2016 Simplified Methodology for Economic Appraisal of Public Investment Projects in the Kurdistan Region

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1. PROLOGUE AND OVERVIEW

In the context of public policy, governments face the problem of allocating scarce resources (natural, human and capital) among infinite uses, to satisfy certain needs and with the goal of obtaining the maximum social and economic benefit. On the other hand, standardization and systematization of public investment processes have demonstrated important advantages in terms of increasing the profitability and productivity of public investment. In general, developing economies should allocate their scarce resources to the most productive investments. The public investment projects financed through increases in tax revenue or foreign debt should then generate increased economic benefits to justify their implementation.

From this perspective, the purpose of this simplified methodology is to assist the Government of the Kurdistan Region (KRG) in developing and evaluating investment projects in order to promote economic and social well-being through the provision of methodological tools to improve the formulation and evaluation of public investment projects. This methodology describes how investment possibilities can be evaluated so that they may be taken from the idea stage (project file) to the implementation phase in a successful manner (project execution).

These guidelines are intended for different types of user in KRG. First, they serve as a technical reference for public-sector authorities who are responsible for making public-sector investment decisions. This group includes public officials (project evaluators) within the Ministry of Planning, Ministry of Finance, line ministries (LMs), departments and agencies (DAs), public enterprises (PEs) and all other institutions involved in the formulation, evaluation and implementation of public investment projects.

2015), Mexico (Secretary of Finance and Public Credit, 2015), the Republic of South Africa (Limpopo Provincial Government, Department of Financial and Economic Development, 2004), and the United Kingdom (HM Treasury, 2013).

A complementary detailed template (spreadsheet) is attached to this instrument. Users of this simplified methodology will hopefully go back and forth between the theory and the case studies, to gain a thorough understanding of how to apply the principles of project evaluation to the analysis of other investment opportunities.

This document is divided into four chapters. Chapter 2 describes the framework for public provision of goods and services and its relationship with the economic project appraisal. Chapter 3 provides the guidelines for project preparation, detailing the project development cycle and its different components. Chapter 4 provides the methodologies for conducting financial, economical and stakeholder analysis, focusing on the preparation of cash flows, the operating and financial plan, the theoretical basis of economic analysis in project evaluation and the integrated project analysis. Chapter 5 shows how to evaluate projects based on project evaluation criteria.
2. PROVISION OF GOODS AND ECONOMIC APPRAISAL

Evaluation tools are essential for making decisions related to project selection (to ensure the highest return). Comparing the total costs (investment and operation) of a project with its benefits allows a decision to be made about the true contribution of that project to the wealth of the country.

As the UK HM Treasury indicates\(^1\), “appraisal, done properly, is not rocket science, but it is crucially important and needs to be carried out carefully. Decisions taken at the appraisal stage affect the whole lifecycle of new policies, programs and projects. Similarly, the proper evaluation of previous initiatives is essential in avoiding past mistakes and to enable us to learn from experience”. The Green Book therefore constitutes binding guidance for departments and executive agencies. Project evaluation allows those in the appraisal role to:

i) Identify those criteria for investment policies that maximize social welfare.
ii) Stop the "bad projects" and promote those that are "good".
iii) Define whether the public or private sector should implement the project.
iv) Establish agreements for desirable cost recovery.
v) Assess the impact of investments on the environment, regional development and poverty, among other things.

The existence of a formal system of project evaluation provides a framework to guide the efforts of government systems (which tend to run projects, which is good!), preventing society as a whole from being harmed (which is bad!). Project appraisal allows us to answer the following questions: What is the aim of the project? What happens if the project is implemented or not? Is the project the best alternative? Does the project have separable components? Who benefits and who pays the costs of the project? Who are the stakeholders that may affect the investment decision or the performance of the project? Is the project financially sustainable (feasible)? What is the environmental impact of the project? What are the sources and magnitudes of the risks? Does the project contribute to economic growth? Is the project a source of political risk? And finally, to answer the big question: Is the project the most desirable relative to others competing for the same budget? (Belli, P. et al., 2001).

In addition, a very important aspect of public investment is determining its actual contribution to the welfare of society: How should public sector investment proposals be analyzed? What are the expected results? What investment alternatives are available? Are there economically suitable alternatives in terms of growth and distribution? Should the analysis be done based on distributional considerations? Is it appropriate to continue or discontinue ongoing projects? Which is the set of alternatives that optimize the use of the projected budgetary constraints? This document is an effort to answer those questions and to help technical units to provide the authorities with sufficient good project proposals for them to select the most convenient.

The utilitarian approach and applied welfare economics provide a conceptual framework to estimate the goodness of public policies in terms of social welfare and thus to answer the above questions. To estimate the contribution of projects, it is necessary to identify,

measure and assess their costs and benefits. Identification of costs and benefits is to determine, qualitatively, the positive and negative impacts generated by the project. The economic assessment of benefits and costs start with the transformation of the financial cash flows into economic resource flows, using the economic prices (efficiency or shadow prices) of goods and services produced and resources used by the project. Of course, there will be some benefits and costs that can be identified but are unlikely to be quantified and valued. However, it shall be the duty of the evaluator to conduct the process rigorously, to identify all the effects and impacts of projects and to reasonably quantify and value as many of them as possible.

2.1. The Public Provision of Goods and Services

In many cases, the market ensures the efficient use of resources. However, sometimes the violation of the assumptions of perfect competition determines the participation of the public sector as a supplier of certain goods and services, particularly so-called public infrastructure or social goods. Then a framework for the efficient allocation of public resources to maximize social welfare is needed.

The violation of the assumptions of perfect competition determines the presence and participation of the public sector in markets. Among others, the following situations can be identified:

- In the case of failure of competition, the market mechanism cannot allocate resources in an efficient way. Under perfect competition, a firm produces at the point where the marginal cost of production is equal to the average cost of production. This is not the case with monopoly production and therefore a monopoly suffers from lack of productive efficiency.

- The existence of economies of scale implies decreasing marginal costs of production in the relevant section of the demand curve, resulting in equilibrium occurring below the economic optimum. This is known as natural monopoly and is one of the main arguments used to justify public involvement in the provision of goods and services.

- The presence of externalities also justifies public intervention; the existence of benefits and costs in the production and consumption function not internalized by producers or consumers results in "external" effects on third parties not directly involved in the exchange market.

- The demand for public goods is another argument for public intervention. In the case of public intervention, the conditions of exclusion and no rivalry in consumption are not present, resulting in the production and consumption of a different amount from that which the social optimum prescribes.

- Sometimes the government should also be involved in the economy for the purpose of income redistribution and for the provision of merit goods. Government welfare activities can then be designed to assist those in need and reduce the gap between rich and poor.

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2 Merit goods are those goods that the government compels individuals to consume based on the assumption that individuals may not act in their own best interests, with the result that the government has to intervene because it knows what is in the best interests of its citizens.
In many developing countries and in economies with capital market restrictions, the magnitude of projects can also be a reason for public provision; the nature of the projects and large requirement for resources may discourage private-sector participation.

Considering the previous arguments, the use of public resources should be evaluated in order to measure their expected return and their contribution to economic and social development. In this context, project appraisal is a key technical tool for decision-making, helping to ensure the efficient allocation of public resources. In the case of public investment, this aspect is much more important because its effects in the medium and long term are higher than in the case of current expenditure. Also, because the rigidities that characterize irreversible decisions also affect the welfare of successive generations.

2.2. Postulates Underlying the Efficiency Approach

The approach adopted in this Methodology to evaluate the economic benefits and costs of projects follows the *Efficiency Approach*. This is the approach most used around the world and is the basis of a modern PIMS. Harberger (1971) formalizes the underlying model assumptions, establishing three basic postulates for applied analysis of welfare economics. These postulates are based on a number of concepts in welfare economics.

1. The competitive, undistorted demand price for an incremental unit of a good or service measures its economic value to the demander and hence its economic benefit.
2. The competitive, undistorted supply price for an incremental unit of a good or service measures its economic resource cost.
3. Costs and benefits are added up without regard to who the gainers and losers are. In other words, a “dinar” is valued at a “dinar”, regardless of whether the benefit of the dinar accrues to a high-income individual or a low-income individual.

In other words, when a project produces a good or a service (output), the economic benefit or the economic price of each incremental unit is measured by the demand price or the consumer’s willingness to pay for that unit. On the other hand, the economic cost of a resource (input) that goes into the production of the project’s output is measured by the supply price of each incremental unit of that resource. Finally, the net economic benefit of the project is measured by simply subtracting the total resource costs from the total benefits of the project’s output. The implications of these three postulates are further elaborated in Box 2.1.

<table>
<thead>
<tr>
<th>Box 2.1: Harberger’s three postulates</th>
</tr>
</thead>
<tbody>
<tr>
<td>The first two postulates indicate that if the market for some output is undistorted by factors such as taxes, subsidies, import duties and tariffs, or other government regulations, then the market price paid for a unit measures both its marginal benefit to the consumer (demander) and its marginal resource cost to the producer (supplier).</td>
</tr>
<tr>
<td>The first postulate establishes that the demand curve represents the maximum willingness to pay for successive units of a good. As such, the demand curve reflects indifference on the part of the consumer about whether to have a particular unit of a good at that price or spend the money on other goods and services.</td>
</tr>
<tr>
<td>The second postulate establishes that the supply curve represents the minimum prices that suppliers are willing to accept for successive units of a good or service. These minimum prices represent the opportunity</td>
</tr>
</tbody>
</table>
cost of these goods. In other words, suppliers will be indifferent about whether to sell these particular units of the good at their supply prices or use the inputs to produce these units for alternative purposes.

Postulate three concerns the distributional aspects of a project and how they should be incorporated in the economic analysis of projects. This third postulate indicates that the costs and benefits of the project must be added, regardless of who wins and who loses. In other words, "a dollar is a dollar, regardless of who pays and who receives it." Harberger (1996) also argues for the general validity of the assumptions that are not intended to indicate only that individuals seek to maximize their own welfare, but also the society as a whole.


- It is a scientific approach, relatively easy to implement for comparison on a rigorous basis. It is not necessary to estimate social welfare functions (especially when the utility is not known).
- It estimates objective evaluations of the profitability indicators.
- Due to the difficulty of rigorously establishing allocation criteria for the preferences of society, this approach prevents possible manipulation of the adjustment factors in the pursuit of sectoral interests that do not necessarily correspond to the preferences of society.

This approach assumes the greater effectiveness of fiscal policy in a redistributive role, regarding explicit incorporation into the assessment. Therefore, the main argument for not incorporating distributional considerations inside this approach is based on the argument that authorities should pursue distributional objectives through specific measures such as taxes, subsidies, transfers or otherwise. The approach assumes that the distributional objective should be completely independent of the public investment decision.

2.3. Project Appraisal and Public Provision of Goods and Services

In general terms, developing economies, such as the Kurdistan Region of Iraq (KRI), should allocate their scarce resources to the most productive investments. Welfare economics is the tool for the analysis of the desirability and goodness of public policy, based on the utilitarian approach developed from the construction of the work of Bentham (1789) and Mill (1863). The utility is the technical concept used to represent the level of welfare of individuals, derived from consumption and production activities. From the concept of \textit{Pareto Efficiency}\(^3\), the relationship between project analysis and cost–benefit analysis (CBA) is straightforward in an attempt to maximize social welfare. According to Boardman et al. (2001, page 28), "if there is a policy that has positive net benefits, then you may find a set of transfers (side payments) that make at least one person better, without diminishing another". CBA is the recommended tool to establish the desirability of allocating resources inside society.

\(^3\) Boardman et al. (2001, page 26) define a Pareto-efficient allocation "when there is no alternative allocation that improves an individual without making another worse". According to this concept, a project that alters resource allocation by drawing resources away from their alternative uses can be said to improve economic efficiency if at least one individual is made better off and no one else is made worse off. From this point on, any policy (or project) in that direction leads to an incremental improvement in the welfare of society.
In Figure N°2.1 the curve B(W) is a representation of added benefits (i.e. consumption) of different levels of service of good W; while, C(W) represents the added costs. In this case, any policy that increases W from W1 to W2 is desirable from the Paresonian point of view (the Pareto optimal solution is achieved in W*, where the marginal social benefit equals marginal social cost: maximum vertical distance between the curves B(W) and C(W)).

Through the aggregation of net profits of all individuals affected by the project, as Boardman et al. (2001) demonstrate, any policy with positive net benefits is a potential Pareto improvement. Therefore, if all the benefits and costs (measured in terms of social opportunity cost) are estimated, a positive difference indicates that the society can compensate those who bear the costs, enough to make no one worse and at least someone better. This is the demonstration of the theoretical validity of CBA as a measure of changes in society’s welfare.

2.4. Basic Needs Approach

Based on the efficiency approach, Harberger (1984) proposed an alternative mechanism in response to criticism over the lack of consideration of distributional effects in this approach (principle of neutrality in efficiency approach in relation to changes in consumption of poor or rich individuals). Under certain circumstances, individuals perceive higher welfare as a product of the improvement of the situation (or welfare) of other individuals in society, which is the basis of the Basic Needs Approach (BNA). Thus recognizing this positive externality and the consumption of others, the BNA explicitly incorporates the efficiency merits of charity and altruism; as Harberger (1984, p.460)
indicates, "the most obvious motivation that causes the altruism externality is present in considerable wealth in modern societies\textsuperscript{4}.

The essence of the BNA is the fact that is a positive externality associated with improvement to the extent to which the basic needs of the mostly needy are met. The externality is enjoyed by donor citizens (e.g., taxpayers) whose altruism is satisfied. This is like a public good and one donor’s gratification does not preclude that of another. Services that satisfy basic needs are usually delivered “in kind”, as opposed to an income transfer. As Torche (1985) points out, BNA assesses not the own income distribution of the individual but the consumption associated with this distribution and in so far as it is intended for certain types of goods\textsuperscript{5}.

A typical case of basic needs, providing basic healthcare to children of poor families, is illustrated in Figure N°2.2.

\textit{Figure N°2.2 Basic Needs Externalities}

\begin{tikzpicture}
    % Draw the axes
    \draw[->] (-2,0) -- (4,0) node[below] {Quantity};
    \draw[->] (0,-2) -- (0,4) node[left] {Price};

    % Draw the demand curve D1
    \draw[thick] (-1,3) -- (4,0) node[above right] {D1};

    % Draw the supply curve S
    \draw[thick] (-2,2) -- (4,-2) node[above right] {S};

    % Draw the demand curve D
    \draw[thick] (-2,2) -- (2,-2) node[above right] {D};

    % Draw the equilibrium point E
    \draw[fill] (1,1) circle (2pt) node[above right] {E};

    % Draw the change in demand D1
    \draw[thick] (-1,3) -- (-1,1) node[below] {E'};

    % Draw the change in quantity Q0 and Q1
    \draw[thick] (1,1) -- (1,0) node[below] {B};
    \draw[thick] (1,1) -- (2,0) node[below] {Q1};
    \draw[thick] (1,1) -- (0,0) node[below] {Q0};

    % Draw the price line P
    \draw[thick] (-2,2) -- (4,2) node[above right] {P};

    % Draw the shift in demand D1
    \draw[thick] (-1,3) -- (-1,1) node[below] {E'};

    % Draw the shift in quantity Q0 and Q1
    \draw[thick] (1,1) -- (1,0) node[below] {B};
    \draw[thick] (1,1) -- (2,0) node[below] {Q1};
    \draw[thick] (1,1) -- (0,0) node[below] {Q0};

    % Add the source information
    \node at (5,0) {Source: Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost–benefit analysis for investment decisions, the integrated analysis of investment projects. Queen’s University, Kingston, Canada.};

    % Add the where
    \node at (5,-1.5) {Where:
        D denotes the Private Demand Curve of the beneficiary group.}
\end{tikzpicture}


\textsuperscript{5} Basic needs refer to the most essential needs of people, such as nutrition, health care, education, and housing. These sectors form the core of the poverty alleviation programs followed by most developing countries and therefore the projects catering to those needs are more attractive to society.
$D^1$ denotes the Social Demand Curve, including basic needs externalities.

Including a basic needs externality in the evaluation of a project is equivalent to saying that society is willing to tolerate a limited excess of economic costs over economic benefits provided that the project’s outputs will contribute to the fulfillment of some basic needs. Necessarily, BN is fully compatible with the three basic postulates (Harberger) of welfare economics applied analysis.

The private demand curve of the beneficiary group is $D$. When the externality accruing to other members of society is also included, the social demand curve becomes $D^1$. The consumption of basic healthcare increases from $Q_0$ to $Q_1$. The net benefit is the difference between the gross benefit $Q_0 Q_1 E' A E$ and the additional cost incurred $Q_0 Q_1 E'E$, that is the triangle $E A E'$. Alternatively, the gain from externality may be seen as $E A E' B$, offset partially by the efficiency cost of $E E' B$ that will arise from the subsidy provided for achieving this additional consumption.

Under this approach, the externality by BNA is not incorporated directly into the utility function of the recipients but the utility function of donors and thus into the Social Demand Curve. Therefore, any increase in the consumption of the recipients has a social value beyond its own Willingness to Pay.

2.5. Final Comments

Under the public investment analysis, the public sector generally faces an important decision: determine the set of projects that will optimize their budget constraint. To do this, the public sector must maximize the collective welfare, subject to the achievement of the goals of growth and equity.

The social welfare function is a theoretical construct that represents the preferences of society. Under certain assumptions, any project or policy with net Pareto improvement (in the sense of Kaldor–Hicks) increases the welfare of society. This normative concept is the foundation of the whole theory of economic investment appraisal.

The efficiency approach constitutes the basis on which this methodology is based. Some of the reasons given to justify the use of the efficiency approach in this document are related to the following:

- It is a scientific approach, relatively easy to implement for comparison on a rigorous basis.
- This approach prevents possible manipulation of the adjustment factors, in pursuit of sectoral interests that do not necessarily correspond to the preferences of society.

Finally, it is important to remember that, in the context of public policy decisions, project evaluation is neither more nor less an additional argument for a rational and efficient budget allocation decision; nor is it a decision (or end) in itself.
3. PROJECT PREPARATION

For optimal allocation of public resources, the process of economic evaluation of projects should ensure the correct selection of projects. This process should start with the identification and analysis of the problem situation: a bad coverage of a service, a bad service delivery, lack of assets, lost opportunities for improvement, among other factors. The definition and evaluation of a range of alternatives that may provide solutions to the problem must follow, ending with the selection of the alternative that maximizes social welfare.

In the context of public-sector investment, a project may be viewed as an instrument for achieving the planning objectives and development goals of a country or a region, available to planners and policy-makers. Often, a project may be considered a series of activities and tasks with a specific objective, to be completed within certain specifications and a given timeframe. Usually, it will also have funding limitations, consume resources and may be evaluated as an independent unit. It may be possible to break down a project into various components, but they cannot be operated independently and each one cannot fulfill a purpose without the other.

3.1. The Project Lifecycle

The project lifecycle is the process by which an idea is transformed into a concrete solution through the analysis of alternatives and the choice of the most profitable alternative from the economical point of view. Every project has certain phases in its development and implementation. These phases are very useful in planning a project, as they provide a framework for budgeting, resource allocation, the schedule of project milestones in implementation and the establishment of a monitoring system. The purpose is to provide a basis for organizing the project for establishing resource requirements, and to set up the management system that will finally guide the project activities.

Although the exact division of a project’s life into its different phases is somewhat sector specific, the project lifecycle phases may be broadly placed in different steps. Figure N°3.1 shows the project lifecycle.

As the project moves through its lifecycle, the focus of managerial activities shifts from planning to operating and controlling activities. It should be emphasized that these phases only represent a natural order in which projects are planned and carried out. Also, none of these phases becomes really final until the project approaches its termination stage.
**Figure N°3.1 – The Project Development Cycle**

**Source:** international best practices.

**The Planning and Project Identification Phase**

This is the first phase of the cycle and is concerned with the identification of potential public-sector projects. The purpose is to establish the basic desirability of a project and to identify high-priority projects that fall within the responsibility of the public sector. Projects are a valuable tool for directing investments into the priority sectors of an economy.

The process of project identification is complex. Projects are brought forward one at a time and are generally identified with their sponsors rather than as part of an economic strategy. Over the years, however, many countries have developed their own planning capability and the process of project identification has become more systematic.

In the planning phase (PP), the emphasis is put on “investment efficacy” or on spending on the right public assets. Spending should promote achieving strategic priorities, and resources should be allocated only to those areas that are best aligned with the government’s objectives. In this sense, the PP, performed at different levels, is a top-down process that produces key deliverables. The strategic fit of projects therefore ensures the strategic alignment of investment projects with regional and sector strategies. The specific objectives of every investment project should consequently be designed in such a way that they support the overall national development agenda.

The PP and economic planning are both necessary and complementary, and they should not be disconnected from one another. If these two do not overlap and match, there will be severe inconsistencies in public policy priorities and the corresponding investment decisions for the future of the nation. One way of matching the two planning exercises is for all investment projects to submit their log frame matrix (LFM) starting at the very beginning of the project cycle, that is, at the project profile level.

In the planning and project identification phase it is necessary to consider the demands of different interest groups, the community, the public sector, the private sector and other
agencies. It includes the diagnosis of the current situation through the collection of information and data, in order for the existence of a problem, need or opportunity to be verified. In order to safeguard the strategic fit of projects, all public investment initiatives in the Kurdistan Region of Iraq (KRI) shall be designed with consideration to the Log-Frame Approach (LFA), so that the strategic objectives each is trying to achieve are identified early on (i.e. the efficacy question) and are also measured applying suitable key performance indicators (KPIs). The LFA will be presented in the following sections.

This analysis introduces the project into the pre-investment phase. As a result of this stage, the analyst should:

- Discard all un-feasible alternatives.
- Select feasible alternatives and possibly advance to the next stage.
- Wait for or postpone the solution to the problem, while the authority makes a decision.

The project format is a kind of analytical tool in its own right that facilitates the task of planning for economic growth and development in the region. The main advantage of casting investment decisions into a project format is that it enables the planner to establish a framework for analyzing information in a systematic procedure.

**Pre-investment Phase**

The pre-investment phase includes the idea and profile definition, pre-feasibility studies and, subsequently, feasibility studies.

The idea and profile definition is the first phase of the cycle and is concerned with establishing the basic desirability of a project and identifying high-priority projects that fall within the responsibility of the public sector. The types of project that qualify for placement in this category will largely depend upon the level of development of the economy.

The project preparation stage should be followed by pre-feasibility studies. The pre-feasibility study is one of the two components of what has been traditionally known as the appraisal phase of a project. This is the first attempt to examine the overall potential or viability of the project. The data and information gathered at the project preparation stage are used in this phase. It is a critical stage of the project cycle because it is the culmination of all the preparatory work and provides a comprehensive review of all aspects of the project before a final decision about its viability is made.

After all the modules of the pre-feasibility studies have been completed, the project must be examined through feasibility studies to see if it shows promise of meeting the financial and economic criteria that the government has set for investment expenditures. This is the final part of the appraisal of a project; its function is to improve the accuracy of the measures of key variables if the project shows a potential for success. In order to improve the accuracy of the appraisal, more primary research will have to be undertaken and perhaps a second opinion sought on other variables. Since the estimates of costs and benefits may be subject to substantial margins of error, an analysis should always be made about the sensitivity of the project’s outcome to variations in the values of key variables.
The **final approval of the project** should come after the feasibility study has been completed. At this point, the cost estimates should be known with a high level of accuracy, and the sources and nature of financing identified. It is important that a conditional approval of the project be given before the detailed design work is completed. The detailed design of the project will involve substantial financial outlays. Also, the formal approval will require the acceptance of funding proposals and agreement on contract documents, including tenders and other contracts requiring the commitment of resources.

In summary, the following results are expected at the end of the pre-investment phase: i) preparation of detailed plans required to support the facility; ii) indication of possible technical packages to be considered; iii) more realistic assessment of costs, time schedule, and operational requirements; iv) identification of areas where high risk and uncertainty exist, and further exploration of those areas; v) firm identification of human and other resources required for the project; vi) determination of necessary support systems; and vii) identification and initial preparation of documents required to support the project, such as procedures, job descriptions, budget and funding papers.

The decision may be to provide funding, either through the traditional fiscal budget, public–private partnership (PPP’s) or international cooperation (grants and/or loans), and to proceed to the execution of the project. If that is the case, new actors will become involved with the project during the investment stage, i.e. project managers. The efficient implementation or execution of a project is obviously critical in ensuring that investment flows become productive assets for the nation. The final investment decision concludes the pre-investment phase.

It is important to mention that not all projects must go through all stages of the pre-investment phase; it will depend on the degree of certainty that is reached in each of these stages. Therefore, it is possible to go directly from project pre-feasibility to the final design. Obviously, in the case of complex projects (requiring detailed engineering studies), it is necessary to go through all the phases and stages of the project lifecycle.

### Investment Phase (implementation and construction)

The next stage in the project’s development cycle is **project execution (or implementation)**, starting with the investment phase. In this stage, project investments take place. This is obviously the responsibility of the project sponsoring agency; the concerned government agency does not have a substantive role to play at this stage. The purpose of project execution is to deliver the expected project results (deliverables and other direct outputs). Typically, this is the phase where most of the budgetary resources are applied.

**Project final or definite design** involves the preparation of detailed architectural design, engineering and/or specialties as deemed appropriate, and a complete project execution plan. **Project implementation** involves planning, procurement, fabrication, civil work construction, installation, contract terms and conditions, to develop detailed schedules and plans for making or implementing the product etc.

During the project execution the construction team utilizes all the schedules, procedures and templates that were prepared and anticipated during prior phases. Unanticipated
events and situations will inevitably be encountered, and the project manager and his project construction team will have to deal with them as they come up. In the standard division of project management discipline, this phase is called "Project Execution and Control". Here, the term "control" is included because execution is not a blind implementation of what was written in advance but a watchful process where doing things goes along with understanding what is being done, and re-doing it or doing it differently when the action does not fully correspond to what was intended. This "control" is an integral part of project management and is the necessary task of a project manager.

However, there is also another monitoring and control process in place; this has to do with budget execution. The Ministry of Planning ensures cash releases during the budget year consistent with the efficient implementation of the capital investment budget. Also, the Ministry of Planning monitors the disbursement of allocated project funds and can also provide incentives and penalties in order to avoid finishing the fiscal year with unused resources.

At the end of this phase, performance tests, hand-over, as-built drawings, close-down, decommissioning and disposal, etc. are necessary.

**Operation and Ex-Post Project Evaluation Phase**

The following phase in the project lifecycle is the operations phase, where the project evolves into its operation stage, at which point it is able to produce its final fully-operational deliverable, (e.g. a new plant, product, system, etc.). The development period is when the production capacity gradually builds up. The final phase is that of full operation. Implementation is a dynamic process in which everyone involved with the project has to constantly respond to new problems or changing circumstances that may affect the project’s outcome.

The management processes in this stage are now shifted towards the effective and efficient delivery of the products and outputs from the new services, plant or mine. A permanent organizational structure is put in place, replacing the project implementation/construction structure. The new team has to earn revenues and/or produce economic benefits; for this it will have to incur operational expenses (such as production, maintenance costs, etc.). This phase is obviously the responsibility of the project-sponsoring agency.

After a reasonable period of operating the project, it is important to verify whether the problem has been solved by the intervention. This process is known as ex-post (or post) project evaluation. This task is very important because all projects face some implementation problems. Problems may arise either because of some flaw or shortcoming in the planning of the project or simply because of changes in the economic and political environment.

During the operational phase, some ex-post evaluations will be deemed necessary to ensure an effective PIMS. Ex-post project evaluation involves assessing the actual operational results of a project and comparing them to planned forecasts. The focus is on establishing whether the project represents “value for money” and on learning lessons for the design and implementation of similar projects in the future. The objective of ex-post
evaluation is to determine the efficiency and efficacy of the investment initiatives, through a feedback structure with management controls and measurements of short-, medium- and long-term results of projects.

For the development of the operational techniques of project appraisal and improvements in the accuracy of evaluations, it is useful to compare the “predicted performance” with the “actual performance” of projects. In carrying out ex-post evaluation, both elements of success and failure are systematically analyzed. It need not be conducted only for completed projects, and it may take place at various stages during the project’s implementation and operational phase.

Once a project has been implemented (i.e. its construction phase is finished) the results are revised and cost deviations are analyzed assuming that the benefits are achieved (the focus is on project management indicators like schedule, time of construction, overall construction costs, quality and technical specifications). Changes in the expected economic criteria are explained according to higher investment costs, timing, size, etc. This short-term ex-post evaluation focused solely on project costs, schedule and checking the assumptions made during the project pre-investment stage. The holistic medium-term ex-post evaluation or project impact assessment determines if the project has indeed achieved its original scope, goals and purpose.

At an early stage of development of the PIMS, it is recommended that the contents of the Methodology be focused on the planning (project identification) and pre-investment phases. However, in subsequent versions of the document it is possible to put more emphasis on other phases of the project development cycle.

3.2. The Relation Between the PIMS and the Project Development Cycle

The PMIS has been designed to put projects through the Project Life Cycle, from the identification of a project idea/concept to the final operation and ex-post evaluation stage.

As mentioned before, many of project activities are inter-related and cannot be confined to one particular phase in the project lifecycle. Here comes the ping-pong of ideas between the project-sponsoring ministry and the Ministry of Planning, who is responsible for the project appraisal.

The project cycle can be seen as an assembly-line production process, but there is a lot of interaction between project designers and project evaluators, and lots of feedback. This interrelationship should be particularly strong among the phases preceding the implementation. There is a considerable interaction between the implementation phase and the evaluation phase as the lessons of ex-post evaluation are constantly used to suitably modify the operations of the project.

Figure N°3.2 shows, for example, the interaction between the pre-investment, investment and operation phases. The figure stresses two ideas: First, the fact that, the deeper a project is allowed to go down the project-cycle, the harder it will be to stop if, indeed, it happens to be a bad project. The more money the sponsoring agency pours into studies, the harder it is to decide to shut down a bad project. Therefore, the traffic lights in the diagram become smaller, on purpose, to reflect that the more a project advances in the cycle the less capacity there is to stop it.
In second place, it is important to effectively impose these traffic lights as effective decision nodes. This means that there must be a decision to reject the project at that stage, or a decision to invest more money in order to eliminate more uncertainty, or a decision to wait.

*Figure N°3.2 – Interaction between Pre-investment, Investment and Operation Phases*

From the point of view of the entire PIMS, the most important phases in the project cycle are the first ones; these are the problem definition and pre-investment phases (specially related to prefeasibility studies). In those early stages, the Ministry of Planning may have more influence in concept design, in analysis of alternatives, scale, timing and optimization. On the contrary, for the promoting agencies, the most important phases of the project cycle are the last, the feasibility and the detailed project design, because they lead into the next phase, which is the implementation.

Also, in terms of negotiation power, those early stages should be considered by the Ministry of Planning as the most important, because the sectors do not benefit from the advantage of information asymmetry. Later, in the final stages of the project cycle, the projects become more engineering- and less economics-intensive. *Figure N°3.3* shows this argument clearly.

From the diagram it becomes clear that the early stages in a project are the ones were the potential to add value to the project is at its maximum, whereas the cost to do it is at its minimum. This concept is also used in engineering design and it is called Front-End Loading (FEL), also known as Front-End Engineering Design (FEED). FEL is a process for the conceptual development of industrial projects (petroleum, petro-chemical, refining and pharmaceuticals); it consists of robust planning and design in the first phases of the
project cycle (“Front End”). Because it is in the early phases of an industrial project that the capacity to influence its design is at a maximum and the cost to make any changes are at a minimum, it is typically applied in capital intensive industries, with long lifecycles (i.e. billions in investment before the return on capital is seen). As is the case in the PIMS, it introduces decision nodes as milestones within the project cycle; a formal decision has to be taken before the project can move on to the next phase.

*Figure N°3.3 – Interaction between Pre-investment and Investment Phases*

<table>
<thead>
<tr>
<th>Concept</th>
<th>Design</th>
<th>Implement</th>
<th>Commission</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1</td>
<td>$10</td>
<td>$100</td>
<td>$1000</td>
<td>$1000</td>
</tr>
</tbody>
</table>

Source: *International best practices.*

As it can see from the figure, the early stages (or the front end) in a project cycle are the ones where the potential to add value to the project design is at its maximum, whereas the corresponding cost is at its minimum. Therefore, it is most efficient to intervene in project design as early as possible before project execution and operation.

### 3.3. The Planning and Project Identification Phase

This is the first phase of the cycle and is concerned with the planning and identification of potential public-sector projects, called **public investment needs** in the diagram below. The purpose is to establish the basic desirability of a project and identify the high-priority projects that fall within the responsibility of the public sector. The types of project that would qualify for being placed in this category will largely depend upon the level of development of the economy. Countries and regions differ with respect to their problems as well as their growth potential.

The generation of project proposals is left to the sectors; this is the responsibility of each line ministry and independent public agencies. In this phase there is little involvement of
the relevant PIM government agency. Any project formulating/sponsoring agency must first clearly identify the problem that gives rise to the idea of a given project. Problem identification should conclude with a literal definition of the problem under scrutiny.

The identification process implies undertaking the identification of gaps in the economy and the definition of investment priorities for the public sector. The gaps in the economy could lie in one or more sectors such as basic infrastructure, food and agriculture, heavy or basic industry, or social sectors such as health and education. In practice, the identification of gaps is not a difficult task. What is difficult is the setting up of clear priorities for public expenditures among competing claims on the limited resources of the country or the region. This, in fact, constitutes the crux of the development problem and is the most difficult challenge that planners and policy-makers have to face.

A project may be identified in a variety of sources of project identification:

- Existing agencies, independent units, line ministries and state-owned enterprises.
- It may emerge out of the process of formulation of the National Development Plan and plans at national and regional levels.
- Regional integration policy.
- Political manifestos.
- It may be identified by the people’s representatives.
- It may arise as a demand from interest groups or beneficiaries.
- It may be brought forward by private sponsors and enterprises.
- It may be the product of a dialogue between the country on the one hand and bilateral donors and international agencies on the other.

Problem identification

To facilitate problem identification, the use of the Logical Framework Approach is proposed, including problem trees (cause-and-effect trees) and solution trees (means-and-objectives tree).

The Logical Framework Approach

One way to make sure that project design teams make an exhaustive analysis of the problem and alternative solutions is the obligation to use the Logical Framework Approach (LFA) in every project profile. The LFA is based on a systematic analysis of the problem, and particularly key is the analysis of the options for addressing those problems. It can be applied in a range of circumstances and to a range of types of activities. The LFA is an analytical, presentational and management tool which can help planners and managers to:

- Analyze the existing situation during activity preparation.
- Establish a logical hierarchy of means by which objectives will be reached.
- Identify the potential risks to achieving the objectives, and to sustainable outcomes.
- Establish how outputs and outcomes might best be monitored and evaluated.
- If desired, present a summary of the activity in a standard format, the Logical Framework Matrix (LFM).
Monitor and review activities during implementation.

LFA starts early in activity design (it is more difficult to use the LFA to review and/or restructure ongoing activities that were not designed using LFA principles and practices\(^6\)). Activity planning and management should always be approached as a team task. This means that adequate opportunity should be given to colleagues and key stakeholders to provide input to the process and product of LFA. This can be supported by:

- Taking time to explain the principles of LFA and clarifying the terminology used.
- Integrating effective team work and learning methods into meetings with stakeholder groups.
- Ensuring that stakeholder groups are involved in situation and/or problem analysis, particularly in the early stages of design.

LFA has proven to be useful at all stages of the project cycle. At the programming and identification stage of the project cycle, the LFA helps to analyze the existing situation, investigate the relevance of the proposed project and identify potential objectives and strategies. At the formulation stage, the LFA supports the preparation of an appropriate project plan with clear objectives, measurable results, a risk management strategy and defined levels of management responsibility. At the implementation stage, the LFA provides a key management tool to support contracting, operational work planning and monitoring. And, at the evaluation and audit stage, the Log-Frame Matrix provides a summary record of what was planned (objectives, indicators and key assumptions), and thus provides a basis for performance and impact assessment.

**Building the Problem Tree**

According to Ortegon, Pacheco, Prieto (2005), the following steps should be taken in the construction of the problem tree.

*Construction of the Causes Tree*

Start from the definition of the central problem (trunk of the tree), then identify the causes downwards (roots of the tree) that give rise to that central problem. It is important to reach the primary and independent causes, which are thought to cause the central problem. In the identification of causes, always make brainstorm sessions with the key stakeholders involved in the problem, regardless of whether they caused it or are affected by it – institutional managers among others.

The identification of causes can be organized in two parts: *causes generated from the supply of the good or service* and *causes generated from its demand*. For both types of cause, it is advisable to consider the causes associated with the conditions of vulnerability to a particular hazard. For example, suppose that Municipality X has received claims from a group of neighbors for the high number of accidents that occur at a given intersection located close to their homes, accidents which involve a great risk to their lives and to the lives of other pedestrians. Based on this, the neighbors demand that a

\(^6\) Unfortunately, LFA is often used mechanically and post-facto, rather than to develop the logic of a project.
traffic light be put in place at that intersection, Y. The problem can then be defined as "a high rate of accidents at that intersection". As mentioned above, the problem should not be stated as the lack of a solution, for example, lack of a traffic light, because the analysis would then be restricted to a single solution, not always the optimal solution to the root problem (the high rate of accidents).

From the study of the current situation (conversations with neighbors, visitors to the area with the problem, among others) and brainstorming, the various causes of the problem can be identified, in Figure N°3.4.

![Figure N°3.4 – The Causes Tree](image)


As shown in the figure, there are different levels of cause. At the first level immediately under the root problem, there are the direct causes of the problem. These causes are generated by various other causes (showed in the level below). The number of levels will depend on the size and scope of the problem. In this example, one of the causes for the high rate of accidents in the intersection is inappropriate vehicle speed, which in turn is explained by the great distance to the traffic lights upstream and downstream and also by the presence of reckless drivers.

**Building the Effects Tree**

Following the analysis, the project formulator must identify the effects (i.e. tree top and branches) generated by the central problem (i.e. tree trunk) on the target group. The same as in the case of the causes tree, these effects should be identified through a "brainstorming", done with the main stakeholders involved in the problem and the project sponsors.

Identifying effects can clarify what will be the outcomes of the problem to be solved. A distinction should be made between the different effects, since there are also different levels. The effects tree plots the chained effects of this problem. The effects generated
directly by the project are those effects of the first level, which in turn generate the effects of the second level and so on. The number of levels to be considered in the design of the effects tree will depend on the expected scope of the project. A direct effect of the identified problem is the high number of injuries, which in turn has the effect of high health-care costs and work absenteeism (see Figure N°3.5).

**Figure N°3.5 – The Effects Tree**

![](image)

**Source:** Ortegón, E., Pacheco, J., Roura, H. (2005, pág.73). Metodología general de identificación, preparación y evaluación de proyectos de inversión pública. Serie de manuales 39. CEPAL.

Choosing the right solution will allow the effects identified in the effects tree to be remedied.

*Integrating the Analysis into the Problem Tree*

The complete problem tree is drawn by integrating the causes tree with the effects tree (see Figure N°3.6).
After this, it is necessary to check the problem tree to assure there is vertical logic to understand the problem (bottom-up check).

Building the Solution Proposals (the Solution Tree)

To construct the objectives tree it is needed to change all the negative conditions of the problem tree into positive conditions; the causes of the problem tree are then transformed into the means of the objectives tree, and the effects are transformed into purposes and ends. What was defined as the root problem now becomes the central objective or purpose that the project must accomplish. Figure N°3.7 shows the solution tree associated with the problem tree in Figure N°3.6.
The Logical Framework Matrix

A useful tool to display and organize the project idea resulting from ex-ante evaluation is the logical framework matrix (LFM), which summarizes what the project intends to do and how it will achieve it; what the key assumptions are, and how the inputs and outputs of the project will be monitored and evaluated. It consists of a matrix with four columns and four rows, which summarizes selected aspects of an activity design, namely:

- What the activity will do, and what it will produce (Activity Description).
- The activity’s hierarchy of objectives and planned results (also Activity Description).
- The key assumptions that are being made (Assumptions).
- How the activity’s achievements will be measured, monitored and evaluated (Indicators and Means of Verification)?

Table Nº2.1 shows the structure of the LFM. The vertical logic of the matrix represents the project objectives: The first column of the log-frame matrix shows the end, purpose, components and activities of the project. The first row is the target level corresponding to the end of the project, it is a description of the solution to a long-term problem that the project is expected to contribute to (consistent with the purposes of the objectives/solution tree). The second row develops the purpose level that corresponds to the central objective of the project, or the direct results to be obtained for the beneficiaries, once the implementation period is completed (coincides with the focus of the objective tree); the third row shows the components level, which corresponds to the
development of products or services to be offered as a result of the project (matching the media objectives tree). Finally, the fourth row shows the outputs level, where the main tasks to be performed to produce the components previously identified shall be specified.

Table N°3.1 – Logical Framework Matrix – General Structure and Content of Log-frame Matrix

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Indicators</th>
<th>Means of Verification</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal or Impact</strong> – The long term development impact (policy goal) that the activity contributes at a national or sectoral level</td>
<td>How the achievement will be measured – including appropriate targets (quantity, quality and time)</td>
<td>Sources of information on the Goal indicator(s) – including who will collect it and how often</td>
<td></td>
</tr>
<tr>
<td><strong>Purpose or Outcome</strong> – The medium term result(s) that the activity aims to achieve – in terms of benefits to target groups</td>
<td>How the achievement of the Purpose will be measured – including appropriate targets (quantity, quality and time)</td>
<td>Sources of information on the Purpose indicator(s) – including who will collect it and how often</td>
<td>Assumptions concerning the Purpose to Goal linkage</td>
</tr>
<tr>
<td><strong>Component Objectives or Intermediate Results</strong> – This level in the objectives or results hierarchy can be used to provide a clear link between outputs and outcomes (particularly for larger multi-component activities)</td>
<td>How the achievement of the Component Objectives will be measured – including appropriate targets (quantity, quality and time)</td>
<td>Sources of information on the Component Objectives indicator(s) – including who will collect it and how often</td>
<td>Assumptions concerning the Component Objective to Output linkage</td>
</tr>
<tr>
<td><strong>Outputs</strong> – The tangible products or services that the activity will deliver</td>
<td>How the achievement of the Outputs will be measured – including appropriate targets (quantity, quality and time)</td>
<td>Sources of information on the Output indicator(s) – including who will collect it and how often</td>
<td>Assumptions concerning the Output to Component Objective linkage</td>
</tr>
</tbody>
</table>

Source: Australian Guideline Logical Framework Matrix.

In developing a log frame matrix, the following points need to be considered:

- The matrix should provide a summary of the project design, and its length will be dictated by the project’s complexity. It should generally be between one and four pages in length.
- If the Log frame is too long, the project may not be focused enough. If the Log frame is too short, it may be missing parts.
- The matrix should only describe the main, or indicative, activities. The detailed activities should be documented separately in an activity schedule.

“If you can still ask ‘how’ questions and not find the answer in the draft log-frame (with the accompanying draft work plan showing activities) then it is not complete.”

The completion of the matrix will be guided by the selected strategy, where the higher level ends (top section of solution tree) will form the goal, the purpose (center) will transfer across, and the outputs and activities will be based on the means (bottom section)
to achieve the purpose (See Figure N°3.8).

**Figure N°3.8. How the Selected Strategy Guides the Completion of the Matrix**

![Diagram](image)

**Source:** international best practices.

Elements from the selected strategy may need to be re-written as they are transferred into the matrix. The first column of the matrix, which presents the project’s hierarchy of objectives, will now be described in greater detail, along with the other columns. Elements from the selected strategy may need to be re-written as they are transferred into the matrix. The first column of the matrix, which presents the project’s hierarchy of objectives, will now be described in greater detail, along with the other columns.

Completing the matrix is usually undertaken in a sequential manner, as presented in Figure N°3.9.
**Figure N°3.9. Sequence to Complete the Matrix**

<table>
<thead>
<tr>
<th></th>
<th>Indicators</th>
<th>Source of verification</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal / Overall objective</td>
<td>1</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Purpose/Core objective</td>
<td>2</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Outputs / Results</td>
<td>3</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Activities</td>
<td>4</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

*Source: International best practices.*

**Project description**

See the following example, describing the application of LFA to a case. See Figure N°3.10.

**Figure N°3.10. Rules Relating to Project Description**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td>Refer to the major issues, the thematic areas related to program or development policies and strategies. Refer to your focus population and location. Project will only partially contribute to achieving the goal. Use clear and concise terminology: “To contribute to...” is often used.</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>Should only be one purpose. If there is more than one purpose, this may require separate problem trees and log frame matrices that outline linked projects within a broader program. More specific than the goal and refers to target group, specific location and time period. The project should be designed to achieve the purpose. Use verbs like: decreased, increased, strengthened, enhanced, improved.</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>Tangible services or products delivered as a result of the activities. Project can be held accountable to the delivery of outputs. Verbs like: delivered, conducted, produced etc. Number outputs (e.g. 1,2,3) so that they can be linked to activities.</td>
</tr>
<tr>
<td><strong>Activities</strong></td>
<td>What will take place to create the outputs. Use present tense written with active verb. Verbs like: train, provide, produce, establish, create, conduct. Number activities to match outputs (e.g. 1.1, 1.2, 2.1, 2.2 etc.).</td>
</tr>
</tbody>
</table>

*Source: International best practices.*

The project description outlines the project’s objectives hierarchy, or the logic that supports the project (Figure N°3.11). This is also known as vertical logic. It describes, reading from the bottom-up, how the project will achieve its ends.

The causality between levels of objective is bottom-up, i.e., to produce components must carry out all the activities specified, each component is necessary for the achievement of the project purpose, and ultimately to fulfill the purpose that the project is intended to contribute to achieving. Meanwhile, horizontal logic is constituted by the narrative summary of each goal, the indicators, means of verification and assumptions.
There are general rules to follow in writing the statements in the project description column. Inputs are generally not included in the project description column. They can sometimes be included adjacent to the activities (in the indicator column) and a high-level summary of the budget may then be included in the sources of verification column. The format to be adopted should be guided by the requirements of the funding organizations (refer to their guidelines) as well as what makes sense to you and the project team.

**Assumptions**

Assumptions refer to key factors outside the direct control of the project team, which must hold true if the project is to achieve its results, purpose or goal. If the assumptions do not hold true (certain events do not occur), this may have a negative impact on the project. Identifying assumptions (or risks) are critical as these may have a strong influence on the project’s likelihood of success.

Assumptions form part of the vertical logic of the matrix (Figure N°3.12). Note that there are no assumptions for the ‘goal’ and thus the assumptions column is left blank. Assumptions refer to factors outside the project’s control that are critical to the project’s vertical logic.
For example, if you charter a vessel (activity) AND the vessel does not break down because it is well-maintained (assumption) THEN there will be reliable and frequent cargo transport (output). An assumption is worded as a positive statement of a condition that must be met in order for the project’s purpose to be achieved. An assumption can also be seen as a risk to the project if it does not hold true. A risk is as assumption reworded as a negative statement.

A risk matrix can be used to guide the decision about which assumptions need to be included in logframe (Figure N°3.13 and Figure N°3.14). This requires turning assumptions into risks, and including into the matrix those that can be managed while excluding those that pose little risk (i.e. those that have a low impact and low probability of occurring). An example of flipping an assumption into a risk is presented below.

Note that risks that have a high likelihood of occurring and a high impact should lead to the project being redesigned, as these are likely to impact the project’s success. Assumptions have to be carefully specified and worded to allow continuous monitoring.
Indicators include information necessary to track the project and assess the achievement of the objectives at the end, purpose, components and activities levels proposed in the ex-ante evaluation. Indicators provide a means to assess the project’s success. This is especially important for the purpose and goal, as various stakeholders may interpret these differently. One way to think of indicators is to visualize what a successful project would look like, that is, what conditions would be met. Indicators need to be closely linked to what you are trying to measure, so that you are confident that what you undertook was an important factor in the observed result.

Indicators must be targeted. This means that they need to specify the quantity of change expected, the quality of the desired change, and the timeframe in which the desired change is to occur. You can remember this as QQT (for Quantity, Quality, Timeframe).

Indicators may refer to targets that have already been determined by existing strategies or action plans. An example of adding QQT to an indicator is described in Figure N°3.15.
**Figure N°3.15. Adding Quantity, Quality and Timeframe to an Indicator**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Increased use of LFA by government staff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity</strong></td>
<td>50% increase in use of the LFA by twenty government staff</td>
</tr>
<tr>
<td></td>
<td>A quantity of 50% increase is specified, as well as the number of staff in which the change is expected</td>
</tr>
<tr>
<td><strong>Quality</strong></td>
<td>50% increase in correct application of the LFA by twenty government staff in developing project proposals.</td>
</tr>
<tr>
<td></td>
<td>A quality is added, in that the LFA is to be correctly applied to the proposal process</td>
</tr>
<tr>
<td><strong>Timeframe</strong></td>
<td>50% increase in correct application of the LFA by twenty government staff in developing project proposals by december 2003.</td>
</tr>
<tr>
<td></td>
<td>A timeframe is added to specify when the desired change is to be achieved, and when the indicator should be measured.</td>
</tr>
</tbody>
</table>

**Source:** international best practices.

Analysts cannot use indicators from a lower level to demonstrate achievement of a higher-level objective. For example, the indicator for ‘staff trained in using the LFA’ (output level) cannot be used as proof that the purpose has been achieved.

There should be more than one indicator selected for each level of vertical logic, but there should not be too many. The number of indicators to choose should be guided by the confidence required to demonstrate achievement of that particular level of the objective hierarchy. Between two and five indicators is generally sufficient. Both quantitative and qualitative indicators should be used where possible (Figure N°3.16). Generally, indicators are not included for activities.
Sources of Verification

The means of verification specify where to gather the information needed to calculate indicators so that you can perform the measurement. The assumptions consider those risk factors in achieving different levels of objectives, which are outside the direct control of project management and which have a high probability of occurrence and impact on outcomes.

Sources of verification refer to:

- How the information for indicators should be collected (survey, document analysis, measurements etc.)?
- Who should collect it?
- When it should be collected?

In determining sources of verification, the project team should consider whether appropriate sources already exist. Where new sources are required, it is important to consider the cost of data collection, as well as how valid and accurate the data collection process is.

Where indicators relate to a specific change in a condition, baseline data (what is the current state of things?) may be required. This will mean that the source of verification requires both baseline and post-project data and data sources. The indicators and sources for the baseline and post-project data may be the same; however, you will obviously collect the data at different times in the project.
Reviewing the Log-frame Matrix

Once drafted, the log frame matrix should be reviewed to assess the:

- **Vertical logic** – whether the means–end relationship (column 1) and assumptions (column 4) make sense.
- **Horizontal logic** – what elements of project design will be measured and how.

It is important to remember that the matrix represents broad steps and not a detailed project plan. It is also important to remember that the LFA is an iterative process, and the matrix should be reviewed on a regular basis during the project’s implementation, and changes made accordingly.

The LFM facilitates understanding, monitoring and evaluation. Regarding this, the definition of the indicators before the project enters implementation allows the construction of the project baseline, which makes the ex-post evaluation easier.

One important warning to keep in mind is that LFA (and LFM) does not substitute for a full-blown cost–benefit analysis; these analytical instruments are complementary, never substitutes for one another. LFA is useful because it is an aid to thinking, forcing the systematic design of a project or program, but it is never sufficient on its own, because LFA does not quantitatively calculate the costs and benefits of a project.

The purpose of a project profile study is that the sector, promoting a given investment initiative, answers the various questions of the Ministry of Planning analysts in terms of base-case optimization, alternative projects, redefinitions, etc. Therefore, if a new obligation to perform an LFA is included in the project profile studies, some sectors may resist this initiative on the grounds of unwarranted bureaucracy. There may be a need for special incentives to persuade the sectors to comply. The most important incentive is time savings. If the sectors perceive that by investing in a good project profile study the total time to get to project implementation is reduced, all will accept.

Developing Project Proposals

- **What is a project proposal?**
- **How does the log frame matrix inform the proposal?**
- **Project proposal template.**

What is a Project Proposal?

A project proposal is a detailed description of a series of activities aimed at solving a certain problem. A proposal is like selling an idea or concept, where the donor is the buyer. You need to know what the buyer is looking for. It is therefore important to undertake research into the types of project that have been funded in the past, and what the current funding organization’s priorities are.

The proposal should describe in enough detail the:

- **Justification of the project** (why is the project needed?).
- **Methodology and logic of the intervention** (how will the project address the
Writing a Project Proposal

Writing a project proposal should be done once all the steps in the LFA have been completed and the log frame matrix has been developed, though some elements can be done before or in parallel to completing the LFA. Tasks that should be considered before or during the LFA process include:

- Making contact with the donor’s contact officer. Relationships are important and if the donor knows that your team is submitting a proposal, it may be looked upon favorably, especially if you have asked some questions to confirm that your project addresses the donor’s priorities.
- Contact colleagues or other organizations that may have received funding from that particular donor.
- Identifying whether the proposal requires completing a template or following specific guidelines.
- Identifying if the log frame matrix requires a specific format or terminology.
- Establish a proposal writing team – this may include experts to help with activity and resource scheduling.

When writing the proposal, it is important to understand the audience that you are writing for. Your research into what they have funded or not funded in the past, what outcomes they seek, and how much they are likely to fund will help guide your proposal writing.

How Does the Log-frame Matrix Inform the Project Proposal?

A quality project proposal is the final product of a participatory process that involves research, analysis, learning and feedback from stakeholders. The log-frame matrix provides the framework to develop the body of the proposal. You can use vertical logic to describe your intervention. Your ability to manage or mitigate against risks can be demonstrated in a risk matrix based on your assumptions. The indicators and sources of verification will instruct the development of a more thorough M&E plan. The log-frame matrix will make your proposal more coherent, logical, appropriate and successful.

Project Proposal Structure

The structure of the proposal will be determined by whether the funding agency requires a specific template to be completed or guidelines to be followed.
3.4. Pre-investment Phase

The pre-investment phase is a gradual process of elaboration on project ideas, following the project lifecycle until an appraisal conclusion is reached. This corresponds to the process of preparing the necessary studies and analysis for the identification, preparation and evaluation of the project that can solve the problem or meet the needs that triggered it, so reducing the degree of uncertainty on investment decisions.

The objective of this phase is to ensure that the project is the best solution to the identified problem (i.e. that the selected alternative is superior to the other alternative solutions and that the project presents higher technical standards and sounder indicators of effective performance compared to similar projects). Once the pre-investment phase is completed, the decision-maker may determine whether to make, defer or reject a project or investment with greater certainty.

In this phase it is important to follow the proportionality criteria: resources spent on appraising capital project proposals should be proportional to the likely project cost, keeping in mind its nature and complexity. At the inception of the PIMS, the type and depth of information required could be dependent on the size and nature of the project.

Idea and Project Profile Definition

The project profile requires a rigorous identification process, which implies undertaking the identification of gaps in the economy and the definition of investment priorities for the public sector. A typical description of a problem requires definition of:

1. The area of influence of the project.
2. The target population.
3. The present and projected demand, supply, and deficit of the service to be provided by the project.

In second place it is necessary to identify different options to solve the problem or project alternatives, including different solutions and the status quo solution or alternative (i.e. the without-project baseline). The analysis of alternatives should be done during the project profile stage. As the project formulator gets involved in the studies with greater detail, he/she increases the probability of choosing the best alternative for solving the problem.

The purpose in a project profile analysis is that the sector, promoting a given investment initiative, answers the various questions in terms of base-case optimization, alternative projects, redefinitions, etc.

The sponsoring agency must first clearly identify the problem that gives rise to the idea of a given project. After that, the problem must be framed as a negative state affecting a population, and not as the “lack of a solution”. In any situation that is analyzed, several problems can be distinguished; however, it is necessary to focus on the root problem, establishing both its causes and its effects.

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7 One initial option is to think about project thresholds (associated with size) that trigger different requirements.
• The sources of information that shed light on the problem should be identified through examples, through reviewing existing studies, using questionnaires and/or interviews with the relevant authorities or stakeholders, through consulting experts, etc.

• Problem identification should conclude with a literal definition of the problem. Along with this, it is necessary to identify the variables contained in this definition, specifying what is meant by each of them and what the related dimensions and magnitudes are. This will allow the problem to be understood consistently by all stakeholders.

• The analysis of causes and effects should be focused around a single problem; this allows the analysis to be refined and to be more effective in shedding light on solutions.

• Do not confuse the problem with the “lack of a solution”. Framing a problem in terms such as "a new hospital building is lacking" is not the same as stating that "there is a group in the population with high rates of morbidity, and it is not being served" (there is a problem). To express the problem as the absence of a solution seriously limits the analysis of alternatives, which may lead to the implementation of actions that do not necessarily solve the root problem.

Once the problem and its solution have been clarified, it is necessary to make a diagnosis of the current situation. The objective of this stage is to analyze the main variables that identify, describe, explain and size the main problem detected and to consider the processes that generated the situation and possible future trends. The diagnosis also serves to corroborate the existence of the problem identified a priori.

Within the relevant background set of diagnosis is essential in analyzing the following areas.

Areas of interest: study and influence area

The Study Area is defined after the geographical analysis and gives a context to the problem being studied. It also delivers the limits for analysis. When defining it, it is recommended that the following variables be considered:

• Existing service network.
• Relevant limits: geographical (i.e. lakes, rivers, hills) and administrative or policy (i.e. services for a target population, such as hospitals, police headquarters, etc.).
• Accessibility conditions: depends on the existence of transport systems in general; specifically, variables such as the existence and condition of roads, the capacity and frequency of public transport with its respective rates, and weather conditions must be analyzed, among other variables.

The Influence Area corresponds to that area where the problem directly affects the population and where alternative solutions should be considered. Typically, the influence area is a subset of the study area, but there are also situations for which the study area and area of influence are equivalent. When defining it, it is recommended that the following variables be considered:

• Geographical location of the population affected both directly and indirectly by the problem.
- Administrative characteristics.
- Both for the study area and the area of influence, the following background information is needed:
  - Type of location (urban/rural/mixed).
  - Extent of the area (surface).
  - Physical aspects of the study area: geographic location, climate (temperature, precipitation, humidity), geomorphology, topography.
  - Main economic activities taking place in the areas.
  - Analysis of socio-economic characterization; number and structure of the population (quantification and classification of the population according to age and gender characteristics).
  - Institutional sector and local government (e.g. location of the municipality, neighborhood, police stations, etc.).
  - Current public and private transport system (roads and connectivity within the community and between communities).

It is recommended that the background in quantitative indicators be shown in order to make a comparison later between scenarios both with the project and without it.

**Affected and Target Population**

Inside the Influence Area analysis, the recognition and description of the **affected and target population** is critical to understanding the current situation and to finding solutions to the problems. Figure N°3.17 shows the different segments that can be recognized in the analysis.

**Figure N°3.17. Segmentation of the Population**

![Diagram showing segmentation of the population]

**Source:** international best practices.

The definition and sources of information for each segment are as follows:

- Reference Population refers to the relevant population inside the total area of influence, which might or might not be affected by the problem. For identification, information from the last census, municipal database or other statistics can be used.
- Unaffected Population refers to the current population that will not be affected by the problem.
• Affected Population refers to the population that will be affected by the problem, which requires goods or services resulting from the implementation of the project. It can be determined from surveys, related studies, field data collection and other sources.
• Target Population refers to the population that will be directly benefited by the project.
• Postponed Population refers to the part of the affected population whose problem will not be resolved with the selected project, at least in the assessment period.

The optimal scenario would be one in which the target population is equivalent to the population affected by the problem. However, the existence of budget constraints, in most cases, show that the demand exceeds the capacity of attention.

For purposes of identification, it is recommended that efforts be concentrated on the identification of the affected population. To do this, information about their socio-economic, demographic and cultural characteristics must be collected. Also, it is necessary to forecast the growth of the affected population in the project evaluation horizon.

Identification and Description of Alternative Solutions

To identify possible solutions, the first thing is to visualize the expected situation once the central problem is solved; this provides strategies for action and, therefore, the set of alternatives to be analyzed. It is recommended that the analysis of alternatives be carried out during the pre-feasibility studies, using the modules approach (developed in the next section). As the sponsoring agency gets involved in the details of the studies, the probability of choosing the best alternative for solving the problem increases.

The purpose of an options analysis is to undertake an analysis of all feasible options that can achieve the identified output specifications. This will assist in identifying the preferred solution to the problem. The following principles should guide the options analysis:

• All feasible options should be evaluated.
• The preferred option should achieve net economic/social benefits (using (CBA).
• The preferred option should be affordable.

A first high-level analysis of these options should include a qualitative listing of the advantages and disadvantages as well as preliminary quantification of the costs and benefits of each option relative to the objectives of the project. This comparison should allow for the development of a shortlist of two to three preferred options, which will be assessed in detail. The processes described in the following stages will separately assess each of the shortlisted options. This information needs to be assembled to enable the undertaking of the financial and economic cost–benefit evaluation of the project.

One of the alternative solutions for all types of problem to be considered in the evaluation of projects is what is known as the "optimization of the base case situation. The formulator must take it into account in the comparison of alternatives".

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Optimizing the Base Case Situation and the Concept of Incremental Analysis

One of the important concepts when defining a project is to ensure that the project’s benefits and costs are being measured on an incremental basis.

An investment opportunity entails incremental net benefit flows that occur over and above what would have been there in the absence of that investment. In application to public investments, this means that one should carefully identify the benefits and costs that are only associated with the project in question.

When conducting a project appraisal, one should conceptualize two states of nature: one that includes the project (with project scenario) and one that does not include the project (without project scenario). The costs and benefits of the “without” case scenario should then be subtracted from the costs and benefits of the “with” project scenario to derive the incremental resource flow statement.

In addition, one of the alternative solutions for all types of problem, to be considered in project evaluation, is the "optimization of the base case situation or without scenario". According to Jenkins, Harberger & Kuo (2013), an important element in the appraisal is to ensure that the without scenario is properly defined. The without scenario may need to be optimized in order to make it comparable to the “with” project scenario. In principle, the without scenario is a projection of how the relevant items would naturally evolve if the project did not go ahead, but if the correct actions been taken on matters such as the maintenance of existing facilities. A simple before-and-after comparison is not appropriate because circumstances can be expected to change even if the project is not built.

The optimization of the without scenario should always be considered an alternative solution, especially in the case of brown-field projects (or incremental projects). Optimization investments apply to all low-cost measures that can improve the current situation, partially or completely eliminating the problem. In this case, it allows for improvements without the need for a fully-fledged project, which involves many financial resources.

Additionally, analysis of the optimized background prevents the overestimation of benefits and over-sizing of a project. Through such an analysis, it is possible to discover a decrease in the estimated deficit and, therefore, the size and cost of the project may be less than originally thought.

Ortegon, Pacheco, and Roura (2005, p.50) mention different actions that can be performed to optimize the base situation. Among others, they identified the following:

- Low cost investments
- Management measures
- Redeployment of staff
- Recruitment of additional staff
- Increased service hours
- Changes in the use of infrastructure
- Redistribution of equipment
• Minor repairs to infrastructure
• Repair of equipment
• Education programs for users
• Training of personnel

If, after the evaluation of the optimized base-case situation, the conclusion is that there is no solution to the given problem, it will be necessary to evaluate alternative solutions, considering the optimized “without project” scenario as a base-case situation. It is from this starting point that the promoter should measure the incremental benefits and costs of each alternative and then choose the most profitable from the economical point of view. It should be remembered that the evaluation of projects is always a comparison between different alternatives (including, of course, doing nothing!).

**Pre-feasibility Studies**

The pre-feasibility study is the stage at which to complete all the preliminary steps for going into a detailed feasibility exercise. Thus, it is the first step in conducting the appraisal of a project. Also, if a project does not prove to be promising at this stage, it may be rejected without the investment of any additional time and resources in its further examination.

The principal objective of a pre-feasibility study is to reject alternatives and to examine the project potential through a sensitivity analysis to determine its critical variables. The result of a pre-feasibility study is normally a recommendation to abandon the project or to advance to a deeper feasibility study. There are cases where a feasibility study is not considered to be necessary and it is possible to go from pre-feasibility to implementation.

The ex-ante project evaluation is a prerequisite to making sound investment decisions. To determine whether the benefits are higher than the costs, it is recommended that CBA be used. Benefits and costs can be quantified and measured by assigning adequate measures and units to benefits, and then, ideally, giving them a monetary value. Project appraisal activities may be outsourced, depending upon the capacity resident in any given line ministry or public independent unit. In any case, these institutions must provide for project planning and studies within their current budget baselines, including, as necessary, funding for outsourced capital project appraisals.

Also, international best practice recommends concentrating the analysis of a pre-feasibility study in modules. The first five are considered the “project building blocks” and the last four the “analytic” modules. Pre-feasibility studies must give privileged attention to these building blocks, trying to maintain the same quality of information through all modules.

The five “building block” modules are the following:

- **Demand module (including environmental factors)**. Estimates, quantifies and justifies demand.
- **Technical or engineering module**. Determines and specifies in detail the technical parameters and investment and operational costs.

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8 See Jenkins, Harberger & Kuo (2013) for a discussion of the various aspects of the pre-feasibility phase.
• **Environmental module.** Determines and specifies the economic effects of environmental norms and possible compensations for ecological damage.

• **Human resources and administrative support module.** Determines the human resource requirements for implementation and operation, in terms of quantities and specialties; identifies the sources of the work force. Also, it determines the management capacity and the functional structure of the operating entity.

• **Institutional and legal module.** Studies the legal restrictions that may obstruct or impede construction or operation, for example, limitations in localization and in the use of soil, special tax considerations in the case of public–private partnerships, etc.

The four “analytic” modules are the following:

• **Financial or private evaluation module.** Determines the financial costs and benefits at market prices, studies alternative financial leverage methods.

• **Economic or social evaluation module.** Economic adjustments from financial data using conversion factors; after that, costs and benefits are appraised from the point of view of the entire economy.

• **Distributional module.** The project is appraised from the point of view of stakeholders receiving economic benefits or costs. Economic externalities have to be calculated and distributed among different actors (stakeholders).

• **Risk (uncertainty) analysis module.** The flow of costs and benefits throughout the project life is uncertain. Given that uncertainty, consideration has to be given to the costs that those risks imply. The objective of this module is to reduce risk exposure through contractual clauses.

It is recommended that each of these modules build on the pre-feasibility stage of the project, as this stage gives a greater clarity about possible solutions to the problem. Given the complexity of introducing the Monte Carlo Simulation Analysis in the first steps of the project appraisal in a new PIMS, the risk analysis module will be focused on the sensitivity analysis and the scenario analysis in this version of the simplified methodology. But in the following versions of the document, that module should be incorporated. For the same purpose of simplification, this version will not take into account the Distributional Module either.

Whenever possible, the pre-feasibility study should utilize secondary research data. Most technical and marketing problems have been faced and solved before by others; therefore, a great deal of information can be obtained quickly and cheaply if the existing sources are utilized efficiently. Secondary research is probably most useful in the technical and engineering modules and less valuable in the marketing, manpower and administrative support modules. Marketing and administrative support modules generally require information that is specific to the project and may require some primary data.

**Demand (or Marketing) Module**

This module examines whether there is a demand for the goods/services of a project both in the domestic market and abroad. Demand corresponds to how much of a good or service is available to meet a populations’ need for it. The demand must be measured in appropriate quantities, i.e. number of medical visits per year, liters of drinking water per day, etc.
In the **demand or marketing analysis**, a distinction must first be made between the output of the project to be used to meet local demand and the output to be sold internationally. For products that are sold in the international market, usually a great deal of information is available on market trends, new technologies, and the approximate cost of production of potential competitors. The key question is: What are the advantages and disadvantages of the proposed facility relative to other competitors, both domestically and internationally? For some products, research on costs relative to those of other producers may suffice; for others, research on likely price trends may be needed; and in some cases, research into the likely demand for the output of the specific project under study may also be required. The function of this module is not only to assess the current demand but also to undertake the more difficult task of forecasting future demand.

In the case of public-sector monopolies, such as public utilities, government policies are an important factor in determining demand for the output. The growth in demand for the output of a public utility may be forecasted fairly accurately by studying the relationship over time of demand with respect to variables such as population growth, disposable income, industrial output, household formation and relative prices. The study of growth in demand experienced by utilities in other countries with similar circumstances can also provide a good indication of what to expect in the future.

The most widely-used method for estimating demand is through individual consumption, i.e. per capita or family. Multiply individual consumption by the total demand of the affected population for the good or service in question for a certain period (t):

\[
\text{Total Demand} = \text{Private consumption} \times \text{Affected population}
\]

To determine individual consumption (per capita), available historical records of the consumption of a population with similar characteristics can be used, or specific information sources, as in the case of the demand for transport services. According to the formula for calculating the total demand growth on the horizon, this project evaluation will depend on the evolution of individual consumption in the affected population. The rates used in the diagnosis must be justified by specific studies, noting all the cases under consideration.

The **actual and projected supply analysis** estimates the amount of goods or services currently available, which helps to solve the identified problem. For its estimation, consideration should be given to such aspects as:

- The capacity of existing infrastructure and standards compliance.
- Compliance with quality standards.

As far as project supply goes, consider the expected evolution of the provision of goods or services by existing providers and the entry of new suppliers into the area of influence. Along with this, the medium and long term must be analyzed, in which there might be an increase or decrease in the supply of goods or services.

The **current and projected deficit** is estimated based on the comparison of the current and projected demand and the current and projected supply in the influence area. The deficit calculation allows the determination of the magnitude of the current and projected gap. This can be expressed in qualitative terms (i.e. deficiencies in quality, regulatory compliance) or in quantitative terms. However, it is necessary that current and projected
demand and current and projected supply be expressed in the same unit of measurement and in the same time horizon.

The Technical (or Engineering) Module

This module is concerned with the input parameters of the project, the quantities and prices of inputs by type required for the construction of the project, the inputs required for the operation of the project by year, and the appropriateness of the technology adopted. It is also concerned with issues such as the size of the project, its design, location, and the technology to be adopted, including the equipment to be used and the processes to be employed. Assessment of the environmental impact caused by inputs, outputs or technology should be a central component of this module.

A major task in technical analysis is to conduct a close scrutiny of the cost estimates of construction along with the engineering data used to arrive at those estimates, provisions for contingencies and expected price increases during the implementation phase, and cost estimates for operating the facilities. The procedures for procurement of materials and provision of professional services are also reviewed at this stage.

For investment and implementation it is essential to identify the inputs required by each of the alternatives under study (machinery, equipment, materials and labor), quantity, cost, and feasibility to access them either at the national or international markets, technological advances, and the possibility of their incorporation into the project.

Incorporating the analysis of the various technological alternatives allows decisions about the optimal size and time to carry out the project. Also, the information obtained in this module allows for the estimation of entire costs of construction and operation during the lifecycle of the project.

Environmental Module

Several projects have a negative impact on the environment that may affect a group of people in the society adversely. This is an externality generated by the project and is not reflected in the private costs of the project. Failure to consider these actions in the ex-ante evaluation of the project may lead to the selection of an alternative that is not necessarily the most profitable in socio-economic terms.

Whenever the project has an impact on the environment, all the costs of pollution control equipment and facilities used for mitigation should be included in the project cost. Whatever residual pollution and environmental impacts remain after the pollution control equipment is in place should be estimated and their economic value assessed. Finally, these values should be included as a cost in the cash flow of the project.

The importance of this module lies in environmental sustainability and the rules regarding it, which may prevent or hinder the implementation of the project. Therefore, it is essential to identify how project alternatives behave in relation to environmental conditions and the effects they may generate. Also, this analysis must be taken into account throughout the project lifecycle when making decisions on matters ranging from the choice of size to technology, materiality, and location, among other things.
Manpower and Administrative Support Module

This module goes into the manpower requirements both for the construction and operation phases of the project. It reconciles the technical and administrative requirements of the project with the supply constraint on manpower.

It would be a mistake to confine project appraisal to the analysis of financial and economic costs and benefits under the assumption that the project can be built and ready for operation on time. This assumes a degree of administrative support and project management capacity for implementation of projects that in many countries and regions does not exist. Many projects have failed because they were undertaken without the administrative and project management expertise necessary to complete the project as specified. The prospect of future financial and economic benefits materializing is only as good as is the administrative/project management capability of the agency in charge of putting the project in place.

This module must reconcile the technical and administrative requirements of the project with the supply constraints on manpower. If those two cannot be reconciled, the project should not be undertaken. A careful study of labor markets should be made in order to ensure that the estimates of wage rates to be paid are accurate and that the planned source of manpower is reasonable in the light of labor market conditions. In general, manpower requirements should be broken down into occupational and skill categories, and these needs should be evaluated in terms of the possible sources from which they will be met.

Institutional Module

This module deals with the adequacy of the local institution responsible for managing the different stages or phases of the project. Insufficient attention to the institutional aspects can lead to problems during the implementation and operation of the project.

The local institution does not cover the borrowing entity and its organization alone. It includes the entire management that goes into the project, along with its policies and procedures. In a broad sense, the institutional setup also incorporates the whole range of government policies and procedures. Experience shows that insufficient attention to the institutional aspects creates serious problems during the implementation and operation phases of the project.

The institutional module should address the following issues.

- Which institutions are related to the project? Which is the institution that should lead the project? Does this institution have enough resources to run and monitor the project properly?
- Is the local entity that is supposed to manage the project properly organized and its management adequately equipped to handle the project?
- Are local capabilities and facilities being properly utilized?
- Is there a need for changes in the policy and institutional setup outside these local entities? These changes may be warranted in the policies of the local, regional or federal governments? Is it necessary to take legal action to carry out the project?
What are the current regulations? Are institutional changes or changes to policy or creating new agreements or commitments needed? And what changes are needed at local, regional and political centers?

Financial Module

This module provides the first integration of financial and technical variables estimated in the marketing, technical and manpower modules. A cash-flow profile of the project is constructed that identifies all the receipts and expenditures that are expected to occur during the lifetime of the project. An attempt should be made at this stage to provide a description of the financial flows of the project that identifies the key variables to be used as input data in economic and social appraisal. In other words, it is essential, based on analysis of demand and technical modules, to identify the main income and expenses over the timeline of project evaluation.

The financial appraisal also helps in determining the level and structure of prices or user fees to be charged to the beneficiaries in order to ensure the project’s financial viability. Sometimes governments decide to subsidize specific services to consumers as a matter of policy or pure expediency. The recovery of user charges has to take into account the income position of the beneficiaries and the practical problems of administering a particular system. The degree of the fiscal impact of such government policies on the budget has a strong bearing on the viability and sustainability of the project. In such cases, not only should the level and structure of prices be defined but the procedure for making future adjustments in prices and government subsidy should be clearly laid down.

The result of this analysis should be the capacity to build a flow of benefits and costs. To do this, the following steps are proposed:

1. Identify the relevant effects of revenues, expenses or investments.
2. Measure in specific measurement units.
3. Value them into money.
4. Sort them in time, i.e. establish at what point in the future each will happen.
5. Compare them in order to determine the net expense or income.
6. The construction and result of the cash flow depends on the type of financing that the project under study develops and whether it is appraised from the financial (private) or economic (social) perspective, an issue that will be looked at more deeply in the next chapter.

Economic Module

This module examines the project from the entire economy's point of view to determine whether or not its implementation will improve the economic welfare of the country or region. An economic appraisal is of exactly the same nature as financial analysis, except that now the benefits and costs are measured from the point of view of the whole country or the entire region, in order to choose those projects that maximize the welfare of the entire society. Therefore, another main difference should be considered: the effects in a private (financial) evaluation do not take into account all the relevant costs and benefits, such as externalities and intangible effects.
Instead of relying on market prices to measure expenditures and costs, as in the case of a financial appraisal, economic analysis requires the use of techniques to determine the economic prices of goods and services, foreign exchange, cost of capital and labor. The true economic values of costs and benefits are not reflected in market prices in the presence of various distortions such as trade restrictions, price control, taxes, subsidies, and minimum wages.

The questions covering the economic appraisal of a project are as follows:

1. What are the magnitudes of the differences between the financial and economic values of variables that are affected by government regulation and control or are subject to taxes, tariffs, and subsidies?
2. What are the magnitudes of the differences between the financial and economic values of variables that are affected by other imperfections in the factor and product markets (e.g. labor unions, lack of competition and restrictive trade practices)?
3. What relative degree of certainty can be placed in each of the above measurements of economic externalities as compared to the estimates of financial expenditures and revenues?
4. When evaluated at a discount rate that reflects the relevant cost of capital to the economy as a whole, does this project produce a positive economic net present value?
5. In order for the appraisal to indicate that the project is economically viable, what proportion of the more uncertain economic adjustments must be included?

Before the adjustments outlined above can be measured satisfactorily, the basic principles of economic evaluation must be clearly understood. However, it must also be pointed out that all these adjustments are made to the basic financial data of the project, and therefore it should always be easy to check the various steps in the methodologies that transform financial evaluation into an economic analysis.

To conduct the economic analysis, the opportunity cost of resources must be known. If a project does not have an economic return equal to the opportunity cost of public funds, it usually should not be undertaken. In some circumstances, however, the project may also lead to net social benefits which can be quantified (but not necessarily measured in monetary terms) and which may be viewed by the decision-makers as being worth the sacrifice of economic resource cost that the project entails. For example, the project might distribute income to a group of people whom the government is very anxious to help. It is in this context that an important factor must be noted. A project may distribute income to a desired group and at the same time it may increase the incomes of those that are not favored. Therefore, both of these outcomes must be considered by the decision-makers in determining the overall attractiveness of the project.

**Uncertainty (Risk) Analysis Module**

The analysis so far has been based on the deterministic values of project variables. But in the real world there is uncertainty. Uncertainty is a major source of risk. One way to measure risk is the expected variability of important project variables; another measure is the probability of a negative net present value (NPV).
A traditional cash flow analysis assumes single (deterministic) values for all variables. The outcome of that analysis is a point-estimate of a project’s indicators, as NPV or its internal rate of return (IRR), and a decision whether to accept a project is made on that basis. More realistically, however, we know that values for most project variables are subject to change and are difficult to predict. While the past values of a particular variable are known with certainty, predicting future values is a different matter. It is more likely to forecast the correct range of future values for a variable rather than its exact value. Given that there are probabilities attached to the possible values of a variable in a given range, there is a good chance that the value that occurs will be other than the one we have chosen.

Risk analysis is important for a number of reasons. Among others, it reduces the likelihood of undertaking a “bad” project while not failing to accept a “good” project. It would be easy to avoid “bad” projects simply by making very conservative assumptions about the values of the key variables and then accepting only those projects that still have a positive NPV. In second place, one of the ways to reduce uncertainty is to gather more data and information, to the extent feasible, about the key project variables in order to narrow their likely range and to determine more precisely the appropriate probability distribution. To deal with the risk analysis, the sensitivity analysis and the scenario analysis are introduced later in this document.

Comments on Modules

Even when the environmental module, manpower and administrative support module and institutional module are not related to project evaluation, they should be considered in project design and preparation and because they are related to the sustainability and viability of the project in the medium and long term. Furthermore, the conclusions derived from the analysis of these modules should be incorporated into the project evaluation, when they affect the benefits and costs of the project. For example, environmental mitigation measures may generate higher investment costs (CAPEX), or attract more and better human resources to ensure that the proper functioning of the project can generate higher operating costs (OPEX). Finally, all aspects of the project should be subject to compliance with the law, even when it is not related to economic efficiency.

3.5. Feasibility Studies

After completing all the modules of the pre-feasibility phase, the project must be examined to see if it shows promise of meeting the financial, economic, and social criteria that the government has set for investment expenditures. This is the final step in the appraisal of a project and its function is to improve the accuracy of the measures of key variables if the project shows potential for success.

Having identified and thoroughly evaluated the alternatives that may provide a solution to the identified need, it is important to quantify the cost of the shortlisted alternatives that are more likely to provide a complete or partial solution, in order to select a preferred option for funding, the preferred alternative. The aim is to identify the best solution that will meet the criteria given any constraints the institution may be facing. The result is a
clear reasoning of why and how the preferred alternative was chosen. The preferred alternative is the option that meets the project objectives most economically.

In order to improve accuracy, more primary research will have to be undertaken and perhaps a second opinion sought on other variables. Since the estimates of costs and benefits may be subject to substantial margins of error, an analysis should always be made about the sensitivity of the project’s outcome to variations in the values of key variables.

It is at the end of this stage that the most important decision has to be made, the decision to approve the project or not. It is much more difficult to stop a bad project after the detailed and often expensive design work has been carried out at the next stage of project design. Once sizable resources have been committed to preparing the detailed technical and financial design of a project, it takes courage for public servants and politicians to admit that it was a bad idea.

If the outcome of the feasibility study is such that the decision-makers give their approval to the project, the next major steps are to tie up financing and develop detailed project design. Negotiations about the financing of the project have to be finalized with all the bankers and a detailed loan document drawn. The drafting and negotiation of the legal documents are essential to ensure that the borrower and the bankers are in agreement not only on the terms of financing but also on the broad objectives of the project and the detailed schedule and specific activities necessary for implementing it.

A preliminary design criterion must be established when the project is identified and appraised, but usually expenditures on detailed technical specifications are not warranted at that time. Once the project has been approved for implementation, the design task should be completed in more detail. It involves detailing the basic programs, allocating tasks, determining resources and setting down in operational form the functions to be carried out, along with their priorities. Technical requirements, such as manpower needs by skill class, should be finalized at this stage. Upon completion of the blueprints and specifications for construction of facilities and equipment, operating plans and schedules, along with contingency plans, must be prepared and brought together before the implementation phase is entered.

When this process is completed, the project is again reviewed to see whether it still meets the criteria for approval and implementation. If it does not, this result must be passed on to the appropriate authorities for final disapproval or rejection of the project.

**Final Investment Decision and Budgeting**

After the project feasibility study is terminated, a final decision on the investment has to be taken, according to Figure N°2.1. The decision may be to provide funding, either through the traditional fiscal budget, PPPs or international cooperation (grants and/or loans), and to proceed to the execution of the project. If that is the case, new actors will become involved with the project during the investment stage, i.e. the project managers. The efficient implementation or execution of a project is obviously critical to ensure that investment flows become productive assets for the country. The final investment decision concludes the pre-investment phase.
3.6. Final Comments

The project lifecycle and its phases play a key role in the success of a project. In these phases, information is gathered and the necessary studies for the identification, formulation and appraisal of the project are done. The studies reduce the degree of uncertainty about the investment decisions, thus allocating fiscal resources efficiently.

Given the importance of these phases, a series of recommendations and obligations to ensure that the project is formulated correctly is listed below:

1. The definition of the problem is essential in determining possible alternative solutions. Framing the problem as lack of a good or service leads invariably to a unique solution and prevents the analysis of more than one alternative to the root problem.
2. It is necessary to understand that a problem in itself is not a project. A project comprises courses of action that arise from a given problem and provides a rational response to the problem.
3. When doing the diagnostic of the current situation, it is helpful to set a baseline for comparisons and benchmarking. This is essential for the ex-post evaluation of the project, which aims to verify whether the project has been a real solution to the problem.
4. The optimization of the base case (or the scenario without the project) should always be considered as one of the alternative solutions to the problem.
5. Always more than one alternative should be analyzed as a solution to the problem.
6. For the calculation of the benefits and costs of each alternative, the situation “without project” or “optimized base case” should be considered the baseline for comparisons, thus avoiding over- or underestimation of benefits or costs.
7. It is recommended that the analysis of project alternatives be performed in the pre-feasibility study, as this involves looking at each alternative in greater detail and therefore increases the probability of choosing the best alternative to solving the problem. A modular analysis for each alternative is recommended.
4. INTEGRATED PROJECT ANALYSIS

Project evaluation is a tool for decision-making that allows a determining of the suitability of society to invest in various initiatives when resources are scarce. Usually, this "convenience" is understood from the economic point of view as a measurement of the costs and benefits of competing projects, leading to the prioritizing of those projects whose expected economic benefits are the highest.

However, there are other areas of analysis that allow a broader view regarding the effect that a project may have on the welfare of people. In that sense, the integrated project evaluation arises as a tool of analysis that encompasses economic, financial, and stakeholder distributional and risk analysis.

The approach adopted in this document may be referred to as “integrated project appraisal” (IPA). The IPA is based on a close interaction between financial and economic analyses. These are conducted using domestic market prices at domestic price level as the numéraire, and this facilitates the identification of benefits and losses to different stakeholders in a project. The IPA provides information about the sustainability of the project in the long run (Jenkins, 1999). In this sense, sustainability is defined as the integration of economic, economic and financial aspects, it being necessary to address all these together.

Comparing the total costs (investment and operation) of a project with its benefits allows public authorities to decide if that project has the potential to make a real contribution to the wealth of the country. Thus, project evaluation allows them to: i) Identify the criteria for investment policies that maximize social welfare; ii) stop the "bad projects" and promote those that are "good"; iii) define whether the public or private sector should implement the project; iv) estimate the fiscal impact of the project; v) establish agreements for desirable cost recovery; and vi) assess their impact on the environment, regional development, and poverty, among other things.

To estimate the contribution of projects, it is then necessary to identify, measure and assess their costs and benefits. Identification of costs and benefits involves determining, qualitatively, the positive and negative impacts generated by the project. The assessment of benefits and costs involves transforming financial cash flows into economic resource flows, using economic prices (efficiency or shadow prices) of goods and services produced and resources used. Of course, there will be some costs and benefits that can be identified but are unlikely to be quantified and valued. However, it shall be the duty of the evaluator to conduct the process rigorously, to identify all the effects and impacts of projects and to reasonably quantify and value as many of them as possible.

The IPA adopted in this methodology expands the scope of the analyses of both public- and private-sector projects beyond the traditional practice of decision making on the basis of the financial and economic net present values of an investment. It demonstrates that if the economic and financial analyses are carried out using a common numéraire, expressing all values in terms of the domestic prices at the domestic-price level, the scope of the analysis can be expanded to include issues of stakeholder impacts, poverty impacts, and an assessment of the long-term sustainability of the project. The benefit of such an extension of the analysis is very important for assessing the political–economic dimensions of public-sector investments.
Following Jenkins (1999), in the context of this methodology there are three types of analysis that represent the pillars of integrated appraisal for determining the sustainability of a project. These are the financial analysis, the economic analysis and the risk (uncertainty) analysis.

4.1. Financial Analysis

The financial analysis assesses the impact of a project on the financial costs and funding of the organization that makes the decision to carry it out. This type of analysis requires the construction of cash flows based on different points of view. For example, if the project does not yield an attractive return to private investors, a related function of financial analysis is to calculate the minimum amount of income to induce these investors to undertake the investment (for example, to define subsidies or transfers to the private sector).

Project implementation involves the use of resources to build, install, upgrade and/or equip infrastructure, facilities or other investments. The financial analysis of a project helps to determine the financial sustainability of the project and its overall success. But an important question arises immediately. Why a financial appraisal for a public sector project? It may appear that the financial appraisal of a project is only of interest to a private investor who wishes to determine the net financial gain (or loss) resulting from an investment project. From a country’s point of view, a project will increase the country’s net wealth if it has net positive economic returns. Conversely, a project that yields negative economic returns should not be undertaken, as it would lower the net wealth of society as a whole.

However, there are several reasons to conduct a financial appraisal for a government project. The most important one is to ensure the availability of funds to finance the project through its investment and operating stages (financial sustainability). In other words, a project that has high economic returns may very often fail if there are not enough funds to finance the operations (working capital) of the project. Therefore, one of the main objectives of a financial appraisal for a government project is to determine if a project has sufficient liquidity “to pay its bills” throughout its entire life, and if not, how the shortfalls can be met.

The second reason for conducting a financial appraisal of public-sector projects is directly related to the understanding of the distributional impacts of the project. For example, the difference between the financial price an individual pays for a liter of water (found in the financial cash-flow statement) and the gross economic benefit he derives from consuming that liter of water (found in the economic resource-flow statement) reflects a net gain to the consumer. Similarly, the difference between the financial price (inclusive of tax) that a project faces and the economic cost of an input required by the

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9 For instance, often water or electricity supply projects are mentioned as typical examples of projects that have large economic benefits due to the large value attached to water, and low financial receipts due to low water tariffs. If the project is undertaken solely on the basis of a favorable economic analysis with no consideration to financial sustainability, the project may very well fail due to lack of funds for maintaining the system and/or service the debt. Finally, the reduction in, or lack of, maintenance results in continuously-increasing water losses and reduces the anticipated economic benefits of the system.
project measures the tax gain to the government. Gains and losses of this nature will be more difficult to establish on the basis of economic analysis only.

In third place, in certain instances, the government approaches a project like a private-sector investor in order to determine the financial profitability of the project. This is necessary if privatization of the project is being considered (also, for the public–private partnership financial model). Determining the profitability of a project is essential to estimate the value that a private investor would be willing to pay for it. Ascertaining financial profitability is also necessary when government policies are designed to encourage small investors and certain groups in society to undertake projects by providing them grants or loans.

For example, the financial sustainability of a water project is required to ensure that fiscal transfers to the project will not be required for operation of the system, the maintenance of the project’s assets and the replacement of the equipment. The economic analysis module is integrated with the financial module in a consistent manner through the use of economic conversion factors. The conversion factors are calculated and used to adjust the financial price of the project output for such items as taxes, subsidies and for the willingness of consumers to pay for the project’s output. The statement of economic externalities is derived by finding the differences between the economic resource-flow statement and the financial cash-flow statement. The present values of these externalities are then distributed across the different project stakeholders.

<table>
<thead>
<tr>
<th>BOX 4.1 – The relationship between the financial and economic analysis</th>
</tr>
</thead>
</table>
| There are two aspects to this issue. First, is financial analysis relevant for a social-sector project? One might argue that it is only the economic analysis that is relevant and if a social-sector project is economically sound, its financial analysis is of little consequence. This view is, unfortunately, erroneous. The financial cash flows are crucial for projecting the cash position of the project into the future and determining if and when cash injections from external sources, including the government budget, are necessary. This may make all the difference between a successful project and a failed project. If the project cannot be implemented due to paucity of funds and lack of advance planning, there is not going to be any economic benefits from the project. Also, it is essential to have an accurate and detailed financial analysis along with an economic analysis in order to conduct the distributional analysis of the project.

Another aspect of this issue is whether it is possible to prepare a detailed financial cash flow, as outlined in the preceding sections, in case of a social-sector project. The answer is yes. There is hardly any difference between a social-sector project and an industrial project in preparing the cash flow on the cost side. On the benefit side, one has to include whatever revenues are being generated by the project along with other elements like grant/subsidy and liquidation values. In the extreme case, when the services are provided free of cost the revenues will be zero and the financial analysis will be able to indicate the yearly requirement of funds for continuing with the project. In such case, it is not necessary or possible to quantify financial benefits in monetary terms or when choosing among different technologies for providing the same services; one has to apply the “cost effectiveness” criterion. To do so, the present values of alternative sets of costs have to be estimated. This is feasible only when a detailed and accurate cash flow has been prepared. |

**Financial Cash Flows**

The financial cash-flow statement of a project is a profile of the project’s receipts (inflows) and expenditures (outflows) over time. The cash-flow statement is organized in two main sections; the first section typically contains the expected financial receipts generated by the project, while the second one contains the expected financial expenditures incurred to generate the receipts of the project. The project’s total
expenditures, also known as total outflows, are subtracted from its receipts (inflows) to provide its net cash flow. Table N°4.1 is an illustration of some of the line items that may appear in the financial cash-flow statement of a project.

### Table N°4.1 Variables in a Financial Cash-flow Statement

**Financial Receipts:**

1. Sales
2. Changes in Accounts Receivable
3. Residual Values
   - (a) Land
   - (b) Equipment
   - (c) Buildings
4. Total Inflows

**Financial Expenditures:**

(i) *Investment Expenditures/Opportunity Costs*

5. New Investment
   - (a) Land
   - (b) Type 1 Equipment
   - (c) Type 2 Equipment
6. Buildings
7. Existing Assets (if any)
   - (a) Land
   - (b) Equipment
8. Buildings

(ii) *Operating Expenditures*

9. Raw Material (1)
10. Raw Material (2)
11. Raw Material (n)
12. Management
13. Skilled Labor
14. Unskilled Labor
15. Maintenance
16. Changes in Accounts Payable
17. Changes in Cash Balance
18. Total Outflows
19. Net Cash Flow

**Source:** Jenkins G., Harberger A., Kuo Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen’s University, Kingston, Canada.

Also, Figure N°3.1 illustrates four of the different profiles that a net cash flow can take. Each profile is a plot of a project’s receipts net of expenditures (net cash flows) against
the sequence of years that make up the project’s life. Typically, a project’s net cash flow is negative in the early part of its life (the investment stage, CAPEX) when the initial investment is being undertaken and the project is not generating any receipts. Once the investment is completed and the project starts operating (OPEX), the net cash flow is likely to be positive (Case A). Case B presents an alternative situation where a period of reinvestment or plant retooling is planned during the life of the project. This may result in negative net cash flows during the operating life of the project. Case C presents a profile for a class of projects that require a large expenditure at the end of the project. The expenditure could be, for example, attributed to clean-up and landscaping costs associated with a mining project, or the decommissioning of a power plant. The profile of the net cash flow in Case D represents projects that do not generate any financial receipts (road projects that charge no tolls), or projects that generate low receipts that are insufficient to cover operating expenditures (possibly water and wastewater projects). In such cases, the project will have a large initial outlay during the investment stage and will continue to show negative net cash flows during the operating stage.

**Figure N°4.1 Different Financial Project Profiles**

- **Case A**: Initial Investment followed by positive cash flows in the operating stage.
- **Case B**: Initial Investment with negative cash flows during the operating stage, indicating a period of reinvestment.
- **Case C**: Initial Investment with negative cash flows in the operating stage, indicating a large expenditure at the end of the project.

Figure N°4.1 Different Financial Project Profiles
The construction of the cash-flow statement is generally preceded by the chronological organization of variables and data into the financial plan (investment, operating and cessation-of-operations stage). Most of the data required should already be organized in the modules discussed previously. See Table N°4.2.

**Table N°4.2 List of Cost ~Items Investment in the Expenditure Statement**

<table>
<thead>
<tr>
<th>INVESTMENT EXPENDITURE</th>
<th>Equipment and Materials</th>
<th>Incorporated Fixed Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary Expenditure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Initial investigations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Research and technical studies (nature of ground, raw materials analysis, water availability and quality, working out the manufacturing processes, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Economic, Marketing, Profitability, Design, Financial and Legal studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment and Materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Machines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Foundations for machines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Machine installation costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Testing and start-up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Electricity and telephone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Vehicles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Office equipment and supplies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incorporated Fixed Assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Patents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Licenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Reproduction rights</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs of Establishment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Costs of forming the company</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Costs of issuing shares</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Setting up a sales network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Recruitment personnel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Personnel training (wages and salaries, teaching, traveling expenses)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working Capital: This includes in particular:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Stocks of raw materials and requisites, intermediate products, and finished products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• The average period for payment allowed to customers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cash requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Foundations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Buildings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Water pipes and connection to electricity mains, telephone system and, gas supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Reservoirs and tanks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Waste-water disposal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Roads and paths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Site and Its Preparation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cost of land</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Registration duties and fees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Drainage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Access roads</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen's University, Kingston, Canada.
Table N°4.2 List of cost items investment in the expenditure statement (continuing)

TECHNICAL OPERATING EXPENDITURE

Taxes and Duties
- Direct duties and taxes: Land tax; Municipal and regional taxes and duties
- Indirect duties and taxes: Value added tax; Tax on services rendered
- Registration taxes, duties and fees: Registration fees for deeds and contracts; Stamp duties
- Customs duties
- Trade taxes
- Duties levied by international bodies

Works, Supplies and External Services
- Rents
- Maintenance and repairs
- Works by outside firms on contract basis
- Water, gas and electricity supplies
- Fees for patents, licenses, brand marks, etc.

Purchases
- Initial investigations
- Materials
- Fuels
- Maintenance materials
- Office supplies
- Packaging materials

Miscellaneous Management Expenses
- Office supplies
- Telephone
- Legal documents and litigation
- Grants and contributions

Personnel Expenses
- Wages and salaries
- Allowances
- Commissions
- Social security commitments

Transport and Traveling
- Personnel transport
- Travel and removal expenses
- Freight and transport for purchases
- Freight and transport for sales

Source: Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen's University, Kingston, Canada.

The most important items related to financial receipts to consider inside cash flow depends on the nature of each project. However, the most important items are related to fees charged to users and state grants. In the latter case, the government can provide a subsidy, per capita, for care or global, which is a cash inflow to the institution responsible for the operation.

The Investment Plan
Following Jenkins, Harberger & Kuo (2013), the investment plan combines information from the market and technical analyses to establish a detailed plan for annual incremental expected capital expenditures during a project’s investment phase\textsuperscript{10}. Also, the investment plan should provide estimates of the liquidation or scrap value of all major fixed assets and the value of net working capital at the end of a project’s life. In addition, it should disaggregate expenditures on machinery, equipment, and building materials into tradable and non-tradable commodities, and should indicate the breakdown of workers by skill and likely source of availability.

\textsuperscript{10} Capital expenditures include expenditures on land, buildings, machinery, equipment, building materials, and construction and management labor.
The investment plan consists of two sections: the first deals with the expenditure on new acquisitions, and the opportunity cost of existing assets, and the second section deals with the financing aspects of the proposed investment. If there are different scales and/or locations under consideration, corresponding investment plans for each scale and/or location should be formulated. Table N°3.3 provides an illustration of sections of an investment plan for a project. All data in the investment plan regarding the expenditures on new acquisitions, and the opportunity cost of existing assets, if applicable, are included in the cash-flow statement. Financing data is included in some statements but not others depending on the point of view, as explained below.
<table>
<thead>
<tr>
<th>Table N°3.3 Example of Investment Plan (Investment Expenditure)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
</tr>
<tr>
<td>Local</td>
</tr>
<tr>
<td>a. Water reservoirs/pumping stations</td>
</tr>
<tr>
<td>Civil works</td>
</tr>
<tr>
<td>Equipment and materials</td>
</tr>
<tr>
<td>b. Transmission mains</td>
</tr>
<tr>
<td>Civil works</td>
</tr>
<tr>
<td>Equipment and materials</td>
</tr>
<tr>
<td>c. Secondary/tertiary networks</td>
</tr>
<tr>
<td>Civil works</td>
</tr>
<tr>
<td>Equipment and materials</td>
</tr>
<tr>
<td>d. Service connections</td>
</tr>
<tr>
<td>Civil works</td>
</tr>
<tr>
<td>Equipment and materials</td>
</tr>
<tr>
<td>e. Office buildings</td>
</tr>
<tr>
<td>g. Consulting services</td>
</tr>
<tr>
<td>h. Land cost</td>
</tr>
<tr>
<td>i. In-house eng. services</td>
</tr>
<tr>
<td>j. Taxes and duties</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

**Summary of investments**

| | | | | | | | | | | | |
| Civil works | | | | | | | | | | | |
| Equipment and materials | | | | | | | | | | | |
| Office buildings | | | | | | | | | | | |
| Consulting services | | | | | | | | | | | |
| Land cost | | | | | | | | | | | |
| In-house eng. services | | | | | | | | | | | |
| Taxes and duties | | | | | | | | | | | |
| **Total** | | | | | | | | | | | |

**Source:** Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen’s University, Kingston, Canada.
Once time schedules and deadlines are formulated, expenditures should be broken down by year of expected expenditure. Each expenditure item should be broken down into its components, whenever possible and appropriate. Investment credits or other forms of subsidies should be explicitly presented. Civil works and building construction should be broken down into raw material, and the different types of labor. These breakdowns are necessary to conduct the economic analysis of the project and are also important in providing a clear understanding of its cost structure.

The second half of the investment plan deals with the means and schedules of financing investment expenditures. The sources of finance used, whether equity or grants, domestic short-term and long-term loans, foreign loans, suppliers’ credit, concessional loans or other forms of foreign aid, should be identified and the disbursement schedules formulated. The second section of the investment plan illustrated in Table N°3.4 presents an example of a financing plan.

| Table N°4.4 Example of Investment Plan (Financing Sources) |
|-------------------|-------------------|-------------------|-------------------|
|                   | Year 1            | Year 2            | Year …            | Year t            |
| Foreign loans     |                   |                   |                   |                   |
| Domestic equity   |                   |                   |                   |                   |

Source: Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen’s University, Kingston, Canada.

Whether the data in the financing section of the investment plan is included in the cash-flow statement or not depends on the point of view being considered.

The Operating Plan

The operating plan combines information from the market and technical analyses to establish a detailed plan for the operating phase of a project. Also, it should provide projections of expected sales revenues and expected operating costs for each year during the operating phase, and should forecast annual net working capital requirements. In addition, it should specify the management and operating manpower requirements by skill and source of availability for each year of the operating phase, and should disaggregate material inputs into tradable and non-tradable commodities.

The operating plan is developed on the basis of the data formulated and organized in the technical, demand (market), and manpower modules. It includes all cash receipts generated from the operations of the business and all operating expenditures. Expenditures and corresponding receipts should be projected by year of operation. Similar to investment expenditures, data breakdowns are necessary. Operating expenditures should be broken down into internationally-traded and internationally-non-traded items; and each expenditure item should be broken down into its components, whenever possible. Expenditures on different types of labor (skilled, unskilled, etc.) should be identified and recorded separately. Any taxes or subsidies associated with operating expenditures should also be identified and recorded separately whenever possible. These breakdowns are necessary for conducting the economic analysis of the

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11 Operating costs include operating material inputs and operating labor.
project and for providing a better understanding of the cost structure of the operating expenditures. Table N°3.5 presents an example of an operating plan.

As a matter of convention, residual values are recorded in the cash-flow statement in the year following the cessation of operations. The underlying assumption is that liquidating assets may take a few months. When determining the residual value of the assets at the end of the project, it is preferable to break down all the assets into different categories: land, building, equipment, vehicles, etc. The residual value is taken as the higher of the in-use or liquidation values. The in-use value of the plant is the value of the plant under the assumption that it will continue to operate as an on-going concern. The liquidation value is the value of the assets if all components of the project are sold separately and perhaps even the plant is taken apart and liquidated. The depreciation rates could be obtained from plant manufacturers; technical journals may contain information on depreciation patterns; also insurance companies (that insure a plant’s assets) have some estimates for the plant’s rate of economic depreciation.

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12 Direct data requirements for a cash-flow statement are slightly different from, and may not be as readily available as, data requirements for income statements and balance sheets. For example, an income statement includes sales and purchases, while a cash-flow statement includes receipts and expenditures. Sales and purchases include credit as well as cash transactions, while receipts and expenditures are cash only.

13 When a new project acquires an asset, the entire expenditure on the asset is accounted for in the cash-flow statement at the time that the expenditure actually occurs. It is quite possible, however, that the life of the project will not coincide with the life of all its assets, or that the span of the analysis will not extend as far into the future as the project may be expected to operate (for example, railway projects). If either of the two conditions exists, the residual value of the asset should be included in the cash-flow statement as an inflow in the year following the cessation of operations.
Table N°3.5 Example of Operating Plan for a Hypothetical Project

<table>
<thead>
<tr>
<th>Operations and maintenance</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year...</th>
<th>Year...</th>
<th>Year...</th>
<th>Year...</th>
<th>Year...</th>
<th>Year t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
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<tr>
<td>Connections/employee</td>
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<tr>
<td>Total employees</td>
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<tr>
<td>Unit salary/mo. (JD)</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Total personnel cost</td>
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<td></td>
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<tr>
<td>Power/fuel (JD /cum.)</td>
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<tr>
<td>Chemicals</td>
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<tr>
<td>Maintenance</td>
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<tr>
<td><strong>Production schedule</strong></td>
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<tr>
<td>Connections</td>
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<tr>
<td>Beginning</td>
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<tr>
<td>New</td>
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<tr>
<td>Ending</td>
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<tr>
<td>Cumulative new connections</td>
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<tr>
<td>No. of persons/connection</td>
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<tr>
<td>Average consumption/person</td>
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<td>(liters/day)</td>
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<tr>
<td>Total consumption (cum./day)</td>
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<tr>
<td>Incremental consumption (cum./day)</td>
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<tr>
<td><strong>Working capital</strong></td>
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<tr>
<td>Number of months accounts</td>
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<td>receivable (*)</td>
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<tr>
<td>Accounts receivable</td>
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<td></td>
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<tr>
<td>Change in accounts receivable</td>
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<td></td>
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<td></td>
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<tr>
<td>Cash balance</td>
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<td></td>
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<tr>
<td>Change in cash balance</td>
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<td></td>
<td></td>
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<tr>
<td>Accounts payable</td>
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<td></td>
<td></td>
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<tr>
<td>Change in accounts payable</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen’s University, Kingston, Canada.

(*) Three months of accounts receivable implies that water bills are collected after three months of actually supplying water.
The Financing Plan

The financing plan should provide details about how any anticipated negative net cash flows will be financed during both the investment and operating phases of a project. Also, in this task, equity investors should be identified and the anticipated timing of their contributions specified. In addition, debt-holders should be identified and the anticipated timing of their contributions specified (interest and amortization schedules should also be stated).

For most projects that are directly undertaken by the government, or involve some government intervention in the form of grants, loans or subsidies, there are several stakeholders that would like to determine the impact of the project on them. Stakeholders are defined broadly to include all those affected by the project. For example, the stakeholders of a project may include the owners, participating banks, any (other) government department providing loans or grants or collecting taxes, competitors, workers, etc. It is therefore necessary to conduct analyses from the points of view of different key stakeholders to ensure the project’s sustainability and success. Even one powerful stakeholder who is adversely affected by the project may be able to derail it entirely.

The most commonly-undertaken financial analyses for government and government-related projects are from the following viewpoints: i) point of view of owner; ii) point of view of all investors combined (banker’s point of view or total investment point of view); iii) point of view of the Budget department.

The Owner’s Point of View

The owner of a project, whether a private investor who is receiving some form of support from the government or a government department undertaking a project, includes all receipts and expenditures related to the project in the cash flow statement to determine whether he is made better off or not. Consequently, the sponsors of the project receive the net cash flow after paying off all the other parties involved. The cash-flow statement from an owner’s point of view will include the disbursement of the loan as an inflow and all subsequent repayments of loan and interest as expenditures. If the project receives any grants or subsidies, these should be included as receipts in the cash-flow statement; and if the project pays taxes, these should be included as a cash outflow. If the project sponsor is going to give up an existing source of income to undertake a project, the forgone earnings (opportunity cost) should be included as an expenditure in the cash-flow statement.

The Total Investment (Banker’s) Point of View

This point of view examines the returns to the total invested capital. In other words, this analysis disregards any distinctions in the sources of finance. It asks if the financial receipts generated from the operations of this project are sufficient to cover the investment and operations expenditures, and provide a sufficient return. This point of view is also known as the “banker’s point of view” because a bank will be interested in examining the expected receipts and expenditures to determine if the net cash flow is sufficient to cover the loan and interest repayments. The banker typically has first claim to the project’s assets and net cash flow, and so the banker’s net cash flow is the project’s gross receipts net of operating and investment expenditures.
The only difference between the analysis from the owner’s point of view and that from the banker’s point of view is financing. Specifically, the cash-flow statement from the total investment point of view will include all items included from the owner’s perspective except loan and loan repayments.

**Budgetary Point of View**

The purpose of the analysis from the budgetary point of view is to ensure that the relevant department has enough resources to finance its obligations to the project. If the government department is the project owner, then the only distinction between the cash flow statement from the owner’s point of view and from the budget point of view is that opportunity costs are not taken into account in the latter statement. If, on the other hand, the government’s involvement is in the form of providing some cheap credit, subsidies, or grants, the cash-flow statement will only reflect these transactions.

Finally, it is important to realize that an analysis that includes the costs and benefits to all involved parties constitutes the first step in the economic analysis of the project. Indeed, this point is used as a kick-off for discussions on the economic analysis. A summary of how different financial items should be included in the cash-flow statement from different points of view is given in Table N°3.6.

**Table N°3.6 Summary of Cash Flow Statement from Different Points of View**

<table>
<thead>
<tr>
<th>Point of View of Owners</th>
<th>Point of View of All Investors (Banker’s or Total Investment Point of View)</th>
<th>Point of View of Budget</th>
<th>Other Perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B) = (A) – Loan and loan and interest repayments</td>
<td>(C)</td>
<td>(D)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grant/Subsidy</th>
<th>Positive</th>
<th>Positive</th>
<th>Negative</th>
<th>Not included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan</td>
<td>Positive</td>
<td>Not included</td>
<td>Not included</td>
<td>Not included</td>
</tr>
<tr>
<td>Investment costs</td>
<td>Negative</td>
<td>Negative</td>
<td>Not included</td>
<td>Not included</td>
</tr>
<tr>
<td>Operating costs</td>
<td>Negative</td>
<td>Negative</td>
<td>Not included</td>
<td>Not included</td>
</tr>
<tr>
<td>Loan repayment</td>
<td>Negative</td>
<td>Not included</td>
<td>Not included</td>
<td>Not included</td>
</tr>
<tr>
<td>Interest payment</td>
<td>Negative</td>
<td>Not Included</td>
<td>Not Included</td>
<td>Not Included</td>
</tr>
<tr>
<td>Foregone earnings</td>
<td>Negative</td>
<td>Negative</td>
<td>Not included</td>
<td>Not included</td>
</tr>
<tr>
<td>Taxes</td>
<td>Negative</td>
<td>Negative</td>
<td>Positive</td>
<td>Not included</td>
</tr>
<tr>
<td>Positive Externalities</td>
<td>Not included</td>
<td>Not included</td>
<td>Not included</td>
<td>Positive</td>
</tr>
<tr>
<td>Negative Externalities</td>
<td>Not included</td>
<td>Not included</td>
<td>Not included</td>
<td>Negative</td>
</tr>
</tbody>
</table>

*Source: Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen’s University, Kingston, Canada.*
Inflation in the Financial Analysis

Much of the published literature on economic project evaluation recommends the exclusion of inflation from the appraisal process. At best, these methods only account for projected changes in relative prices of inputs and outputs over the life of the investment. However, experience with projects suffering from financial liquidity and solvency problems has demonstrated that inflation can be a critical factor in the success or failure of projects. Correctly designing a project to accommodate both changes in relative prices and changes in the rate of inflation may be crucial for its ultimate survival.

Improper accounting for the impacts of inflation when conducting the financial analysis could have detrimental effects not only on the financial sustainability of a project but also on its economic viability. Assumptions regarding inflation will have a direct impact on the financial analysis of the project and may require adjustments in operating or investment policies. Since an inadequate treatment of inflation may adversely affect the financial sustainability of the project, ultimately the economic viability of the project may be compromised if inflation is not accounted for properly and the necessary adjustments made.

It is important to realize that the ultimate analysis of financial cash flows should always be carried out in a statement prepared in real terms (i.e. net of inflation). It is not easy to analyze nominal (current) prices or nominal net cash flows as one will be attempting to understand figures that reflect two changes: changes in the real price and changes in the general price level (i.e. inflation). The correct treatment of inflation requires that preparatory tables be made using nominal prices, and at the very end cash-flow statements prepared in nominal prices be deflated to obtain the cash-flow statements in real prices.

When the sponsoring agency prepares the cash-flow statement, certain variables such as tax liabilities, cash requirements, interests and debt repayments need to be estimated, in current prices, for the years they are to be incurred in. Other variables making up the cash-flow statement are also presented in current prices and initially cash flows in current prices are developed. These cash flows are later deflated and presented in real prices. By constructing the financial analysis in this manner, we ensure that, first, all the effects of inflation are consistently reflected in the projected variables, and, second, that all variables are deflated by the projected increase in the general level of prices.

The steps required to carry out the inflation analysis are as follows:

1. Estimate the future changes in the relative prices for each input and output variable. This will involve the examination of the present and future demand and supply forces that are expected to prevail in the market for the item. For example, an examination of the real prices of many minerals will indicate that they have been dropping a few percentage points a year over the past decade. Real wages, on the other hand tend to increase over time as the economy grows.
2. Estimate or develop a set of assumptions concerning the expected annual changes in inflation over the life of the project.
3. Determine what the nominal rate of interest will likely be over the lifetime of the project given the expected changes in the price level estimated above.
4. Combine the expected change in relative prices with the expected change in the rate of inflation to give the expected change in the nominal price of an item.
5. Multiply the nominal prices for each item by the projections of quantities of inputs and outputs through time to express these variables in the current year's prices of the period in which they are expected to occur.

6. Begin the construction of a cash-flow statement using the current (nominal) values for the inputs and outputs.

7. Construct a profit and loss statement for each year of the project's life to determine income tax liabilities with all variables expressed in their nominal values. Depreciation expenses, cost of goods sold, and interest expenses and income tax liabilities are estimated according to the taxation laws of the pertinent country. The estimated income tax liabilities are included in the cash-flow statement.

8. Estimate cash requirements and any changes in the stock of cash that are reflected in the cash-flow statement.

9. Determine financing requirements, along with interest payments and principal repayments, and include these items in the cash-flow statement. This completes the construction of the projected variables in terms of their current (inclusive of inflation) values. Now we have a cash-flow statement in current prices from the owner’s point of view.

10. Deflate all items in the owner’s cash-flow statement by the inflation price index to arrive at real values for the cash-flow statement. Note that loans, interest payments, and loan payments are included at their deflated values in the determination of cash flow in real prices.

11. Discount the net financial cash flow to the owners of the enterprise by either the real (net of inflation) private opportunity cost of equity financing (if it is a private owner) or by the target financial rate of return (net of inflation) set by government (if it is a public-sector enterprise).

12. Estimate the net financial cash flow from the point of view of the total invested capital. In this case, loans, interest and principal payments do not enter into the calculation of the net financial cash flow.

13. Calculate the net financial cash flow from other points of view if necessary (budget, etc.).

When the financial analysis is carried out in terms of real prices, it is essential that the private opportunity costs of capital or the target financial rates of return used as discount rates be expressed net of any compensation for the expected rate of inflation. In other words, these discount rates must be real, not nominal variables.

It should be noted that the real financial prices for the input and output variables developed above are used as the base on which to estimate economic values for the benefits and costs of the project. Once these economic costs and benefits are estimated, an economic resource-flow statement is constructed. The structure of the statement should be similar to that of the financial cash-flow statement. Finally, the difference between the two statements is analyzed to determine the distributional impacts of the project.

4.2. Economic Analysis

The economic analysis is similar to the financial analysis in the sense that it also measures changes in the wealth generated by a project. However, economic analysis is concerned with society as a whole and not only with the welfare of the owners of the project. Here, the
starting point for economic analysis is the incremental expected net cash flows to total capital from the financial analysis.

When the markets for outputs and inputs are perfectly competitive and when there are no other reasons for economic externalities to exist, market prices will measure economic prices. Under these conditions, and where a project introduces only small changes in the demand for its inputs and in the supply of its outputs, the financial analysis of a project will serve as a good proxy for the economic analysis.

But in the majority of cases, these requirements are not satisfied. Then market prices no longer provide a reliable measure of marginal economic benefits or costs. Economic analysis requires that a series of adjustments be made to convert estimates of incremental cash receipts into incremental economic benefits and estimates of incremental cash disbursements into incremental economic costs. These adjustments are based on the three basic postulates of applied welfare economics (Chapter 1), used to measure economic benefits and costs and then to add them up.

The market distortions referred to externalities like taxes, subsidies, trade tariffs, price controls, monopoly markets, environmental impacts (such as pollution or congestion), and open access or common property situations. Also, it is necessary to take into account externalities in the price of capital (discount rate), in the price of foreign exchange (because of trade distortions and controls in the foreign exchange markets), and in the labor market (where the financial wage rate may be different from the economic price of labor).

The Conceptual Framework for Project Appraisal is developed in the Annex N°1.

**Steps in Economical Analysis**

As in the case of financial analysis, economic analysis strongly depends on the proper construction of an economic resources statement (ERS). The steps to conducting an ERS are the following.

*Identification of Economic Costs and Benefits*

At this stage, all the benefits generated by the project to society are recognized. The sponsoring agency should consider not only those benefits that are generated in the same market services or products (direct benefits) but the benefits generated in a related market (secondary and indirect benefits and positive externalities). Similarly, all the costs should be recognized, considering the direct costs plus the costs imposed on the rest of society (secondary and indirect costs and negative externalities).

At this level of analysis, it is sufficient to describe the benefits and costs involved, and the focus will be to list as many of these.

*Quantification and Valuation of Economic Costs and Benefits*

This step requires the appropriate allocation of benefits and costs in measurement units. Quantification of direct costs is generally the easiest task at this stage, as it only requires adequately estimating the physical requirements of each type of input used in the implementation of the project (investment) as well as the operational and maintenance cost. The valuation of these costs does not present major difficulties, since for most of the resources used in the project there are clearly defined markets with prices that can be used.
The quantification of economic benefits, particularly positive externalities, is a complex task that requires different studies, establishing numerical relationships between resource availability and consumption of goods.

This also applies to the quantification and valuation of indirect, incidental costs and externalities, which must be analyzed case by case depending on the available information.

**Economic (Shadow Prices) and Conversion Factors**

For the purposes of economic analysis, costs and benefits are estimated using the three postulates of efficiency approach. The first postulate states that the competitive demand price for a given unit of an item measures the value of that unit to the demander and is otherwise known as the willingness to pay by the demander. The second postulate states that the competitive supply price for a given unit of a good or service measures the value of that unit to the supplier and is otherwise known as the concept of opportunity cost. The economic prices of goods and services used for economic analysis are derived by adjusting the market or financial prices for distortions. Financial prices are used to construct financial cash flows and are essentially the starting point for conducting the appraisal of any project. Thus, it is imperative to develop a strong financial analysis before proceeding to undertake the economic appraisal. The third postulate states that costs and benefits are added up without concern for who gains and who loses; in other words, a “Jordan Dinar” is valued at a “Jordan Dinar”, regardless of whether the benefit accrues to a high-income person or a low-income person. From this principle, the net economic benefit of the project is measured simply by subtracting the total resource costs from the total benefits of the project’s output.

In order to get these true economic values, the project formulator needs to know:

1. Whether the goods are tradable or non-tradable.
2. How distortions such as tariffs, taxes, and subsidies create a wedge between the market and the economic exchange rates and how these distortions also create a divergence between the economic and financial values of both the tradable and non-tradable inputs and outputs of the project.
3. How the transportation and handling costs of inputs and outputs affect the true economic values of goods and services used and produced by a project.

As such, the concept of a conversion factor, defined as the ratio of the economic price to the financial price, plays an important role in looking at the financial and economic costs or benefits of a project. If the conversion factor specific to the project’s inputs and outputs and the economic costs of capital and foreign exchange are known, it is easy to translate the financial appraisal of a project into its economic valuation. For a given good or service, the term commodity specific conversion factor (CSCF) is used. While commodity specific conversion factor values may be different when calculated at project sites, economic parameters such as economic cost of capital and foreign exchange are national parameters that remain constant, at a given time, across projects in the overall economy.

If there are no distortions in the supply and demand market of a commodity, the CSCF will simply be 1 because the economic and financial prices are the same. If the market for foreign exchange is distorted, the market exchange rate (Em) or the official exchange rate (OER) will not accurately reflect the economic value of a unit of foreign exchange in relation to the domestic currency. Thus, it is essential to make an adjustment for the
divergence between the market or official price of foreign exchange and its economic price, also referred to as the economic exchange rate (Ee) or sometimes as the shadow exchange rate (SER).

In summary, the steps required to carry out economic analysis are as follows:

1. Estimate the CSFC for all the prices of inputs and outputs involved in the evaluation.
2. Estimate the future changes in the relative prices for each input and output variable. This will involve the examination of the present and future demand and supply forces that are expected to prevail in the market for the item.
3. Multiply the economic prices for each item by the projections of quantities of inputs and outputs through time to express these variables in the current year's prices for the period in which they are expected to occur.
4. Begin the construction of a resource-flow statement using the current values for the inputs and outputs.
5. Discount the net economic resource by the economic opportunity cost of capital.
6. Conduct the sensitivity analysis.

4.3. Uncertainty Analysis

Generally, when evaluating investment projects, it is assumed that the variables used have a deterministic character. However, there are a number of variables in all infrastructure investment projects that do not behave this way. There are variables whose value cannot be accurately predicted, but there is some uncertainty in their estimation.

The benefits and costs of the projects are not immediate but are distributed over time. This means each variable related to the calculation of a project’s profitability should be estimated by models, which leads to uncertainty in the estimation of the variable. In addition, the models must incur higher costs as a result of the acquisition of information to make reliable estimates.

This uncertainty may come from two main sources. The first is the fact that there are contingencies whose occurrence will affect the project, both internally and externally. The second source of uncertainty is in the process of evaluating the project itself. This uncertainty arises either because the available information about variables, such as prices, demand elasticity and other factors, or the methodologies to estimate them, are not able to reflect perfectly the preferences of people. Another source of uncertainty arises from the existence of human factors such as errors in estimating demand, project design or in the modeling of the project.

A traditional cash-flow analysis assumes single (deterministic) values for all of the variables. The outcome of that analysis is a point-estimate of a project’s indicators, as NPV or its IRR, and a decision about whether to accept a project is made on that basis. More realistically, however, we know that values for most project variables are subject to change and are difficult to predict. While the past values of a particular variable are known with certainty, predicting future values is a different matter. It is more likely that the correct range of future values for a variable will be forecasted rather than its exact value. Given that there are probabilities attached to the possible values of a variable in a given range, there is a good chance that the value that occurs will be other than the one we have chosen.
However, there are several factors that introduce uncertainty in the economic evaluation of an investment project, affecting in different ways NPV calculation. For example, in the initial investment there is a potential source of uncertainty about the duration of the works and the difference between actual and expected costs, etc. Also, the net social cost at any time (period "t") is unknown and it can change because of modifications in the estimated population growth, income or price of certain inputs (oil prices, labor, materials, energy, wages, prices, among other things). There may also be uncertainty caused by the modeling itself.

As explained in the work of Rus, Betancor and Campos (2006), there are several factors listed below that introduce uncertainty in the economic evaluation of an investment project, affecting in different ways the NPV calculation. The NPV is calculated by the following expression:

\[
\text{NPV} = C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + ... + \frac{C_n}{(1+r)^n}
\]

In the component \((C_0, \text{initial investment})\), have potential sources of uncertainty as the duration of the works, the difference between actual and expected costs, etc. The term \(C_t\) (net social cost in the time period "t") is unknown and it can vary because of changes in the estimated population growth, income or price of certain inputs (oil prices, labor, materials, energy, wages, prices, among others). There may also be uncertainty caused by the modeling itself.

Each of these sources of uncertainty has a different impact on the possible final values of the NPV of a project. Therefore, and due to the impossibility of knowing with certainty every one of the random variables involved in a project, it is necessary to follow a rigorous process of modeling uncertainty, and risk analysis allows efforts to be focused on those elements whose relative effect is greater.

The fact that project variables have ranges of possible values with their associated probability distributions means that project NPVs will also have a range of possible values rather than a single value. Any judgment based on deterministic future values of project variables and a single value of NPV calculated on the basis of those variables is most likely to be incorrect. In fact, the only certainty in project analysis is that the estimated NPV from a set of deterministic future values of project variables will never occur in real life. This makes the outcome of projects and project analysis very uncertain. In this kind of world of uncertainty, it is unrealistic to work with deterministic values of variables affecting a project. It is only possible to work with probabilistic values of project variables that will yield expected values of the NPV and with probabilities of achieving a higher or lower level of NPV. Outcomes will have a range of values and therefore variability in results. Risk analysis is concerned with how to identify risk variables, analyze a project, and interpret the results in the presence of uncertainty.

To face the problem of the uncertainty inherent in the relevant variables in the calculation of the profitability of a project, the formulator can use three methods:

1. Sensitivity analysis.
2. Scenario analysis.
3. Monte Carlo analysis.

Because of the complexity of risk analysis, it is recommended that the sensitivity analysis and the scenario analysis be used in the first steps of investment project appraisal. Both methods will be explained in the following sections. However, the Monte Carlo analysis should be incorporated further along the project appraisal process in the updated versions of these guidelines.

**Sensitivity Analysis**

The sensitivity analysis is a means of testing how sensitive a project’s outcomes (cash flows, NPV or IRR) are to changes in one parameter value at a time. Sensitivity analysis is often referred to as “what if” analysis, such as, “What would happen to the NPV if some variable changes by a certain amount or percentage?”

Sensitivity analysis is conducted as follows:

Step 1: Based on expectations of future values, or the deterministic analysis, estimate the cash flows and NPV of a project. This is called the base-case analysis.

Step 2: Sensitivity analysis can be conducted on either the values of the variables or on the assumptions that underpin the values that were estimated. The variables could be specific to the project or broader macroeconomic variables.

Step 3: While holding other values constant, let the base-case value of each of the variables change by (say) 10 per cent, and calculate the percentage change in the NPV. The resulting number measures the degree of sensitivity of the NPV to changes in each variable, while holding other variables constant.

For the variables that cause the greatest change in the NPV, calculate what happens to the NPV as values for one variable at a time change over their likely range. If the NPV turns negative after only a small change in a variable, then it may signal the need either to reject a project or to take some mitigating action before the project is initiated.

Step 4: The results can be recorded in a table or graph where it is relatively easy to spot the key risk variables.

The variables that are an important source of risk are generally those that satisfy two criteria:

a. They represent a large share of cash receipts (benefits) or cash disbursements (costs).

b. The range of their possible values is quite wide.

Even though a variable could have quite a wide range of values, its variation is unlikely to be of major significance for the NPV unless it also represents a significant share of the benefits or costs. Similarly, a variable could constitute a large proportion of benefits or costs, but it will not be a major source of risk unless it is expected to vary considerably. A variable whose value is fixed is not going to be a source of risk.

However, sensitivity analysis has a number of limitations:
a. Although Step 3 above took some account of the likely range of values for a variable, there are no probabilities attached to the values in a range. As a result, sensitivity analysis does not recognize that some values are more likely to occur than others.

b. The second limitation is that variables are altered one at a time without taking into account any relationship (correlation) between variables. This shortcoming can be rectified by conducting the scenario analysis on revenues rather than selling prices, or by directly taking any correlation with units sold into account, or by using Monte Carlo analysis, properly adjusted to make allowances for the correlation.

c. Third, how the results of a sensitivity analysis are viewed depends on the risk preferences of investors or analysts. For these reasons, it is difficult to derive a general decision rule about whether to accept or reject a project based on sensitivity analysis.

**Scenario Analysis**

The scenario analysis deals with a major limitation of the sensitivity analysis, that is, the individual variation in variables. This tool recognizes that one-at-a-time testing of variables is not realistic on account of the interrelation between variables, so it provides consistent scenarios in variations of a group of variables together. Scenario analysis then solves this interrelation by allowing a number of variables to be altered in a consistent manner at the same time.

Scenarios can be based on macroeconomic factors like the performance of the economy (e.g., expansion, normal, recession), industry-specific factors like the behavior of competing firms, or project-specific factors like the possibility of a technological breakthrough. Scenario analysis is conducted as follows:

**Step 1:** Identify the key sets of circumstances, usually based on major sources of uncertainty, that are likely to determine the success or failure of a project. Define the scenarios accordingly, e.g. a) worst (pessimistic) case; b) expected (best-guess) case, which is often the base case; and c) best (optimistic) case.

**Step 2:** The values of each of the variables in the financial analysis are adjusted to be consistent with each scenario.

**Step 3:** Calculate the NPV for each scenario. In some cases the interpretation of the results is easy. For example, if the NPV is positive even in the worst case, accept the project; if the NPV is negative even in the best case, reject the project. However, if the NPV is sometimes positive and sometimes negative, the results are more difficult to interpret, but at least a decision can be made from the knowledge of the “downside” and “upside” risk potential.

Although scenario analysis allows for interrelationships between variables, it usually does not take into account the probabilities associated with each scenario. Probabilities could be assigned, but they are likely to be highly subjective and could be biased either in favor or against a project.

The scenarios themselves are likely to be discrete rather than continuous. This presents no problem in some cases where an event either happens or does not happen, but in others the scenarios that are defined may not fully reflect all of the possible situations that could arise, for instance, the full range of possible rates of growth for real GDP.
The main limitation of this method is that it does not allow the representation of the probability of occurrence of each of the proposed scenarios, so that while delivering as much information as the sensitivity analysis (considering the correlation between different variables) it cannot be enough, since the number of variables and values for each that can be tested is limited.

The integration of the financial analysis, economic analysis and risk (uncertainty) analysis is shown in Figure N°4.2.

**Figure N°4.2. The Integrated Project Analysis**

Source: Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen’s University, Kingston, Canada.

### 4.4. Cost-Effectiveness Analysis

This is an appraisal technique primarily used in social-sector infrastructure projects, where it is difficult to quantify and valorize benefits in monetary terms. For instance, when there are two or more alternative approaches to improving the nutrition levels among children in a community, the selection criterion could simply be to select the alternative that has the least cost. The benefits in such cases are treated as identical and, therefore, it is not necessary to quantify them or place a monetary value on them. This approach is also useful for choosing among different technologies providing the same services (for example, when there are two alternative technologies related to the supply of drinking water or the generation of electricity).

In applying the cost-effectiveness approach (CEA), the present values of costs (PVC) have to be computed. While using the CEA, it is important to correctly estimate the salvage values at the end of the projects and to choose the discount rate carefully. The preferred outcome may clearly change with a change in discount rate. The rate at which the two alternatives are the same is referred to as the “cross-over discount rate”.

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**Table of parameters**

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**Financial Analysis**

**Economic Analysis**

**Conversion Factors**

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**Assumptions**

**Sales**

**Invest. Costs**

**O&M Costs**

**Benefits**

**Invest. Costs**

**O&M Costs**

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**Source**: Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen’s University, Kingston, Canada.
The CEA can be used in two forms. First, the “constant effects” method, in which the least cost alternative that provides a stated level of benefits, including intangible benefits, is chosen. Second, the “constant cost” method, in which the cost per unit of benefit, called the cost-effectiveness ratio, is calculated. In the latter approach, it is necessary to quantify benefits although there is no need to put a monetary value to them. For instance, reducing X number of sick days per Le. 10,000 of investment by opening a primary health center in a community, without putting a monetary value to the benefits of reducing one sick day. The alternative that minimizes the discounted present worth of cost per unit or maximizes the discounted present worth of units of output per unit of invested currency is the better alternative.

It may be noted that the CEA does not need an estimation of benefits and by the same token it cannot give a measure of the worth of a project or program.

4.5. Final Comments

This chapter presents a conceptual framework for the comprehensive analysis of public infrastructure projects that is concerned not only with the economic aspects of such projects but with other factors, both economic and financial, that determine the success of a project.

The components of the proposal to be developed and the depth with which they are addressed through integrated assessment are specific to the project in question and the context in which it develops. A financial analysis should be performed whenever there is the possibility that a private investor is interested in implementing the project, either because there is evidence about similar projects or because the project is associated with the sale of products or services that are traded in the market.

The method used to perform the economic analysis depends on the amount and quality of information that is available. The CBA is the preferred method and should be used whenever possible to quantify and value the benefits associated with a project. The CEA will be used when there is not enough information to value the benefits associated with a project, when the task is very expensive compared with the benefit of having this information (i.e. the cost of a full cost–benefit analysis cannot exceed the value that is assigned to less uncertainty about the wealth generated by the project to society) or where it is not desirable to make such estimates (i.e. about education and health projects).

Finally, it should be noted that the financial and economic analyses represent a guide for decision makers and do not represent a decision in themselves. The evaluation approaches proposed above are just an input to the policy process that the projects undergo.
Annex N°4.1 – Conceptual Framework for Project Appraisal

Applying the Three Postulates of Harberger

The framework for analyzing the economic benefits and costs for public investment projects is based on the three postulates of Harberger (seen in Chapter 2). The demand curve of a good shows the maximum price that consumers are willing to pay for successive units of the good given the prices of all other goods and services, and the income of consumers. If the market-determined price of the good is \( P_m \) and the quantity consumed at that price is \( Q_m \), then the economic benefit of the last (marginal) unit consumed is \( P_m \) but the benefits of earlier (infra-marginal) units will be greater than \( P_m \). Applying the first postulate, the benefits of the successive units consumed are determined by the corresponding prices on the demand curve. Consequently, the economic benefit of the output of this industry (the quantity \( Q_m \)) is given by the area \( P_{\text{max}}OQ_mC \). Figure N°4.1.1(a).

On the other hand, the supply curve or marginal-cost curve reflects the resource cost for producing successive units of the good. At the market-determined price, \( P_m \), the quantity \( Q_m \) is produced. While the resource cost of the marginal unit produced is \( P_m \), that of each of the inframarginal units is less than \( P_m \). Following the second postulate of Harberger, the economic resource cost of producing \( Q_m \) is \( OECQ_m \).

Following the third postulate, economic costs and benefits can be added to determine the net gain or loss in this industry. Since the benefits are represented by the area \( P_{\text{max}}OQ_mC \) in Figure N°4.1.1(a) and the costs are given by the area \( OECQ_m \) in Figure N°4.1.1(b), the net economic benefit is given by the triangle \( P_{\text{max}}EC \) in Figure N°4.1.1(c).

**Figure N°4.1.1 Demand and Supply Curves and Benefits and Cost**

(a) Total Economic Benefit  
(b) Total Economic Cost
The only price observable in the market is $P_m$, and all $Q_m$ units are bought and sold at this price. Consumers value each unit they consume at its corresponding price as given by the demand curve, but they pay less than that price for all units consumed except the last one. This difference between what consumers value the output at and what they actually pay for is a net gain to consumers and is known as consumer surplus. Consumers pay an amount equal to $O P_m C Q_m$ but enjoy a gross benefit of $P_m^\max O Q_m C$.

The fact that all units are sold at a price, $P_m$, implies that industry revenues, $O P_m C Q_m$, are larger than the economic costs, $O E C Q_m$. The excess of revenues over resource cost, the triangle $E P_m C$, represents a net profit to the owners of the factors of production. This difference is known as the economic rent or producer surplus. It now becomes evident that the net economic benefit in this industry as determined using the three postulates is shared between the owners of the industry and its consumers.

**Measuring the Effects of the Project in Undistorted Markets**

Consider the case of a project that produces a non-tradable good such as concrete. Figure N°4.1.2 shows the supply and demand for this non-tradable good. The industry demand and supply curves prior to the introduction of the new project are denoted by $D_0$ and $S_0$ respectively. The new project produces a quantity $Q_p$ and results in a shift in the industry supply curve from $S_0$ to $S_0 + P$. The additional supply by the project results in a drop in the market price from $P_m^0$ to $P_m^1$. As a result of the decrease in price, consumers demand more and total consumption increases from $Q_0$ to $Q_{d1}$. Also due to the decline in price, existing suppliers will cut back their production from $Q_0$ to $Q_{s1}$ as some of them can no longer supply the same amount of the good at the new (lower) price, $P_m^1$. $Q_p$, the quantity produced by the project, equals the sum of the two quantities, $Q_0 - Q_{d1}$ and $Q_0 - Q_{s1}$.
Since the project sells its output at the new prevailing market price, $P_{m1}$, the gross financial receipts to the project are given by $(Q_p \times P_{m1})$, which is area $Qs_{1}ACQ_{d1}$. To estimate the **gross economic benefits** of the project, it is necessary to determine the economic value of the new consumption to the demanders, and the value of the resources released by existing suppliers. These values are estimated using the first two postulates as follows:

i) The additional consumption is valued, according to the first postulate, by the demand price for each successive unit, or by the area under the demand curve $(Q_0BCQ_{d1})$.

ii) The resources released by other producers are valued, according to the second postulate, by the supply price (resource cost) of each successive unit or by the area under the supply curve $(Q_0BAQs_{1})$.

The gross economic benefits are given by the sum of the two areas above $(Qs_{1}ABCQ_{d1})$. It is important to emphasize that these benefits are gross (they have not yet been netted from the economic costs of producing these goods). The positive gross benefits alone do not indicate whether the project is economically viable or not, in the same way as positive gross financial receipts do not indicate whether the project is financially profitable or not.

It is often the case that the quantity produced by the project is relatively small compared to the size of the market and there is no change in the market price. In such a situation, and given that we are operating in an undistorted market, the gross financial receipts will be equal to the gross economic benefits. In other words, there is no difference between the financial revenues generated by a project and its economic benefits to the society. The difference arises only when the project has a huge impact on the industry.

The following example demonstrates how the **economic cost** of a non-tradable item demanded by a project can be estimated using the three postulates. The industry demand
and supply curves without the additional demand by the new project are denoted by D0 and S0 respectively (Figure N°4.1.3). The new project demands a quantity Qp and results in a shift in the industry demand curve from D0 to D0 + P. The additional demand by the project results in a rise in the market price from Pm0 to Pm1. As a result of the increase in price, existing consumers will cut back their consumption from Q0 to Qd1 and producers will increase their production from Q0 to Qs1 at the new (higher) price Pm1. Qp, the quantity demanded by the project, equals the sum of the two quantities Q0-Qd1 and Q0-Qs1.

The project buys its requirement at the new prevailing market price, Pm1, and incurs a gross financial expenditure of (Qp×Pm1), which is the area Qd1CAQs1. To estimate the gross economic costs of the input demanded by the project, it is necessary to determine the economic value of the consumption that is foregone by the existing consumers, and the value of the additional resources utilized to accommodate the project’s demand. These values are estimated using the first two postulates as follows:

i) The cutback in consumption is valued, according to the first postulate, by the demand price for each successive unit given up or by the area under the demand curve (Q0BCQd1).

ii) The additional resources used to accommodate the expansion in output are valued, according to the second postulate, by the supply price (resource cost) of each successive unit or by the area under the supply curve (Q0BAQs1).

**Figure N°4.1.3 Economic Cost of an Input Demanded by a Project in an Undistorted Market**

*Source: Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen’s University, Kingston, Canada.*

The gross economic cost for this input is given by the sum of the two areas above (Qs1ABCQd1). By determining the economic cost of each input used by the project in a similar way, and the economic benefit of its output as outlined above, we will be in a position to determine the economic viability of the project by subtracting all economic costs from the gross economic benefits.
Box A.1 Tradable and Non-Tradable Goods

A good or service is considered **tradable** when an increase in demand (supply) by a project does not affect the amount demanded (supplied) by domestic consumers (producers). The increase in demand (supply) by a project is eventually reflected as an increase/decrease in imports or a decrease/increase in exports, depending on whether the project is demanding or supplying the importable or exportable commodity. Importable goods include imported goods and all goods produced and sold domestically that are close substitutes for either the imported goods or potentially imported goods. Exportable goods include exported goods and domestic consumption of goods of the same type or close substitutes for the exported goods. An increase in demand for an importable commodity as a result of a project results in an increase in demand for imports. An increase in demand for an exportable commodity as a result of a project results in a reduction in exports.

A commodity or service is **non-tradable** from a country’s point of view if its domestic price lies above its FOB export price or below its CIF import price. The international transportation cost may be very high compared to the value of the product so that no profitable trade is feasible. Alternatively, an importable good will become non-tradable if it receives such a high level of protection in the form of trade quotas or prohibitive tariffs that no import transactions will take place.

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**Measuring the Effects of the Project in Distorted Markets**

In general, the markets for a project’s outputs or inputs are distorted. In the presence of external effects, the estimation of the economic costs and benefits, as well as the distributional impacts, will be slightly more involved. With the introduction of distortions in the form of taxes and subsidies, another stakeholder enters the picture, the government. Consequently, when estimating the economic costs and benefits of goods and services in distorted markets, additional benefits or costs are to be expected, and new players added to the list of beneficiaries or losers affected by the project.

**Consider a market for an industry’s output, distorted by a value-added tax (VAT).**

The tax will drive a wedge between the maximum price that consumers are willing to pay for successive units of the good and the net of tax (effective demand) price they pay to the supplier (Figure N°4.1.4). D0 is the gross-of-tax (undistorted) demand curve that measures consumers’ willingness to pay, and D0+net is the net-of-tax or effective demand curve that reflects the prices consumers are prepared to offer producers. D0+net lies to the left of the original curve, D0, because the prices that consumers are prepared to offer to suppliers for successive units of goods are now reduced by the amount of the VAT. The market-clearing price, Pm0, and quantity, Q0, are determined by the intersection of the net-of-tax demand curve, D0+net, and the supply curve, S0, as shown in Figure No.4.1.4. While suppliers receive Pm0, which is equal to the resource cost of the marginal unit produced, consumers have to pay VAT in addition to the market price Pm0. Thus the price that consumers pay is Pd0.

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14 FOB price implies “free-on-board” export price and is the price of a good at the Jordan border before it is shipped abroad. Thus it includes transportation and handling in moving the good to the port. CIF price implies “costs of insurance and freight” import price and is the price at the border before any transportation and handling is incurred to move the good inland, to the project site.
The above situation depicts the market without the new project. To determine the gross economic benefits of a new project in this market, it is necessary to follow the same logic and mechanics used to estimate the economic value of a project’s output in an undistorted market. The new project produces a quantity Qp and results in a shift in the industry supply curve from S0 to S0+P. The additional supply by the project results in a drop in the market price from Pm0 to Pm1 and subsequently in the demand price from Pd0 to Pd1. As a result of the decrease in price paid by consumers, they increase their consumption from Q0 to Qd1. Also due to the decline in price, existing suppliers will cut back their production from Q0 to Qs1 as some of them can no longer supply the same amount of the good at the new (lower) price, Ps1. Qp, the quantity produced by the project, equals the sum of the two quantities Q0-Qd1 and Qs1 – Q0.

Since the project sells its output at the new prevailing market price, Pm1 (which is also equal to the new supply price, Ps1), the gross financial receipts to the project are Qp × Ps1. To estimate the gross economic benefits of the project, it is necessary to determine the economic value of the new consumption level to the demanders, and the value of the resources released by existing suppliers. Following the first postulate, the value of additional consumption is measured by the area under the undistorted (gross-of-tax) demand curve – the area Q0BCEFDQd1. Following the second postulate, the value of resources freed is measured by area under the supply curve – the area Q0BAQs1. The gross economic benefits are the sum of these two areas: Qs1ABCEFDQd1.

From a distributional perspective, it is interesting to determine who has gained and who has lost as a result of the project. The gross economic benefits can be broken down into the gross receipts, net of VAT, to project owners (Qs1AFQd1), the gain in consumer surplus...
Consider a market for one of the project’s inputs, **distorted by a subsidy**. The subsidy will drive a wedge between the true resource cost of the successive units of the good and the prices that suppliers are now willing to charge consumers (Figure N°4.1.5). $S_0$ is the before-subsidy supply curve, which measures the true resource cost of the units produced; and $S_0$ after subsidy is the after-subsidy supply curve that reflects the prices that suppliers are prepared to charge consumers. $S_0$ after subsidy lies to the right of the original curve, $S_0$, because the prices that suppliers are willing to charge consumers for the successive units of the goods are now reduced by the amount of the subsidy they receive from the government. The market clearing price, $P_m0$, and quantity, $Q_0$, are determined by the intersection of the after-subsidy supply curve, $S_0$ after subsidy, and the demand curve, $D_0$, as depicted in Figure N°A.3.5. While consumers pay $P_m0$, which is equal to their willingness to pay for the marginal unit consumed, producers will receive a government subsidy in addition to the market price, $P_m0$, they receive from consumers. The price per unit that suppliers finally receive (which also reflects the resource cost of the marginal unit) is $P_s0$.

Now suppose a project demands an input in this market. The former logic is used to determine the gross economic costs of this input. The new project demands a quantity, $Q_p$, and results in a shift in the industry demand curve from $D_0$ to $D_0+P$. The additional demand will bid up the market price of the input from $P_m0$ to $P_m1$ and subsequently the supply price from $P_s0$ to $P_s1$, as shown in Figure N°4.1.5. The increase in price will result in additional production by suppliers from $Q_0$ to $Q_s1$, and a cutback in consumption by the existing demanders from $Q_0$ to $Q_d1$. Therefore, $Q_p$, the quantity demanded by the project, equals the sum of the two quantities $Q_d1 – Q_0$ and $Q_0 – Q_s1$.

**Figure N°4.1.5. Economic Cost of Input Demanded by a Project in a Distorted Market**

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Source: Jenkins, G., Harberger, A., Kuo, Ch. (2013). Cost-benefit analysis for investment decisions, the integrated analysis of investment projects. Queen’s University, Kingston, Canada.
The economic cost of the project’s input is measured by the value of the additional resources used to accommodate the expansion in production from Q0 to Qs1, and the value of the cutback in consumption by existing consumers. Following the second postulate, the value of additional resources used is measured by the area under the before-subsidy supply curve – the area Q0BCEFQs1. Following the first postulate, the value of the postponed consumption by other demanders is measured by the area under the demand curve – the area Q0BAQd1. The gross economic cost is the sum of these two areas: Qd1ABCEFQs1.

For the distributional analysis of the project’s demand, it can break down the economic costs of the input into its financial expenditures – after subsidy – paid by the project (Qd1AFQs1); the loss in consumer surplus (Pd1ABPd0); the gain in producer surplus (Ps0CEPs1); and the loss in government expenditures on the subsidy (Pd0BCPs0–Pd1FEPs1).

The analyses presented here are carried out under the assumption that despite the distortions that might exist in the form of taxes and subsidies, or that can be expressed as a tax or a subsidy in the markets for these non-tradable goods or services, there are no quantitative restrictions on the demand for or supply of these goods or services.

The same analyses apply when instead of distortions such as taxes and subsidies, the market has externalities as external effects in consumption or in the production of goods and services.
5. PROJECT EVALUATION CRITERIA

The financial and economic attractiveness of a project is determined by the net present value of its incremental net cash or resource flows. The net present value criterion is widely accepted by accountants, financial analysts, and economists as the only one that yields correct project choices in almost all circumstances. However, some investors have frequently relied upon other criteria such as a project’s internal rate of return and the benefit–cost ratio.

5.1. The Discount Rate

Investment decisions are fundamentally different from consumption decisions because the former have a time dimension. For example, land and capital equipment are purchased at one point in time, and they are expected to generate net cash flows, or net economic benefits, over a number of subsequent years. To determine whether the investment is worthwhile, it is necessary to compare benefits and costs, which occur in different time periods.

The time dimension of a project’s net cash/resources flows and net economic benefits can be captured by expressing values in terms of either future or present values. The discount rate is a key variable in applying any one of the two major investment criteria for project selection: net present value or internal rate of return. Its correct choice is critical given the fact that a small variation in its value may alter the results of the analysis completely and affect the final choice of project.

The rate of discount, stated in simple terms, is the cost of funds that are invested in the project. In financial analysis, the discount rate depends upon the point of view of analysis. In the economic analysis of a project, the relevant cost of fund is the economic opportunity cost of capital (EOCK) to the country. From the point of view of the economy, the funds are generally drawn from three sources. First, funds that would have been invested in other investment activities and have now been displaced by the project (the cost of these funds would be the return that would have been earned on the alternative investments which are now foregone). Second, funds come from different categories of savers in the economy who postpone their consumption in the expectation of getting a return on their savings (the cost of this part of the funds is the cost of postponing consumption and this is reflected in the interest rate that the savers earn). Finally, some funds may be coming from abroad, that is from foreign savers (the cost of these funds would be the marginal cost of foreign borrowing). The EOCK will simply be a weighted average of the costs of funds from three sources outlined above: rate of return on postponed investments, the rate of interest on domestic savings, and the marginal cost of additional foreign capital inflows.

5.2. The Net Present Value Criteria

The Net Present Value (NPV) is the algebraic sum of the present values of the incremental expected positive and negative net cash flows over a project’s anticipated lifetime. If this sum is equal to zero, investors can expect to recover their incremental investment and to
earn a rate of return on their capital equal to the private discount rate used to compute the present values\textsuperscript{15}.

An NPV greater than zero means that investors can expect not only to recover their capital investment and to earn a rate of return equal to the discount rate, but also to receive an addition to their real net worth equal to the positive amount of the NPV. Only projects with positive NPVs are going to be beneficial and hence attractive to private investors. They are unlikely to pursue a project with a negative NPV unless there are strategic reasons.

The formula for computing the NPV of expected incremental net cash flows over \( n \) time periods with annual discounting is:

\[
NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t}
\]

Where:

The incremental net cash flows \((CF_t)\) could be negative, zero, or positive.

\( r \) is the discount rate equal to the cost of capital

The sigma sign \((\Sigma)\) is the symbol for summation.

The NPV formula can be written out in its component present values of the annual net cash flows, as follows:

\[
NPV = C_0 + \frac{CF_1}{1+r} + \frac{CF_2}{(1+r)^2} + \ldots + \frac{CF_n}{(1+r)^n}
\]

The net present value criterion can be stated in the form of a set of decision rules.

Decision Rule 1: Do not accept any project unless it generates a positive NPV when discounted by a discount rate equal to the opportunity cost of the funds.

Decision Rule 2: To maximize net worth, choose among the various projects, or scenarios of projects, the one with the highest NPV. If investment is subject to a budget constraint, choose the package of projects that maximizes the NPV of the fixed budget.

Decision Rule 3: When there is no budget constraint and when a choice must be made between two or more mutually exclusive projects, e.g. projects being considered for the same building site, investors who seek to maximize net worth should select the project with the highest NPV.

These rules follow from the definition of the NPV, namely the algebraic sum of the present values of the incremental expected positive and negative net cash flows over a project’s anticipated lifetime.

\textsuperscript{15} The recovery of the invested capital is anticipated when \( NPV \geq 0 \) because the incremental capital expenditures are included in the initial negative net cash flows.
5.3. The Internal Rate of Return Criteria

By definition, the internal rate of return (IRR) is the discount rate ($\rho$) that sets the NPV = 0 in the following equation:

$$\sum_{j=1}^{n} \frac{CF_j}{(1 + \rho)^j} - I_0 = 0$$

Where:

$CF_j =$ the incremental net cash flow in year $j$ to total, or equity, capital,

$I =$ the initial investment,

$\rho =$ the IRR. We have to solve for $\rho$.

This definition is consistent with the meaning of a zero NPV as explained in the previous section, namely that investors recover their invested capital and earn a rate of return equal to the discount rate, which is the IRR. The internal rate of return criterion can be stated in the form of a set of decision rules.

Decision Rule 1: Do not accept any project unless its IRR is greater than the opportunity cost of the funds (accept project if $\rho > r$, the opportunity cost of capital; otherwise, reject). The opportunity cost of capital is measured by the cost of funds or the expected rate of return offered by other assets equivalent in risk to the project being evaluated.

Decision Rule 2: When a choice must be made between two or more mutually exclusive projects, investors should select the project with the higher, or highest, IRR.

### Box 4.1 Weakness in IRR

Even when both criteria use the same formula, there are profound differences between them. Some of the problems of the IRR are the followings:

**The IRR may not be unique, there could be multiple IRRs, or the IRR may not even exist.** The IRR is, strictly speaking, the root of a mathematical equation. The equation is based on the time profile of the incremental net cash flows. If the time profile crosses the horizontal axis from negative to positive only once, the root, or IRR, will exist, but it may not be positive. However, if the time profile crosses the axis more than once, there may be more than one root, or there may be no real roots, only imaginary roots. Although this may sound like more of a theoretical concern, it is certainly disconcerting to know that an investment decision criterion may not have a solution.

**Wrong ordering of mutually exclusive projects, e.g. projects of different scale.** The problem of having to choose between two or more mutually exclusive projects arises quite frequently. Examples would include two alternative buildings being considered for the same building site, or a new highway that could run down two alternative rights of way. Whereas the NPV takes explicit account of the scale of the project by means of the investment that is required and the initially negative net cash flows that accompany it, the IRR ignores the differences in scale. The IRR is expressed as a rate per Leones of investment but does not indicate how many Leones that rate can earn.

**IRRs are not additive.** Larger projects will frequently have a number of separable components. Each of these components should be analyzed on its own merits and then assessed in conjunction with the other components. Since some of the possible components may be mutually exclusive, those separate combinations have to be examined as well.
The reason for the problem is that whereas NPVs are additive, IRRs are not. When the separate projects were analyzed, they all had the same scale of investment, but the combinations increase the scale of investment and, therefore, should not be ordered according to the IRR criterion. In this case, the larger scale of investment lowers the IRRs of the combinations and makes them appear less attractive.

5.4. The Cost–Benefit Ratio

As its name indicates, the benefit–cost ratio (BCR), sometimes referred to as the profitability index, is the ratio of the NPV of the net cash inflows (or economic benefits) to the NPV of the net cash outflows (or economic costs):

\[
BCR = \frac{\text{NPV inflows/economic benefits}}{\text{NPV outflows/economic costs}}
\]

The benefit–cost ratio criterion can be stated in the form of a set of decision rules.

Decision Rule 1: Do not accept any project unless its BCR is greater than one. (Accept project if BCR > 1; otherwise, reject.) The NPVs in both the numerator and the denominator of the ratio should be discounted by the opportunity cost of the funds. The opportunity cost of capital is measured by the cost of funds or the expected rate of return offered by other assets equivalent in risk to the project being evaluated.

Decision Rule 2: When a choice must be made between two or more mutually exclusive projects, investors should select the project with the higher, or highest, BCR.

By using the BCR as a measure of economic desirability, the risk is run of screening out possible candidate projects according to a faulty criterion. In some instances, worthy candidates could be eliminated from consideration early on based on their BCRs, and in so doing the overall NPV could be lowered unnecessarily. Furthermore, as illustrated below, the NPV criterion and the BCR criterion can often draw the opposite conclusion; using the two criteria together then becomes a source of confusion, and possibly of mistakes.

Also IRR and BCR criteria have weaknesses relative to the NPV criterion that is recommended in this handbook and most textbooks in corporate finance theory.
6. FINAL COMMENTS

This document is a simplified tool to technically guide the process of project formulation and project evaluation. Therefore, and because it is a technical document, the methodology does not describe the roles and administrative responsibilities for the public investment process. This description must be part of the rules and procedures of the PIM system.

In addition, the financial analysis can be broken down into two parts: (i) carrying out financial analysis to assess financial viability; and (ii) carrying out budget/resource analysis to assess financial affordability and sustainability. From the financial viability point of view, financial analysis is important, particularly when the decision involves the alternative of financing the project through a mechanism with private-sector participation (therefore, financial analysis from the perspective of ‘a project’ or ‘a project entity’). On the other side, considering financial affordability and sustainability, financial analysis is important to ensure sufficient resources for the correct operation of the project (therefore, using budget/resource analysis from the perspective of ‘a government’). This document is focused only on the first point of view. The project’s financial viability in terms of budget/resource affordability should be part of the following and updated versions of this tool.

Finally, in many cases, it is important to develop financial analysis in order to derive economic (efficiency) prices with which to conduct economic analysis. For this reason, it is recommended that both types of analysis (financial and economic) are performed in order to provide good information on decision-making on public investment projects.
7. REFERENCES

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