

Cost-Benefit Analysis

An overview and an example

Introduction

A Cost-Benefit Analysis is a structured process used to determine whether or not a particular project or policy is worthwhile.

It compares all the possible advantages of a project or policy, including community welfare and societal gains, with the project / policy's price tag, including financial expenditure and environmental costs.

Ultimately, the outcome of this analysis will determine whether the project / policy is economically feasible, or whether other action is more appropriate, including pursuing a different project, developing an alternative policy, or abandoning the idea altogether.

This type of analysis assists decision makers – be they government organisations, listed companies, corporations, etc. – by offering evidence in support for or against suggested investments or regulations.

A Cost-Benefit Analysis not only helps to decide whether a project or policy is worth going ahead with, it also assists in:

- framing appropriate objectives for the project;
- preparing estimates of the resources required to perform the project work; and
- developing appropriate before-and-after measures of project success.

Advantages of a cost-benefit analysis

Cost-Benefit Analyses are frequently used in regulatory impact statements, development applications and environmental impact statements, such as the one developed for the \$5 billion+ Cross River Rail project in South East Queensland.

A Cost-Benefit Analysis is particularly important in regard to projects or policies with medium-to-long-term implications, where costs and benefits build up over a number of years.

A distinct advantage to the Cost-Benefit Analysis is that it provides an internally consistent framework for determining the net benefits of a project and how those net benefits (or net costs) are distributed across various groups, including private investors, government, the wider community etc.

The internally consistent framework requires that a Cost-Benefit Analysis is undertaken in a variety of different layers. These include private benefits and costs, social benefits and costs, and distributional analysis – how net benefits and costs are distributed across various groups (e.g. income, age, demographic).

Money as a common unit of value

In order to compare the positive and negative aspects of a project or policy, a common unit is required. In a Cost-Benefit Analysis calculation, costs and benefits are represented as dollar values, making the common unit money.

Time value of money is also a very important concept in this analysis. When executing a Cost-Benefit Analysis, future costs and benefits are converted into present value by using a “discount” rate. Values are discounted into a common base year, so it is possible to compare benefits and costs that accrue at different points in time. Effectively, discounting is the technique of converting benefits and costs that occur over time into present values.

All positive and negatives of the project or policy are first quantified in monetary terms and then adjusted for their time-value to obtain correct estimates for conducting a Cost-Benefit Analysis.

Anticipated benefits like lower operating costs or higher revenues can quite easily be expressed in monetary equivalents. However, there are also benefits that can initially seem difficult to quantify in numerical terms, but can be estimated by an experienced economist. If for example, a company is working on a policy aimed at boosting staff morale, associated benefits could include lower employee turnover, higher productivity, reduced absenteeism among workers and fewer formal complaints from staff members.

Costs to consider in a cost-benefit analysis

It is essential to factor in costs that apply to all phases of the project or policy.

Broadly, speaking costs will include capital expenditures (CAPEX)—e.g. the construction of a new factory—and operating expenditures (OPEX)—e.g. wages and salaries, supplies, materials, maintenance and repairs.

Some of these costs will be non-recurring, like capital investment and particular operations and/or services, but there will be recurring costs can include labour, supplies, materials, maintenance and repairs. In a Cost-Benefit Analysis it is important to consider the full set of costs over the life-cycle of a project or program. Hence Cost-Benefit Analyses are typically undertaken for periods of 10, 20 and even 30 years.

Typically, costs will be higher in the earlier years, as capital expenditures or other upfront costs are incurred, and benefits may only start to exceed costs after several years.

Even projects or policies that stack up can take many years for the value of their benefits to exceed costs—this leads to the metric of the payback period.

A Cost-Benefit Analysis should also always consider these three points:

- Potential costs of not doing the project / implementing the policy
- Potential costs if the project / policy fails
- Opportunity costs – for example the potential benefits if your money had been spent successfully developing and implementing a different project or policy

Key metrics of cost-benefit analysis

Net Present Value (NPV)

This is the dollar value of the difference between benefits and costs in present value terms, which is the bottom line for Cost-Benefit Analysis.

Benefit-Cost Ratio (BCR)

This refers to the ratio of benefits to costs in present value terms. A ratio of more than 1 is an absolute bare minimum and ratios of 1.5 and over are considered healthier.

Internal Rate of Return (IRR)

This is the discount rate at which the Net Present Value would be zero. It is a measure of the project's or policy's rate of return, which can be compared with the company's cost of capital to assess whether the project or policy is worthwhile.

It is essential to remember that for a project which requires you to look quite far into the future, the more important it is to convert your estimates of benefits over costs into today's dollars. Another consideration is that the further in time you are looking, the less accurate your estimates might be, especially given the rapid pace of changing technologies, etc.

Payback period

This commonly-used metric tells the analyst how many years it takes for a project to pay back its initial investment. For example, if a new toll road costs \$2 billion to construction and makes \$100 million in profit each year, then the payback period is 20 years. This is a simplistic metric and does not account for the time value of money. Hence, the other metrics described above are preferable.

Case Study - Proposed algae farm for the regional agricultural and logistics business, Woods Group

The Woods Group has a one-hectare site at Goondiwindi in south-east Queensland that may be suitable for an algae farm. The proposed farm would trial a new process for the extraction of Omega-3 oil from algae.

A staged approach has been suggested for the development of the farm, with the initial farm to comprise two ponds. Two additional ponds would be built in Year 5 and another three ponds would be built in Year 10. This staged approach would allow Woods Group to determine if the project is profitable enough to proceed from the first stage to the second, and then the third.

A Cost-Benefit Analysis was undertaken from Woods Group's perspective and this involved building a financial model of the project, taking into account all items of capital expenditure (CAPEX), operating expenditure (OPEX), revenues, taxes paid and borrowing costs.

The financial model estimated the annual net cash flow of the project to the Woods Group – that is, the difference between cash inflow and cash outflow over the expected life of the project. This is converted into present value (PV) terms, by discounting future costs and benefits by an annual percentage discount rate, to reflect the “time value of money”. For a private business such as the Woods Group, the discount rate can be thought of as the opportunity cost of capital invested. The PV of the net cash flow is referred to as the Net Present Value (NPV).

A sensitivity analysis was conducted for the project using @RISK software, with the sensitivity of results tested for variations in the critical variables of litres of algal oil sold and the sale price. Following the Cost Benefit Analysis, Woods Group applied for a commercialisation grant from the Queensland Government and was successful in being awarded \$579,000 to develop the concept.

Why a CBA isn't a DIY task

An experienced economist is essential in the undertaking of a Cost-Benefit Analysis because they know how to correctly estimate benefits and costs, they will avoid any double counting and they will properly assess the impacts on different stakeholders.

They can also assess the net benefits by stakeholder—i.e. a distributional analysis—of who wins or loses and by how much.

Experienced economists are able to provide a Sensitivity Analysis and a Broader Risk Analysis as part of the Cost-Benefit Analyses they provide.

Project opponents, government agencies and regulators will be scrutinising every detail of your Cost-Benefit Analysis, so engaging an experienced economist to ensure the process is water-tight will provide the best peace of mind.

Get in touch to discuss Cost-Benefit Analysis

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