Limestone analytics

Unified CBA (UCBA) Guidelines

Version 1.0

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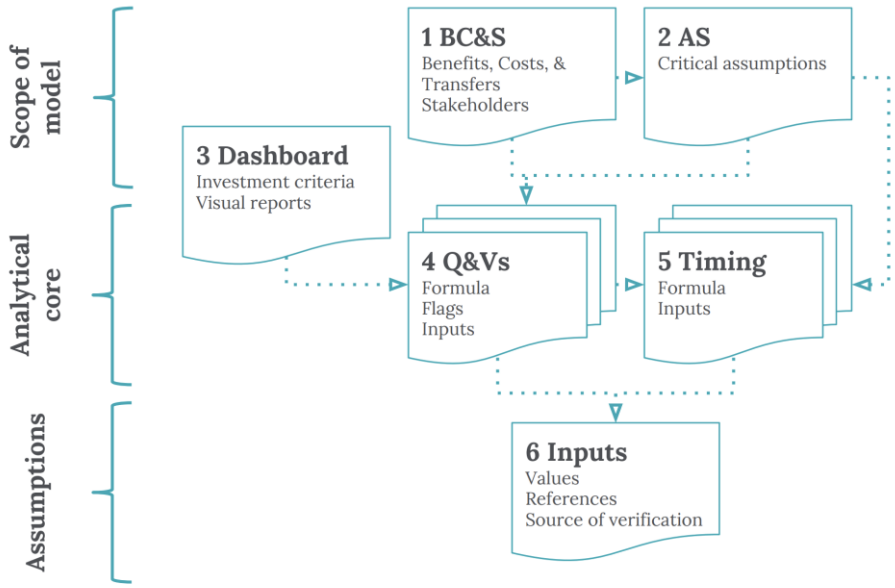
Introduction

This concept paper introduces a set of conventions and specification tools for cost benefit analysis (CBA) referred to by Unified CBA or UCBA. Together, they are expected to standardize the way CBA models are specified. A model that is specified using UCBA may follow any economic theory for quantifying and valuing impacts, or can be implemented in any software.

The intended audience of the paper are expected to be knowledgeable on applied economic analysis (welfare economics and cost benefit analysis). Depending on the choice of financing and the nature of the economic activity, knowledge of project finance, public finance, engineering, health, or education can be a required skill. The use of UCBA reduces the time and effort required to create and maintain CBA models. This approach to model specification also enhance the ability of the analysts to efficiently interact with clients and subject area experts regarding the model's assumptions, logic, and results.

The figure below illustrates the general structure of the UCBA paradigm for specifying a CBA model.



These guidelines do not replace the need for an in-depth understanding of the CBA's fundamental economic theories. These theories can be studied through articles and books

published by scholars such as Arnold Harberger, Massimo Florio, and Glenn Jenkins. See the Oxford handbook of well-being and public policy[1] for an overview of CBA and other approaches used for the analysis of public policies and development projects.

Furthermore, UCBA does not replace the need to have modeling expertise, however, it enables the economist to specify the model to a degree that an expert modeler with no knowledge of CBA can implement. The model can therefore be implemented in a spreadsheet or any other dynamic analytical environment such as a web-based dashboard.

Except for some conventions, UCBA conventions are all based on human language, requiring minimal effort to learn before utilization. There are two barriers to the adoption of UCBA:

1. Experienced economists need to change the way they are used to do CBA, limiting their efforts to specifying a model in human language. Many economist enjoy working with spreadsheets, like architects who like construction work. Taking away the joy of working with spreadsheets can result in some passive resistance to adoption of UCBA.
2. Inexperienced economists may find UCBA as a means to learn CBA quickly, thinking that putting their CBA models in a properly formatted specification platform will make them theoretically sound. This can result in resistance from higher-ups in the organizations as they start finding model specifications that look pretty but are based on mistakes and errors. In fact, UCBA enables economists to have independent specifications for the estimation of each benefit or cost, allowing them to efficiently get advice from subject matter experts without the need to explain an entire model.

Some of the unique features of UCBA include:

1. A logical framework for defining the stakeholders and impacts
2. A logical framework for identifying input
3. Formalizing the approach to sensitivity analysis (analytical capacity)
4. Defining the breadth and depth of the model separately (scope vs calculations)
5. Separation of cash (and resource) flows from other decision criteria (dashboard)
6. Separation of inputs from the rest of the analysis

[1] Adler, Matthew D., and Marc Fleurbaey, eds. The Oxford handbook of well-being and public policy. Oxford University Press, 2016.

7. Specification of the depth and breadth of a complete CBA model in human language, in less than 10 pages.

UCBA reduces the cost of communications, enabling CBA practitioners to seek advice and approval along the process. The approval process will not only improve the quality of output, but it also provides an efficient learning opportunity for young practitioners. The peer review must be performed by an economist who is a Senior CBA Expert and a certified UCBA modeller. Below are the recommended stages at which a peer review can be conducted:

- First peer review: once BC&S, AS, and Dashboard are developed
- Second peer review: once Q&Vs and Timing are developed
- Final peer review: when a functional model along with all UCBA components are compete.

Background

There are no industry standards for how cost-benefit analysis models should be specified or structured. These models provide vital information about the feasibility of large investments, and yet they are often in the form of a single spreadsheet. The way models are currently developed, assumptions and the formulation of costs and benefits are not immediately clear. Consequently, auditing such models can be costly, and they are difficult to reuse. These challenges have limited the wide-scale use of cost-benefit analysis as a tool to assist decision makers.

Many organizations have attempted to standardize the methodology, look, or structure of models. These attempts include the production of template spreadsheets and interactive softwares such as the World Bank's Highways Development Model (HDM)[2] and the United Nations COMFAR[3]. However, to be successful, template spreadsheets can only be designed for specific applications, such as the World Bank's HDM, which is geared for the analysis of highway development projects only. This limitation reduces the ability of any organization in maintaining an adequate level of analytical support when new sectors or innovative project models are introduced. The alternative is to build flexible templates that are applicable to a broader set of project models and sectors. Flexible models turn out to be either too simplified to be reliable, or very complicated and detailed to be useful over the conventional approach of building tailored spreadsheets.

This concept paper describes an alternative solution to this problem by introducing a set of modelling conventions and model specification tools. Together, they are expected to help the sector by standardizing the way models are specified, rather than the way they are implemented. A similar solution, referred to as the Unified Modelling Language (UML), revolutionized the software development space in the late 1990s. That is part of the reason this paradigm is named Unified CBA (UCBA).

For readers who are not familiar with UML and model specification languages, another example is the standard family of blueprints prepared for specifying the design of a building by architects. Similar to economic models, buildings come in many shapes, functions, and scales; they are also designed and constructed using scientific engineering

[2] Archondo-Callao, Rodrigo. 2008. Applying the HDM-4 Model to Strategic Planning of Road Works. Transport paper series;no. TP-20. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/17419 License: CC BY 3.0 IGO.

[3] https://www.unido.org/resources/publications/publications-type/comfar-software

theory. Having a set of standardized specification media such as blueprints of architectural plans helps this sector reduce the potential for errors and allows architects to work in teams, reuse plans, and communicate various aspects of the design with stakeholders who have limited engineering or design background including the customers and construction contractors.

The concepts, modelling conventions, and specification language discussed in this report are based on ongoing experiments and experience of practitioners at Limestone Analytics. Limestone staff provide technical support to organizations such as the World Bank, the Millennium Challenge Corporation, US Agency for International Development, and World Vision, who use CBA for project design and reporting purposes. These guidelines can help such organizations adopt a more institutionalized approach to CBA that can be more efficient and effective. At the moment, most economists who develops CBA models operate like a group of architects who poorly, if at all, specify their buildings prior to construction and, therefore, they have to implement the models themselves and spend significant resources to communicate their assumptions and methodology with others.

The future of UCBA can include an expansion of the logical framework to incorporate sources of data verification, confidence intervals, and logical tests for robustness. Furthermore, a software platform can be developed with the following features:

1. Streamlining the logical steps such as creating the tables, identifying the unique inputs, etc.
2. Enabling seamless teamwork through task assignment, peer review process management, and real-time collaboration

Key benefits

Efficient use of resources

- Economist focuses on methodology and analysis
- Subject matter expertise can be efficiently utilized for specific sections (health expert, education experts, etc.)
- Technical skills in research and modelling can be utilized with no requirements for knowledge of CBA

No boundaries for implementation

- Models can be implemented in any platform (Excel, R, Matlab, etc.)

Ease of communication and knowledge management

- Much less effort to understand the methodology and assumptions
- Significant time saving for developing reports about the assumptions and methodology

Conversion from an art to a profession

- Making peer review and audit easy
- Standardize documentation processes
- Enabling teamwork

Key concepts and conventions

Before we begin looking at the model specification tools proposed in this document, it is important to learn about some of the theoretical concepts and conventions behind UCBA.

Resource flows and decision criteria

CBA models are typically constructed to use a series of assumptions to forecast a set of time series (costs and benefits). These time series data can represent costs, benefits, net flows, or even quantities such as the number of individuals reached. In the end, however, what is reported from these models are comprehensive decision criteria such as the Net Present Value (NPV), cost per unit of effectiveness, and Internal Rate of Return (IRR), or other measures such as the number of people reached or cases of a health outcome averted.

In UCBA, it is important to distinguish between the decision criteria and time series that summarize the costs and benefits. The primary outputs of the paradigm are the time series that summarize costs, benefits, and transfers[4] from alternative perspectives[5]. These time series, or the intermediary calculations for their estimation, provide the inputs required for what will be eventually reported - the decision criteria. The separation of the analytical formulation from what is reported allows the analyst to build models that are comprehensive and follow the same paradigm irrespective of the reporting requirements.

In the UCBA paradigm, the decision criteria are specified in a table called the “dashboard.” Dashboard is is specified in the early stages of the process to complete the list of time series and summary criteria that the model needs to estimate.

[4] In economic analysis, transfers are transactions that reflect no cost or benefit from the society’s point of view. They simply represent the movement of funds from one agent in the economy to another. Examples include taxes and subsidies.
[5] Majority of CBAs focus on society (economy) as the main perspective, some include financial perspectives, and in rare cases detailed analysis is conducted from other perspectives such as the government

Financial, Social, Economic, and External Perspectives

Financial actors & external actors

While many institutions have traditionally focused on estimating the net economic impact of the project such the World Bank's Economic NPV (ENPV) and MCC's Economic IRR (ERR), the demand for reporting the impact on stakeholders has increased over the years. Some institutions have come up with additional names for such analysis, including "risk analysis" of Inter-American Development Bank, "stakeholder analysis" of USAID, and "beneficiary analysis" of MCC. The financial analysis have also gathered renewed attention in recent years as partnerships with private sector and other economic agents such as farmers has increased. Analyzing the distribution of financial and non-financial impacts of the project on each stakeholder is therefore factored for in UCBA.

In practice, the terms used to describe impacts on different stakeholders can be different from one model to another. To avoid any confusion, the following conventions are followed in UCBA:

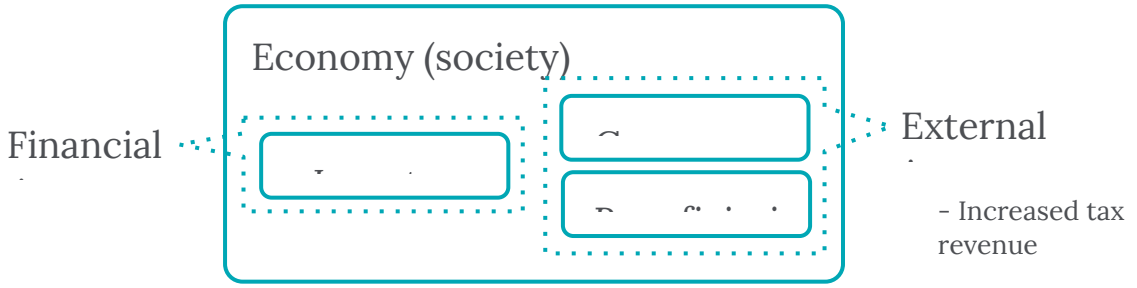
- Financial actors: any actor who needs to make a DIRECT[6] financial contribution to the project WITH or WITHOUT the expectation of a financial gain.
- External actors: any other actor who may receive non-financial[7] or INDIRECT financial impacts (costs or benefits)

The term "economic"

The term "economic" in the area of international development is perceived as the overall impact on all the agents in the economy, including financial and non-financial costs and benefits, but excluding transfers such as taxes and subsidies. As the use of CBA expands into NGOs and engineering firms, a conflict has appeared in the interpretation of the term "economic", where it is often interpreted as "financial" in the social sector and by engineers. Therefore, this guidelines uses the term "social" to refer to the economic point of view to avoid communication issues. For the purposes of this report, the terms social and economic mean the same thing: the aggregate impact of a transaction or the net aggregate impact of a project on all stakeholders including the financial perspectives.

[6] Grants are an example of a DIRECT financial contributions. Taxes and subsidies are examples of INDIRECT financial impact (to the government).
[7] Non-financial impacts include, but are not limited to, safety, education, nutrition, and health.

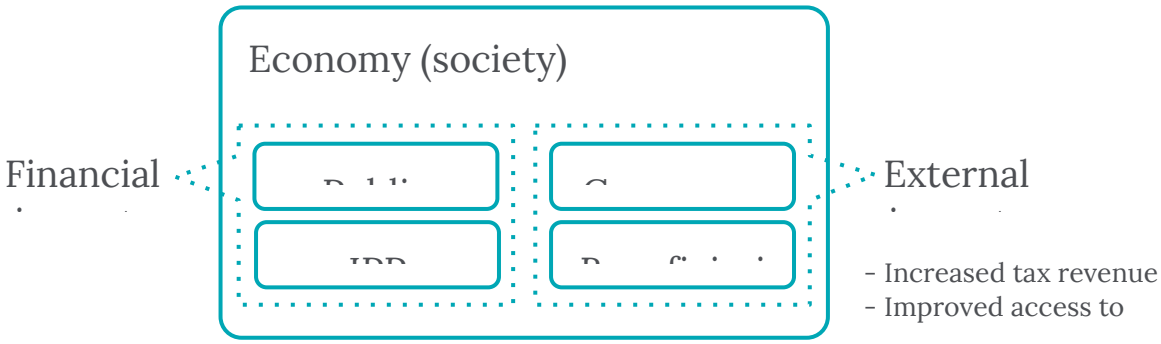
In the most basic form, all of these actors are in the same economy and the economic (social) impact is the aggregate impact on all of these actors. This relationship is illustrated below.



In such an accounting framework, transfers are a cost for one party and a benefit for another, making their net economic (social) impact equal to zero. There are situations in which the definition of these actors may not be as straightforward. Some of these situations are discussed below.

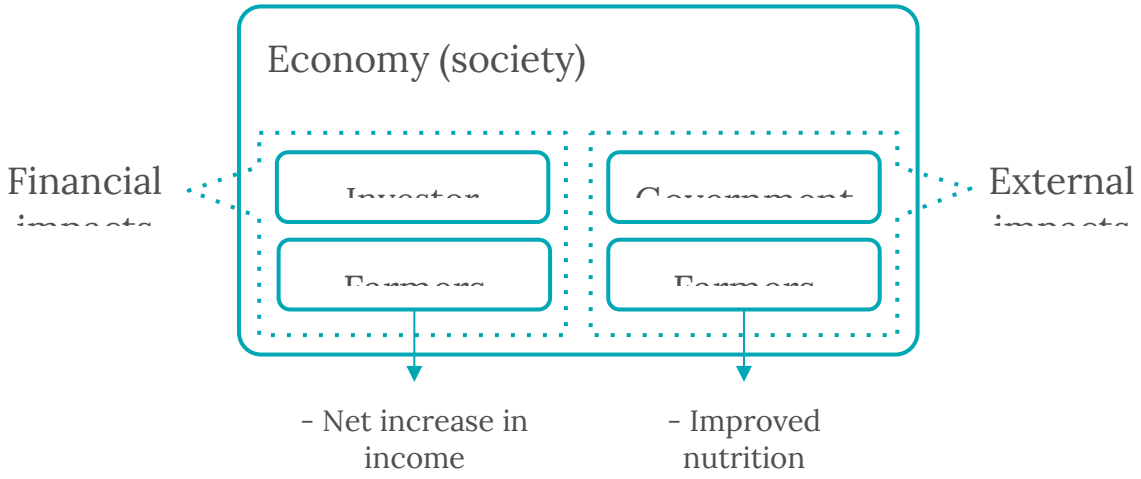
In the case of financial partnerships (multiple financial perspectives)

When other actors, not just the investor, are assumed to take part in paying DIRECTLY for the costs of the project with the expectation of some DIRECT financial benefits, they become an additional financial actor. An example is the public utility that off-takes the power produced by an independent power producer (IPP) and sells it to final consumers after paying for the costs associated with transmission and distribution. For the benefits of such a project to be realized for the final consumers of energy, the operation must be financially sustainable for both the IPP and the public utility.



When financial sustainability for beneficiaries matter

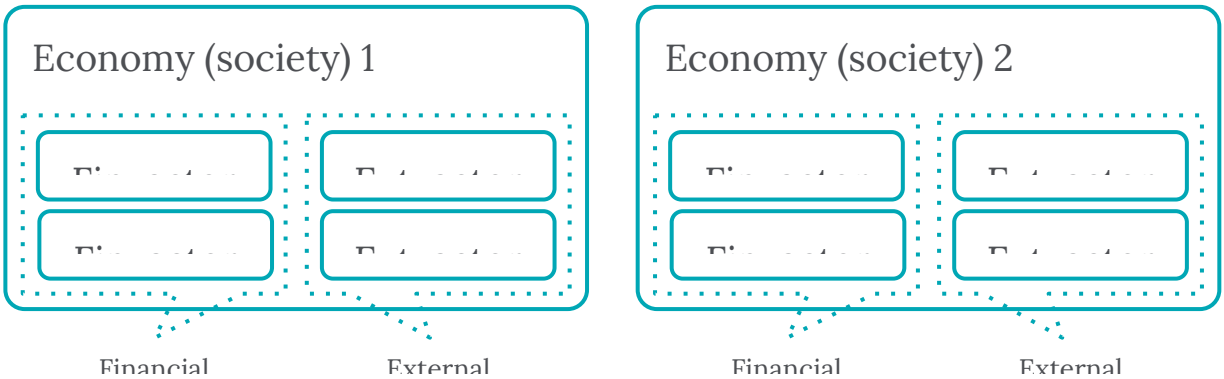
In some instances, the party that is required to DIRECTLY pay for some of the costs may receive both DIRECT and INDIRECT benefits from the intervention. A typical example is when farmers are expected to incur some costs and adjust their operation in the expectation of increased financial benefits along with improved health and education. Under such circumstances, the impacts on such actors must be split in between financial and external. This separation allows to conduct a meaningful financial analysis that reflects the decision-making structure of the farmer which is primarily based on the DIRECT financial costs and DIRECT financial benefits.



When there are multiple countries involved (global perspective)

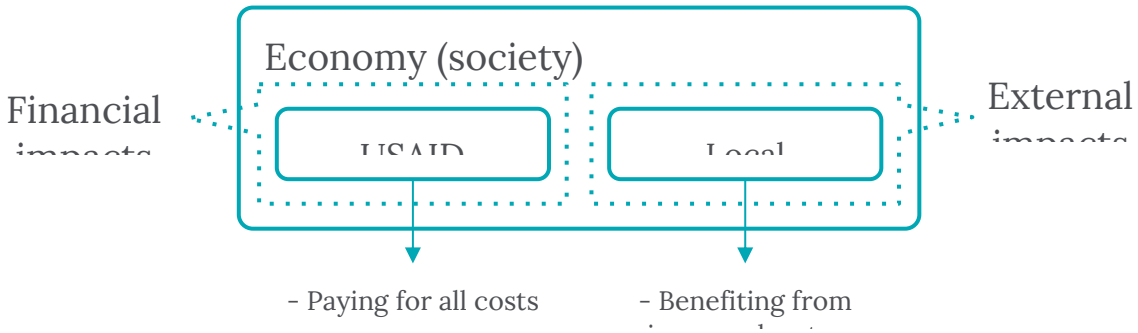
The analysis of projects may need to consider the impacts on more than one economy. Having multiple economic perspectives is relevant for international transport and transmission projects. When projects are defined at a regional level simply for their institutional scale, the analysis must be conducted separately for each country. Another example when having multiple economic perspectives is justified is when a project is expected to leave a significant impact on one or more markets in another economy.

Global perspective

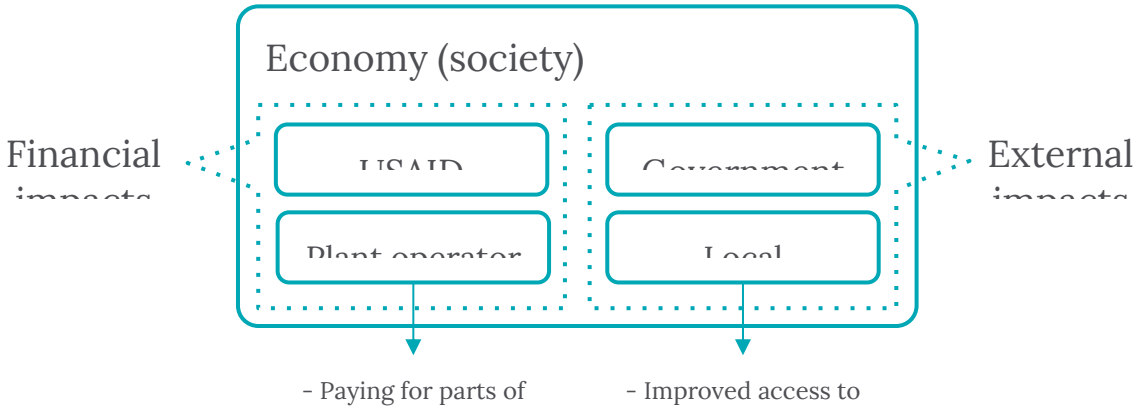


Some examples

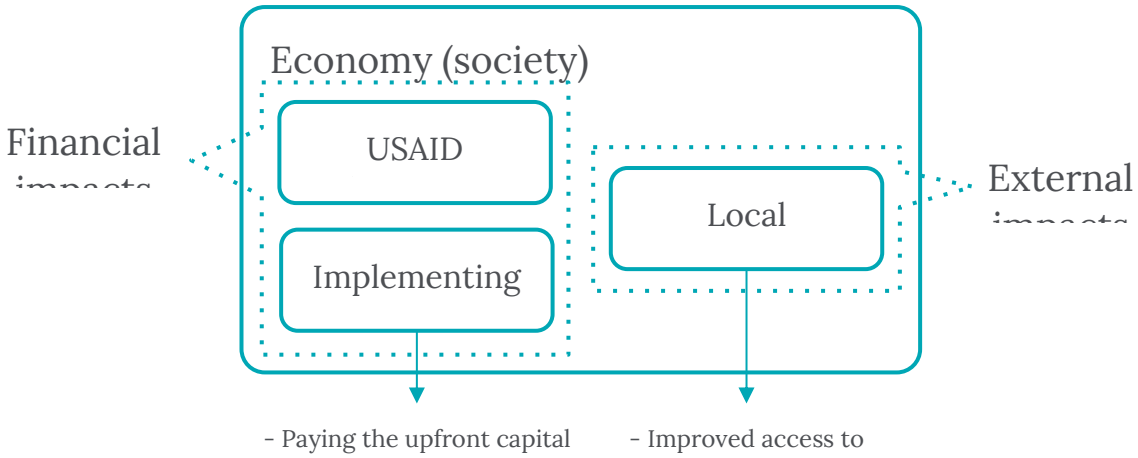
- **Grant Financing:** USAID implements the construction of a water treatment plant. Note that this does not change if USAID provides a grant to an NGO to implement the project, the NGO will simply be hired by USAID to deliver the project.



- **Blended Finance:** USAID partially finances the construction of water treatment plant in form of a grant, expecting the plant operator provides the rest of funds required in the expectation of revenue from sales of water. In this scenario, the operator will pay taxes to the government.



- **Results-Based Finance:** USAID, as an outcome-payer, off-takes the delivery of impact. An NGO, using its own finance, or by raising equity from investors, finances the working capital required.

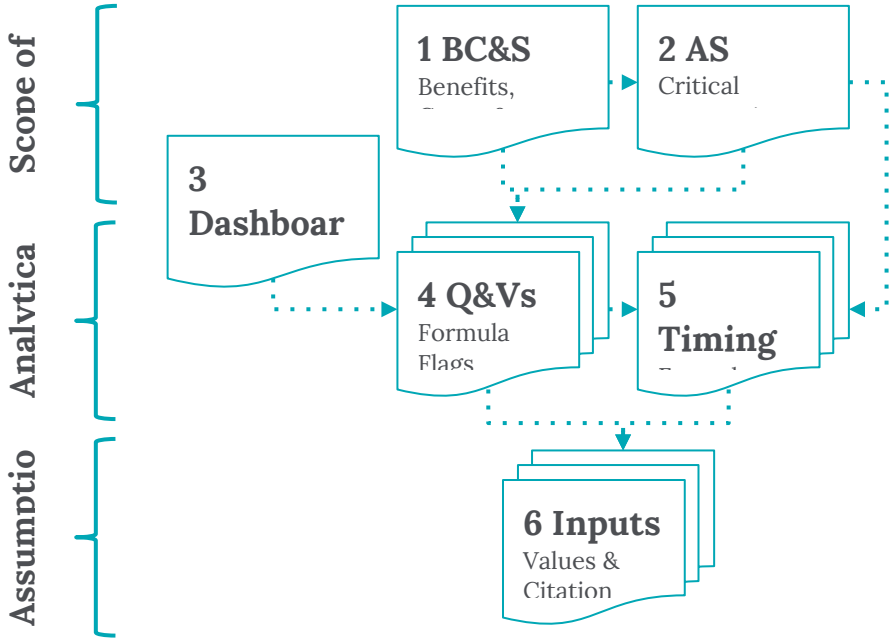


The modelling paradigm

Model specification is the main objective of UCBA. This is done using a series of visual elements, mostly tables. Below is a list of these visual elements sorted by the order in which they should be created within the UCBA paradigm. Please note that this is not a waterfall process, once created these elements must be maintained in an iterative fashion as the model matures.

- Scope of the model
  - General Summary
  - Benefits, Costs, and Stakeholders (BC&S)
  - Analytical Sensitivity (AS)
  - Dashboard
- Analytical core
  - Quantity and Value (Q&V)
  - Timing
  - Inputs

The diagrams below shows how these elements interact with each other. The interactions highlighted in this diagram may be confusing at this point, it is recommended that you return to this diagram after you learn about the role of each element.



Scope of the model

General Summary

Prior to specifying the details of the model, it is useful to provide a table that includes a description of the project or policy being analyzed by the model. This will help future reviewers of the analysis to learn about the project prior to its CBA. An introductory summary table is recommended to include the following elements:

- A narrative about what is being done by the project/policy
    - Included activities
    - Targeted beneficiaries
    - Scale
    - Source of financing
    - In applicable, financial stakeholders (sharing risk and reward)
- List of benefits to all affected stakeholders
- List of costs for all affected stakeholders
- Main currency of the model
- Additional currencies for financial analysis from specific perspectives (if applicable)
- The timeframe of the project/policy including stages such as investment, ramp-up, operation, clean-up, etc.

Once complete, the elements described below can be used to specify the scope of CBA.

Benefits, Costs, and Stakeholders (BC&S)

List the costs, benefits and transfers in the first column. Subsequent columns contain the various perspectives, starting with financial stakeholders, followed by the various external stakeholders.

Impacts	Financial stakeholder 1	Financial stakeholder 2	External stakeholder 1	External stakeholder 2
B1 Benefit 1[8]		✓	✓	
B2 Benefit 2		✓		✓

[8] A benefit can have a financial and an external impact, the value of which is likely different. A water project that reduces the cost of water for the consumers has an external impact (cost saving) that is different than the financial impact (sales revenue).

C1 Cost 1	✓		
C2 Cost 2		✓	✓
T1 Transfer 1	✓+	✓-	
T1 Transfer 2	✓+	✓-	

In the BC&S table impacts can be a cost to one stakeholder and a benefit to another. When completing this table, place a check mark to show that a cost or a benefit applies to a given stakeholder. The costs and benefits included in this table can be financial or non-financial nature. The approach used for the estimation of these values along with the value of transfers will be specified under Q&V tables.

Transfers are financial impacts that affect two financial stakeholders. When specifying a transfer, the following logical conditions must be followed:

1. A transfer must affect at least two financial stakeholders
2. When specified later in Q&Vs, the horizontal sum of the transfer on different stakeholder must come to zero.

With transfers, use a plus (+) or a minus (-) sign to show which financial stakeholder is paying for the transfer and which financial stakeholder is receiving it.

The level of breakdown for costs, benefits, and transfers must be chosen efficiently; balancing between insight provision and ease of communication. Some examples of good and back breakdowns are provided below.

Poor breakdown

- Cost of pens
- Cost of paper
- Cost of stapler
- Cost of computer

Efficient breakdown

- Operating costs
- Equipment costs

Please note that detailed breakdown can be included in the Q&V or inputs tables when needed. It is recommended to keep the ability to fit the BC&S table in one page (less than 15 rows).

Analytical Sensitivity (AS)

The AS table lists the assumptions you would be worried about when thinking about the project or policy being evaluated by the CBA model. The objective is to summarize which benefits, costs, and transfers are expected to be sensitive to these critical assumptions. The table has the exact same first column as in BC&S. The rest of the columns are however used to show which of the critical assumptions (listed in the first row) are expected to affect the value of the benefit, cost, or transfer.

Impacts	Critical assump. 1	Critical assump. 2	Critical assump. 3	Critical assump. 4	...
B1 Benefit 1	✓				
B2 Benefit 2					
C1 Cost 1					
C2 Cost 2					
T1 Transfer 1					
T2 Transfer 2					

Keep the number of critical assumptions limited to some of the key inputs, not all the inputs. Using this table, the analyst can obtain feedback from the client on the analytical capabilities of the model at the very early stages. This way, if the client has questions about the impact of a specific assumption such as cost or time overrun, the economist will learn about it prior to the specification of the calculations and wire with the capability of showing what will happen in case of a time or cost overrun.

Analytical core

Quantity and Value (Q&V)

There will be one Q&V table for each of the benefits, costs, and transfers. They specify the approach for the calculation of these impacts. Each Q&V summarizes the following:

- A narrative describing how the impact is estimated
- Timeframe: the period(s)[9] in which the calculation is relevant
- List of inputs (and their units)
- Calculations[10]

The information listed above must not take more than a page. If more than a page is required, it is an indication that some of the calculations deserve to be reported in the form of a research paper and then cited in CBA.

The inputs must, at least, include all of the critical assumptions from the AS table that were linked to the impact being specified in the Q&V. Any of the inputs listed in the Q&V table should be used in the formulas and calculations in the same Q&V table. Ensuring consistency across the labelling of inputs in the different sections of the Q&V tables is essential to ensure the tables are easy to follow.

The information within the Q&V tables should be able to stand alone from the rest of report, meaning that the source of the benefits and costs specified in each table should be clear from the table narratives. The narratives are an essential component of the Q&V tables, and should specify any assumptions made about the calculations and inputs. The narrative should also include references for any external sources (for example, where secondary data sources or critical assumptions are coming from). An example of the Q&V table frame is presented below.

Title
Narrative
Timeframe
List of Inputs (and units)
Calculations

[9] Examples of periods for projects: construction, rampup, operation, and closure
[10] Multiple calculations may be reported in a Q&V when an impact affects multiple stakeholders

Inputs

In general, there are three types of inputs:

1) **Simple inputs**, which come with no dimensions (for example, the average life expectancy for members of the population, number of inches in one meter, or the expected life of the project).
2) Those indexed in a **single dimension** (for example, if child labor rates vary by province then the assumption would be a *one dimension variable that varies by province*. If the number of program participants varies by year, then the number of program participant would be a *one dimensional variable that varies by year*. Province and year are the dimension in each of these examples, respectively)
3) **Multi-dimensional inputs** (for example, yield rate by farm size and by province)

Inputs are identified earlier in the paradigm when Q&V tables were drafted (in the section called "list of input"). It is very common to have an input repeated in multiple Q&Vs, in the end we need a unique list to be specified here.

To avoid duplication, no values are assigned to inputs when identified in the Q&V tables. The value of each input and the source of this information are summarized in the inputs table. It is good practice to

- Gather all "simple inputs" in one table,
- Aggregate "single dimension" inputs across dimensions and create a table for each dimension, and
- Create a separate table for each of the "multi-dimensional" inputs

Each input table needs to specify:

1) The label used (this should be exactly equivalent to the label used in the inputs specified in the Q&V tables)
2) The description of the variable
3) The input's value
4) The source of the information and (if relevant) the source that can be used to verify the input value after (for example, administrative data, performance evaluation report, impact evaluation report, etc.)
5) The confidence interval for a value (only when relevant)

If a spreadsheet is used to implement the model, it is good practice to set the input tables up in the same workbook that will include the Q&V tables. This will make it easier to

connect the calculations tables (implementation of Q&Vs) to the inputs that each are to include, since each input may be used in the calculation of multiple Q&V tables.

The following table shows as example of the **simple inputs** that are included in a model. Each input from the Q&V tables that does not vary on a dimension (such as time, location, age, etc.) should be listed here. The name of the inputs must be the same as what is used in the Q&V tables. In this example a spreadsheet is used for the implementation of the model and the name, value, and unit of each input are listed. The reference is also included (in square brackets).

Assumptions			
Units			
Percentage		%	
Number		#	
Currency		USD	
DALYs		DALY	
Sector		Sector	
Year		Year	
Flag		Flag	
Child Labour			
Hourly child labour wage	[1]	$0.38	USD
Number of hours in a FTE	[2]	2000	#
Health Costs			
Life expectancy in Cambodia	[3]	69	#
Value of a statistical life in Cambodia	[4]	$394,036.22	USD
References			
[1] International Labour Organization (2013) “Child Labour Report”			
[2] International Labour Organization (2003) "Investing in Every Child"			

In the following table, the **input that varies by a dimension** is presented as an example. The input is the “additional lifetime income by grade”. This parameter shows the additional

lifetime earnings expected from completing a grade. Note that the values that grade (the dimension) can assume (ie. 1, 2, 3, ...) are also treated like inputs of the model under these conventions. Like the simple inputs, the references for each input have been included at the bottom of the table and units have been included for each type of input.

Assumptions						
Grade						
Grade		#		1	2	3
Gains from Education						
Additional lifetime income from completing grade	[1]	USD		$241.14	$258.02	$276.09
References						
[1] World Bank. (2005). "Cambodia Basic Education for All"						

An example of a two-dimensional table is included below where the input "additional lifetime income from completing grade" now varies across grade as well as by region.

Assumptions						
Gains from Education						
Additional lifetime income from completing grade						
Grade						
Grade		#		1	2	3
Region						
Battambang	[1]	USD		$241.14	$258.02	$276.09
Siem Reap	[1]	USD		$253.20	$270.92	$289.89
Eastern Cambodia	[1]	USD		$265.86	$284.47	$304.38
Sihanoukville	[1]	USD		$279.15	$298.69	$319.60
References						
[1] World Bank. (2005). "Cambodia Basic Education for All"						

For **variables that vary across more than 2 dimensions**, a multi-dimensional tables will be needed. To avoid excessively wide tables, it is good practice to choose the dimension with the least number of items as the third, which is shown as the column headers. An example of a table with three or more dimensions is below, where "additional lifetime income from completing grade" now varies by not only grade and region, but also by gender. If multi-dimensional tables exceed a page in length or width, it is advisable to split the table into two or more separate tables (so you have one table for each value of one of your dimensions) so they are easier to follow.

Assumptions									
Gains from Education									
Additional lifetime income from completing grade									
Gender									
Gender			Males			Females			
Grade									
Grade		#	1	2	3	1	2	3	
Region									
Battambang	[1]	USD	$241.14	$258.02	$276.09	$168.80	$180.62	$193.26	
Siem Reap	[1]	USD	$253.20	$270.92	$289.89	$177.24	$189.65	$202.92	
Eastern Cambodia	[1]	USD	$265.86	$284.47	$304.38	$186.10	$199.13	$213.07	
Sihanoukville	[1]	USD	$279.15	$298.69	$319.60	$195.41	$209.09	$223.72	
References									
[1] World Bank. (2005). "Cambodia Basic Education for All"									

Timing & Flags

Any benefit, cost, or transfer in the CBA model requires a timeframe within which its formula applies, and is otherwise zero. These timeframes can be anywhere from 1 year to 50 years. Some examples include the investment period, the operation period, and the closure period. The number of periods and the length of each can be different from one project to another.

“Flags” are a modelling shortcut used to specify periods. They can have a value of one or zero, where one indicates that a given timeframe is relevant for that instance of time. See the example below which shows how flags can be specified or calculated in Microsoft Excel.

Period	2018	2019	2020	2021	2022
Investment flag	**1**	**0**	**0**	**0**	**0**
Operation flag	**0**	**1**	**1**	**1**	**0**
Closure flag	**0**	**0**	**0**	**0**	**1**

Flags are used in the model to simplify formulas. For instance, imagine that we know a particular benefit is valued at 200 but it is only delivered during the operation period. Using flags, one can simply use formula that multiplies the “Operation flag” with the input value (200) in all time periods. This flag will help with maintaining the same formula across the project life.

Flags can be calculated using formulas as well, this is useful to test how sensitive the results are to assumptions around the timing of the project, such as construction delays.

The Timing table is the list of flags that will be identified by reviewing the timing section of Q&Vs. Flags should be treated like Q&V tables, meaning that in their specification the inputs and calculation must be identified. Critical assumptions around timing normally fall into the calculation of flags, it is therefore important to make sure those inputs are included in the calculation. An example of flag calculation is presented below.

A	B	C	D	E	F	G
1	Start year	2018				
2	Duration of operation	2				
3	Period	2018	2019	2020	2021	2022
4	Investment flag (formula)	=if(C3<C1+C2, 1, 0)	=if(D3<C1+C2, 1, 0)	=if(E3<C1+C2, 1, 0)	=if(F3<C1+C2, 1, 0)	=if(G3<C1+C2, 1, 0)
5	Investment flag (output)	**1**	**0**	**0**	**0**	**0**

Dashboard

The dashboard specification , ironically, is less of a visual part of UCBA than the other components. It is a list of criteria and visual elements you would like to report along with the models the most critical assumptions. This table should include a narrative that details the elements in the dashboard and may include elements such as the ones listed below.

- NPV from different perspectives
- Debt service ratios when applicable
- Return rates
- Charts that list breakdown of costs
- Charts that show flows over time
- Measures of output and outcome such as number of beneficiaries
- Breakdowns of the above by subsets of the affected stakeholders (geographically, gender, age, income, etc)

Like the Q&V Tables, this table should specify the calculations used to measure these elements, if relevant. It should also specify the inputs required. The dashboard may introduce new inputs. For instance discount rate is required to estimate the NPV but may not have been required for any of the benefit, cost, or transfer calculations directly.

Practical notes

Naming of variables (convention)

- Benefits, Costs, and Transfers (flows) are identified with B, C, and T respectively.
- Flows can be numbered for ease of reference as in B1 and T2.
- Flows can have different values from different perspectives, these perspectives can be different stakeholders or different subsets of a stakeholder. These perspectives are represented with superscripts such as B_1^{Youth}

Checklist

- ❑ Are the flows (Bs, Cs, and Ts) identically listed and named across BC&S, AS, and Q&Vs?
- ❑ Are there any inputs in Q&Vs that are missing in the Input tables?
- ❑ Are the name of inputs consistent across Q&Vs and Input tables?
- ❑ Are the inputs all independent? (example of dependent inputs: total cost as an input while breakdowns of costs are inputs too)?