis compares planned and effective inputs/outputs and shows how budgets vary with variations in quantities and rates.

Input-output
financial analysi...

References and further reading

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- ICRA Learning Materials (no date) – Cost benefit analysis I, II, III - Key Concepts:
  - http://www.icra-edu.org/objects/anglolearn/Cost_Benefit_Analysis-Key_Concepts1.pdf
  - http://www.icra-edu.org/objects/anglolearn/Cost_Benefit_Analysis_3-Key_Concepts%28new%29.pdf
  - http://www.icra-edu.org/objects/anglolearn/Cost_Benefit_Analysis_2-Key_Concepts.pdf
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