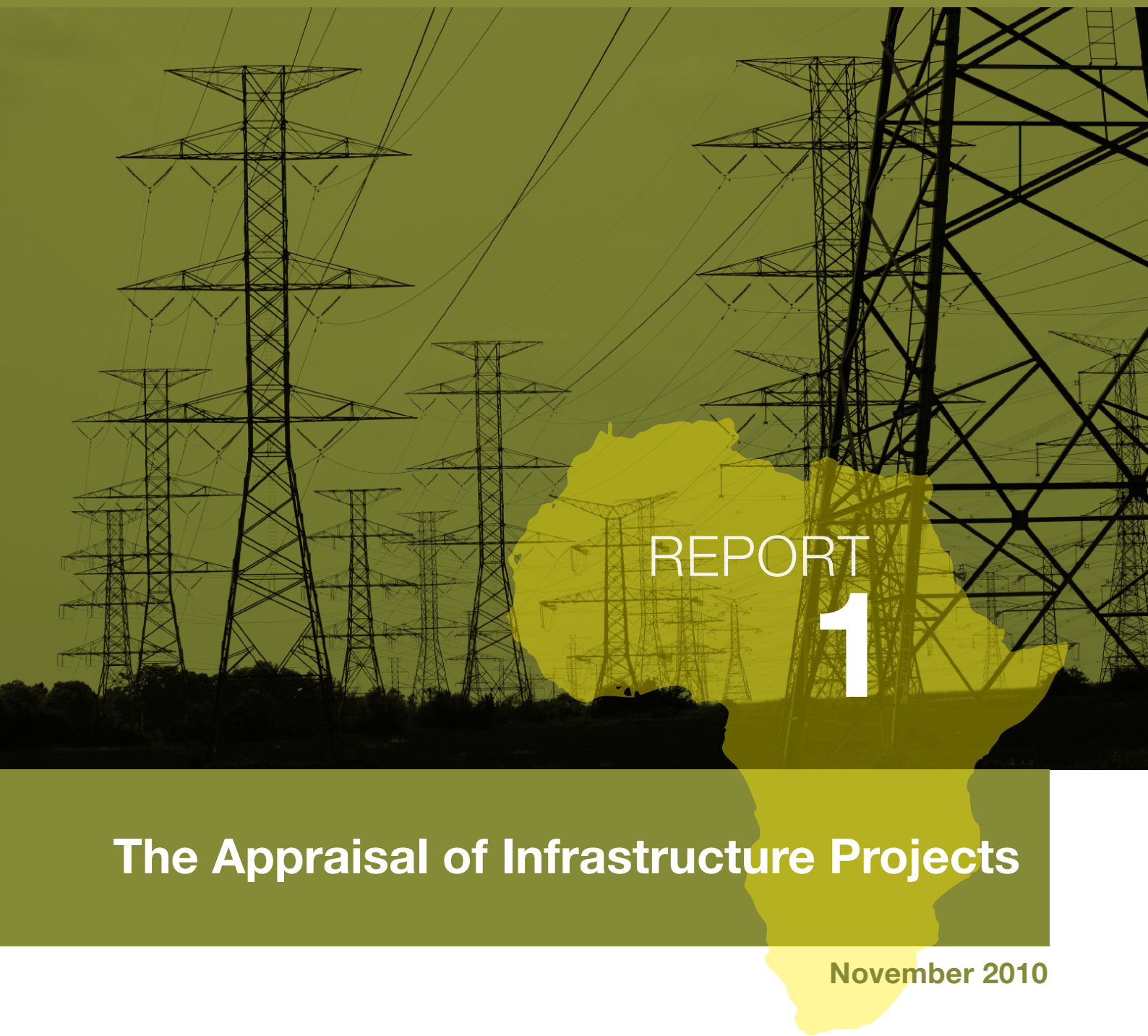
Ensuring Value for Money in Infrastructure in Africa



REPORT 1

The Appraisal of Infrastructure Projects

November 2010

CABRI

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About CABRI

The Collaborative Africa Budget Reform Initiative (CABRI) is a professional network of senior budget officials in African Ministries of Finance and/or Planning. CABRI was officially launched on 14 May 2008 in Maputo, Mozambique. On 3 December 2009, CABRI became a legal and independent membership-based organisation.

CABRI's main objective is to promote efficient and effective management of public finances, which fosters economic growth and enhances service delivery for the improvement of living standards of African people. Specifically, the network seeks to:

- support senior budget officials in the management of public finance systems by developing appropriate approaches, procedures and practices;
- advance the development of member states by building capacity and promoting training and research in the field of public finance management, in particular from a practitioner's perspective; and
- develop and promote common African positions on budget-related issues of interest to Africa.

About the infrastructure dialogue

The three-day CABRI dialogue on financing and managing infrastructure projects brought together senior officials from the budget office and ministries of infrastructure from 12 CABRI countries. The objective of the dialogue was for senior officials to find better ways to plan and evaluate public investments, to discuss alternative ways for governments to finance these projects and to establish ways to manage expenditure on these projects during implementation to achieve value for money.

The dialogue was articulated around six case studies that investigated key decision-points in large infrastructure projects:

- wastewater public-private partnership in Egypt;
- hospital public-private partnership in Lesotho;
- the Maputo Port Concession in Mozambique;
- hydroelectric project in Sierra Leone;
- urban sanitation project in Guinea; and
- the Songo Songo Gas Project in Tanzania.

The Dialogue used case studies as learning tools to apply the approaches, concepts, frameworks and tools presented in the main papers to real-life situations. Participants analysed these case studies and came up with recommendations with regard to a course of action to resolve the problem presented.

Those case studies were supported by keynote papers with a particular focus on the following areas:

- the pre-contracting phase with a focus on appraisal;
- the financing of infrastructure projects with a focus on the use of public-private partnerships; and
- managing the implementation of projects from the government's side through monitoring and review.

The infrastructure dialogue was the first in a series of three dialogues on the financing and management of expenditure in sectors.

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PART 2

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The research was led by Mr Taz Chaponda and Mr Tony Milanese. Case-study research was conducted by Ms Clara Picanyol, Mr Matthew Smith and Ms Geraldine Baudienville.

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Part 1

The pre-contracting phase: The importance of appraisal

Tony Milanese and Taz Chaponda

1. Introduction

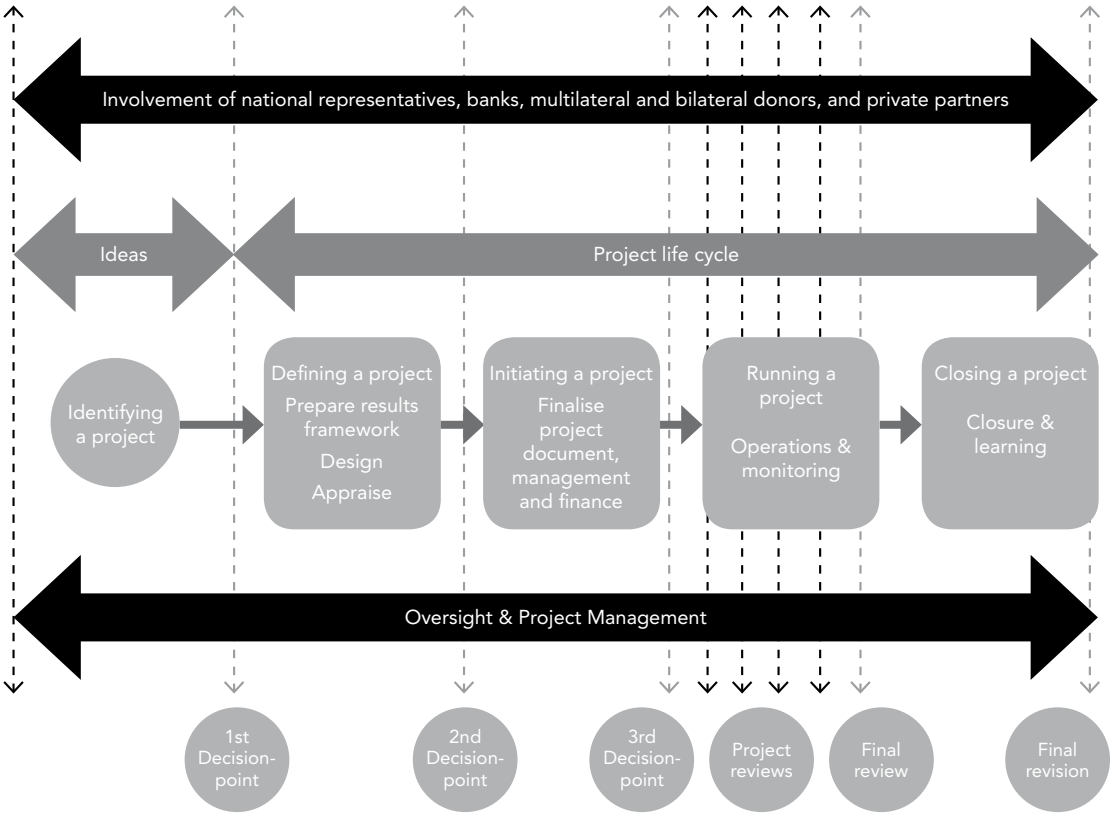
The expansion of public infrastructure is a critical underpinning of growth and development, and an important claim on public resources. Typically, governments are called upon to undertake far more projects than can be afforded. A rigorous approach to appraisal assists governments in selecting projects that can be implemented efficiently and provide the greatest net benefit to society. This paper highlights the main elements of infrastructure appraisal. It commences with a background discussion of the elements associated with project identification and design, and how this fits into the planning process. Key concepts and measures used in project appraisal are then introduced. This is followed by an outline of the financial analysis and economic analysis that need to be undertaken. The paper closes with a review of the risks and uncertainties encountered in project appraisal.

2. Background on project identification and preparation

Project analysis, which is undertaken for a particular purpose and from a specific point of view, involves two main questions: Is the project worthwhile? Will the project work as proposed?

All projects go through a sequence of activities: the initial identification of the project (conceptualisation of project ideas); preparation of the project (project formulation and design); project appraisal and selection; and project implementation. Figure 1 illustrates the sequence of project identification through to implementation as a flow chart.

Figure 1: Project phases



The role of resource-constrained planning processes

Most large infrastructure projects are derived from the formal processes through which governments plan for the management of the economy and the use of society's resources. Project justification, in the context of economic and social needs, is a first step towards the identification and preparation of projects.

As a rule, projects are included in the public investment planning process wherever they make a claim on the government budget. The public investment programme is usually drawn up on the basis of proposals received from various public sector organisations. Typically, they are put together on a sector basis to form a sector plan or programme in which sector priorities are defined. In larger countries, small- and medium-scale projects may enter the planning process through regional and sub-regional plans and programmes. This applies particularly to projects located in rural areas and involving non-governmental organisations (NGOs).

Projects that do not make a claim on public resources (albeit from own or development-partner resources) may not be accorded as much priority in the public investment planning process, but they are quite likely to be subject to regulatory planning controls if they are to have significant environmental impact or involve monopoly pricing.

Often, sector planning provides the link between planning at the macro level and project planning. The sector review and definition of a sector strategy are major activities involved in drawing up a sector plan, and are important forerunners of the appraisal process.

The sector review is the initial stage in formulating a plan, and defines the environment within which any project has to operate. It may consist of the following: a description of activities and trends; an assessment of existing resources, such as land, human resources, fixed capital, financial capital and foreign exchange; an analysis of the constraints facing the sector; and an assessment of potential opportunities. This sector review, if properly undertaken, provides the context and a data source for the appraisal of projects.

Ideally, the sector strategy should aim at defining the best possible use of sector resources and, therefore, should be formulated within the context of budget constraints. This forces sectors to prioritise projects at an early stage, reducing the risk of project-development resources being spent on projects that cannot be realised, which can happen when there are several competing priorities within individual infrastructure sectors such as energy, water, solid waste and transport. For the project reviewer, it is important that the project sponsor has justified the project in terms of sector/national-level plans.

Issues in project identification

There are different ways of identifying and selecting projects, depending on ownership, sector and sources of funding. Political imperatives and/or the planning process shape public sector projects, whereas private sector projects are undertaken on the basis of an opportunity for profit. In both cases, project identification is characterised by demand for the outputs and the availability of resources to produce them. These two factors are brought together through a technical solution. Often, in putting together a technical solution, stakeholders need to be consulted. This is also true for preparing the project for financing and contracting (see Appendix A for stakeholder analysis).

Project identification is derived from studying demand (presupposing both ability and willingness to pay) for the project outputs of commercial or directly productive projects, or

needs for the services provided by social and other indirectly productive projects. For projects producing a commercial output, adequate demand is required, and is normally assessed from the existing market.

Estimation of the extent of demand is particularly important for the infrastructure sectors in which producers are often monopolies (energy, water supply and waste treatment, solid waste, transport) and where prices may be controlled or where some services (such as roads) may be free. For these sectors, demand can be estimated by times-series data where available, or from cross-sectional data where comparison is made with other areas or even other countries facing similar situations. It is common practice to include factors such as income or population growth in building models to predict demand.

Project identification on the basis of need assumes importance for social sector projects (in health and education, for example). Certain infrastructure projects, such as rural water projects, could also be seen as satisfying a basic need. In the case of need-based projects, the involvement of key stakeholders in defining the nature of the need can be critical. Incorrect perceptions of need by people with inadequate knowledge of a project area can have serious implications for the sustainability and acceptance of the project.

Building project profiles and screening

Generally speaking, there are more project ideas than there are successful projects. Therefore, it is important to deal with the following before embarking on detailed studies:

- project objectives should be specified in terms of something that can measured;
- the main constraints preventing the achievement of the project objectives should be identified;
- alternative means of achieving the project objectives (or of overcoming constraints) must be identified; and
- the resources required, and the people who will be affected or whose co-operation is necessary, must be specified.

The next step is to prepare a project profile, in order to enter a process of screening against selected criteria to decide whether to go ahead with further preparation. This represents a first decision-point in filtering projects to ensure value for money in infrastructure spending. The criteria could include: potential financial profitability; potential for earning or saving foreign exchange; impact on employment or the incomes of target groups (identifying poorer sections of the community, for example); contribution to skills development; environmental impact; social acceptability; sustainability of project activities; and effect on other economic activities.

From this list, a priority schedule can be drawn up and those projects with the greatest potential can be developed further, while the others can be abandoned at an early stage without incurring excessive expenditure of resources.

After a project has passed the first decision-point, it enters the phase of project preparation. The quality of work undertaken in the project-preparation phase is critical for the successful implementation of a project. It is during this phase that the project is designed, all stakeholders are consulted appropriately, project documentation is prepared and the project is analysed and appraised.

3. Elements of project appraisal

The appraisal process is a complex, often reiterative, process. In the public sector, project appraisal provides assurance to the government that: the project is justified; the chosen project represents the least-cost option to achieve identified objectives; and the chosen option is feasible and desirable.

This paper focuses on the financial and economic appraisal of projects. A full project appraisal contains several other elements. The list below provides an overview of aspects that should/could be included, depending on local legal requirements and priorities:

- development of a 'business case' for the project (preliminary, outline or full) consisting of –
  - a 'strategic case' (developing the project justification by forecasting demand/need and defining project objectives, given the need for government intervention),
  - an 'economic case' for the preferred project option,
  - a 'financial case' for the project,
  - a 'project-management case' for the project (developing a project-management plan illustrating that the project is feasible), and
  - a 'technical case' for the project (developing an assessment of project technical specifications for feasibility);
- assessment of distributional effects;
- regulatory impact assessment;
- health impact assessment and/or health and safety impact appraisal;
- environmental appraisal; and
- consumer impact assessment.

In total, a project appraisal should take account of relevant financial, economic, technical, regulatory, environmental, distributional and population/consumer-impact elements.

4. Basic principles and concepts of project appraisal

This section discusses the basic principles and concepts of financial and economic project appraisal. These are the tools used to assess projects and provide summary measures by which project sponsors, financiers and reviewers can determine whether a project is feasible and desirable.

Project feasibility and desirability

A distinction has already been made between those aspects of appraisal that involve the issue of project feasibility and those that involve the issue of project desirability. Feasibility analysis is about what will work. The underlying question is whether a project can be done. Questions of desirability apply particularly to the financial and economic appraisal of projects, where attempts are made to compare costs and benefits to decide whether the project is worthwhile. The underlying question is whether a project should be done. The desirability of the project can be interpreted from the point of view of the investor (a financial analysis) or from a wider national perspective (an economic analysis). In principle, economic analysis can be adapted to include environmental and social issues where such costs and benefits can be identified and measured. A checklist of feasibility and desirability criteria is provided in Table 1.

Table 1: A matrix of criteria for project appraisal

Project aspect	Feasibility	Desirability
Technical	Technical design requirements can be satisfied Technical capacity of management and workforce adequate Output targets can be met	Local resources/skills used where appropriate Sustainable technology used Technical efficiency maximised
Financial	Cash balance is always positive (required finance is available and all financial commitments can be met) All parties have adequate financial incentives	Financial profitability measures satisfactory to all parties Internal rate of return to equity exceeds real interest rate Uncertainty and risk associated with project is minimised
Economic		Economic internal rate of return exceeds target rate Domestic resource cost of foreign exchange lower than shadow exchange rate Cost-effective methods used for non-commercial projects Risk that project failure will damage economy is minimised
Social	Project acceptable in relation to existing laws and social norms	Target groups involved in project design and operation Distribution of costs and benefits of project contributes to government objectives
Institutional	Implementing agencies have authority and motivation to perform roles assumed	Preferred forms of organisation are used Implementing agency operations are sustainable
Environmental	All negative effects are below legal/customary limits	All negative effects are minimised All positive effects are maximised
Political	Project is consistent with government policies and plans	Project has active political support

Project value

A fundamental principle of project analysis is that the value of the project is determined by comparing the assumed situation with and without the project. The difference between the two measures the value of the project.

The without-project assumption is important in both financial and economic analyses. One asks: what would happen if we did not implement the project? In economic terms, what is lost by implementing the project can be described as the project's opportunity cost. The opportunity-cost principle provides the basis for most aspects of the economic analysis of projects.

Projects of different types should all be subject to an analysis of cost and benefit, with and without the project. Four common project types can be distinguished:

- *green-field projects* are completely new activities operating where the activity did not exist before;

- *expansion projects* are those that are designed to lead to expansion of an existing activity;
- *rehabilitation projects* are those that are designed to lead to the rehabilitation of an activity that has suffered from some form of decline; and
- *competing projects* are those that involve the establishment of an activity in direct competition with another activity.

Evaluating different options

Public sector projects should be chosen on the basis of the least resources being used to achieve the same objectives. A key part of project appraisal is the comparative analysis of the costs and benefits of alternative ways of achieving the objectives. If alternative ways were not identified during project profiling and screening, the appraisal process should develop and put forward these alternatives. Initially, the development of options should include the creation of alternative ways to achieve the objectives, and of a 'do-the-minimum' option. The costs and benefits of each option would be identified and valued, using the techniques discussed in this paper and taking into account risk, in order to choose the optimum solution for the objectives posed.

Cost-benefit and cost-effectiveness analyses

A technique such as cost-benefit analysis (CBA), involving the comparison of costs and benefits to ascertain whether benefits exceed costs, can be used to determine the desirability of the project. A variant of CBA known as cost-effectiveness analysis (CEA) compares the relative expenditure (costs) and outcomes (effects) of two or more courses of action. CEA is often used where a full CBA is inappropriate (for example, when the government has to assess how best to comply with a legal requirement).

CEA is commonly used in social and infrastructure sector projects, where there are choices of location or technology, and benefits are not easy to measure. However, it can also be used in the economic sector, where the same objectives may be achieved with different interventions. In some cases, the alternative might not involve infrastructure development, but rather an alternative means to deliver the same goal. For example, congestion in a harbour may be managed more efficiently by investing in information technology to process shipments faster than by expanding harbour capacity.

CBA and CEA use both economic principles and accounting principles. Sometimes, project assessment involves comparing CBA or CEA criteria with criteria not measurable in monetary terms. This is referred to as multi-criteria analysis (MCA).

Cost-benefit statements

CBA involves the comparison of costs and benefits over the period of time that is defined as the project life, and they are set out against the year in which they occur. This is commonly done in a series of statements, which record project costs and benefits by category.

Project life is calculated on the basis of the expected life of major assets such as buildings or major items of equipment. Often, for large-scale infrastructure projects (for example, the construction of a dam), project life is at least 20 years and can be as long as 50 years.

For commercial projects – where the government will be charging a fee to beneficiaries using the resulting infrastructure – there are four basic categories to take into account when comparing cost and benefits with and without the project: investment costs; operating costs; revenues (a measure of project benefit); and working capital. All projects follow the same basic principles of distinguishing between capital and recurrent costs. Costs and benefits are stated in constant prices.[1]

Investment costs

Investment costs are the once-off payments made for goods that last more than a year. The nature of investment costs varies considerably from sector to sector, but some categories of investment that are commonly expended include land and site development, buildings and civil works, machinery and equipment, vehicles, plant installation, technical assistance and training.

In both CBA and CEA all investment costs, including the replacement of assets such as machinery and equipment and significant capital-maintenance programmes, are entered into the analysis in full as and when they are expected to occur. Depreciation is an accounting convention used for the valuation of assets and the calculation of tax. It is not a real cost and is not used in any CBA statements, although it can be used for the estimation of tax in the financial analysis of commercial projects. However, at the end of the project's life there is usually a residual or salvage value for those assets that still have an operating life. This residual value is generally recorded as a benefit in the final year of operation.

There is a certain margin of error in estimating investment costs and that is why contingencies, often to land preparation, buildings and plant and machinery costs, are added to large-scale infrastructure projects.

Operating costs

Operating costs are recorded on a year-by-year basis and are divided into fixed costs (or overheads) and variable costs. Variable costs vary according to the level of sales. Some costs are variable but do not vary directly according to sales; these are classified as semi-variable costs. Utilities are an example of a semi-variable costs, where part of the cost is an overhead and part is variable.

The logic behind operating-cost estimation is important. Many production processes including infrastructure have recognised norms as to the quantity of inputs required to produce a given quantity of output. For sectors such as energy generation, water and solid waste, it is physically impossible to achieve an increase in output without an increase in at least some of the inputs.

In an operating-cost statement, unit costs are given for the variable-cost items. These are multiplied by the quantity of sales to derive direct operating costs. In addition, there are some overhead costs that change over the life of the project but do not depend directly on the level of sales.

Sales revenues or benefits

Sales revenue values are derived from estimates of the quantity to be produced – adjusted for changes in stock levels – and assumptions about the expected price. There are some important

1 Typically, project costs and benefits are estimated in terms of constant prices, with the base year being the year in which the project is planned. Using constant prices removes the distorting effect that fluctuations in the general level of inflation might have on the value of project costs and benefits.

qualifications regarding revenues of the major infrastructure sectors. For energy such as electricity and gas, output is measured in kilowatt-hours or cubic metres. Water supply and treated wastewater are measured in cubic metres, while solid waste measures household waste in tonnes and containerised waste in cubic metres. Urban transport revenue is based on tickets sold, while ports revenue is based on tonnages of docking ships. All of the above use a tariff as the price to be applied to the volumes. For energy, water and solid waste, different tariffs can apply for different categories of customer (households, industry and government organisations, for example).

Working capital

Working capital for infrastructure sectors includes the following: stock of material inputs (mainly materials, chemicals and fuel); accounts receivable; accounts payable; and cash. Stock is a minor component and does not feature significantly in working capital calculations.

Only increases in working capital in each year are recorded in CBA statements. Estimation of the annual increase in the working capital requirement may be done by calculating each item on an incremental basis, or by estimating the value of the total working capital and deriving the incremental value from the increase in total working capital. In the last operating year of the project, working capital is run down or reduced so that at the end of the project's life there is no stock and no outstanding accounts. Therefore, incremental working capital in this final year is negative.

Statement of project costs and benefits

A conventional annual statement of project costs and benefits usually shows the four basic categories of costs and benefits on a yearly basis over the project's life.

The annual statement gives an indication of the overall desirability of the project to all the capital involved at constant market prices. It may then be refined through an economic analysis to give a perspective of the value of the project to the economy, or it can provide the basis for a financial analysis of the project from the owner's point of view.

Table 2 provides an example of an annual cost-benefit statement. In principle, the net revenue or net benefit of the project in each year is defined by subtracting investment costs, operating costs and incremental working capital costs from the value of the benefits for each year.

Table 2: Statement of project costs and benefits

US$ (1'000) per year

	1	2	3	4	5	6	7	8	9	10	11	12
Investment costs	20 000	15 000					2 500					-4 200
Incremental work capital		1 940	1 105	1 050	68						(4 162)	0
Operating costs		11 660	19 780	24 180	24 900	25 000	25 000	25 000	25 000	25 000	25 000	0
Sales/ Revenues		16 200	24 300	32 400	32 400	32 400	32 400	32 400	32 400	32 400	32 400	0
Net revenue	(20 000)	(12 400)	3 415	7 170	7 432	7 400	4 900	7 400	7 400	7 400	11 562	4 200
Net present value at 5% = 16 801, at 10% = 5 173, at 15% = -2 064. Internal rate of return = 13.32%.												

The example in Table 2 is of a green-field project, and the value of the resources used by the project is adequately represented by their price; hence, no without-project assumption is given. Had the project involved rehabilitation or expansion of an existing facility, it would have been necessary to deduct the assumed costs and benefits of the facility without the project.

Measures of project worth

In order to make comparisons between project options of project costs and benefits, measures are required of the value or worth of a project, from which criteria can be derived for judging the acceptability or desirability of a project.

There are several main measures of project worth. Usually, each measure leads to the same recommendation as to whether or not to go ahead with a project, but there are some special circumstances when they do not. The main measures of project worth are the net present value (NPV), the internal rate of return (IRR), the payback period and the benefit-cost ratio (BCR).[2]

Net present value

The mostly widely used technique for analysing a potential investment opportunity or project is the net present value of cash flow or NPV approach. Using the NPV of cash flow technique, we would discount all cash at the opportunity cost of capital (discussed later). The business rule that is applied with this analysis is to accept all projects or investments where the NPV is greater than zero. NPV compares the value of a dollar today with the value of that same dollar in the future, taking inflation and returns into account. If the NPV of a project is positive, it should be accepted. However, if NPV is negative, the project should probably be rejected because cash flows will also be negative.

Internal rate of return

The IRR, or discounted cash-flow rate of return, offers analysts a way to quantify the rate of return provided by the investment. The IRR is defined as the discount rate where the NPV of cash flows is equal to zero. The IRR can be calculated using trial and error (changing the discount rate until the NPV = 0). Generally speaking, the higher a project's IRR (assuming the NPV is greater than zero), the more desirable it is to undertake the project. The rule with respect to capital budgeting or when evaluating a project is to accept all investments where the IRR is greater than the opportunity cost of capital.

Payback period

A payback period allows us to see how rapidly a project returns the initial investment back to the investor. In practice, investors establish 'rules' around payback when evaluating a project. For example, an investor might decide that all projects need to have a payback period of less than five years. This is also referred to as the cut-off period.

Benefit-cost ratio (BCR)

A benefit-cost ratio (BCR) is an indicator, used in formal cost-benefit analysis, that attempts to summarise the overall value for money of a project or proposal. A BCR is the ratio of the benefits of a project or proposal, expressed in monetary terms, relative to its costs, also expressed in monetary terms. All benefits and costs should be expressed in discounted present values.

2 Mainstream computer spreadsheet packages include special functions for calculating both the NPV and IRR.

The financial discount rate

The financial discount rate is the opportunity cost of capital. Opportunity cost means that when we use capital in one project we renounce the possibility of earning a return in another project. Thus, we have an implicit cost when we sink capital into an investment project: the loss of income from an alternative project.

Bearing this broad definition in mind, we need to estimate empirically the relevant opportunity cost of capital for a given project, in a given country at a given time. There are basically three approaches that may be helpful in identifying the appropriate financial discount rate.

The first approach estimates a *minimum opportunity cost of capital*. Sometimes, this approach suggests that the real discount rate should measure the cost of the capital used for the specific investment project. As a consequence, the benchmark for a public project may be the real return on government bonds (the marginal cost of public deficit), or the long-term real interest rate on commercial loans (if the project needs private finance).

The second approach establishes a *maximum limit value for the discount rate*, as it considers the lost return from the best investment alternative. In practice, the opportunity cost of capital is estimated by looking at the marginal return on a portfolio of securities in the international financial market, in the long run and with minimum risk, i.e. the alternative to the project income is not the buying back of public or private debt – it is the return on an appropriate financial portfolio.

The third approach is to determine a *cut-off rate*. This implies avoiding the detailed examination of the specific cost of capital for a given project (under the first approach) or the consideration of specific portfolios on the international financial markets or on alternative projects for a given investor (under the second approach), and rather using a simple rule-of-thumb approach.

For a cut-off rate, we take a specific interest rate or rate of return from a well-established issuer in a widely traded currency, and use a multiplier on this minimum benchmark. An obvious minimum benchmark may be long-term bonds denominated in Euro or US dollars issued by the National Bank. The real return on these bonds can be established by the consideration of the nominal return rate less the inflationary rate in the country in question.

The social discount rate

The social discount rate attempts to reflect how future benefits and costs should be valued against present ones. It is the rate at which society as a whole is willing to trade off present for future benefits by undertaking a project now that will yield benefits in the future, instead of taking the benefits now. It may differ from the financial rate of return when the capital market is imperfect. Theoretical literature and international practice show a wide range of approaches in interpreting and choosing the value of the social discount rate to be adopted.

The World Bank has adopted a required economic rate of return of 10%. This is generally regarded as quite a high cut-off rate and, according to some criticisms, it may reflect a kind of cream-skimming of best projects by prime lenders. High discount rates also favour projects with high short-term benefits and significant long-term costs. National governments usually set the social discount rate for public projects at a lower level than that set by international financial institutions.[3] A social discount rate of 5% might be appropriate for sub-Saharan Africa for co-financed projects, although this is best determined on a case-by-case basis.

3 The UK Green Book (HM Treasury) uses a rate of 6%. In France, a rate of 8% is used by the government.

5. Project financial analysis: a base for economic appraisal

Project financial analysis estimates the profit accruing to the entity that operates the project. Economic analysis measures the impact of the project on the national economy. For a project to be economically viable, it must be financially sustainable, as well as efficient. If a project is not able to sustain itself financially, the economic benefits will not be realised. Therefore, financial analysis and economic analysis are both necessary when projects are appraised.

Financial analysis takes into account all expenditures incurred in the project and all the project revenues. The main purposes of financial analysis are:

- to provide an adequate financing plan for the proposed investment (financial analysis ensures that project revenues will be available to meet the project's financial obligations);
- to determine the profitability of a project from the point of view of the owners or the project beneficiaries;
- to assist in planning the operation and controlling of the project, by providing management information to both internal and external users; and
- to provide the starting point for economic analysis.

This analysis should also hold true for non-commercial projects for which there are lower financial returns. For example, with social infrastructure such as schools and hospitals, financial analysis can assist when analysing potential savings in maintenance and concession payments if the private sector is involved in operations.

Project financial analysis concentrates specifically on liquidity and profitability (for commercial projects). The concept of liquidity is concerned with the availability of funds for the continued implementation and operation of the project. The liquidity status of a project is determined primarily from the cash flow. Therefore, project cash-flow statements are important for the calculation of a project's funding requirements against time.

The main supporting statements required for the financial analysis of a project are the fixed assets schedule, the depreciation schedule, the trading account, the working-capital schedule (current assets and liabilities), the loan-repayment schedule and the cash-flow statement. These statements also form the basis of the project financial plan, if approved.

6. Undertaking project economic analysis

Economic analysis allows the appraiser to assess a project's contribution to the economic welfare of the region or country. It is made on behalf of the whole society (region or country) instead of just the owner of the infrastructure, as in the financial analysis.

A good project economic analysis will be reflective of the following steps:

1. *Defining project objectives and economic rationale:* the basis of a good appraisal is a clear statement of the project objectives and economic rationale.
2. *Forecasting the effective demand for project outputs and project costs*: the financial and economic benefit calculations require an understanding of demand for the outputs of the project, albeit kilowatt-hours of power or places in a school.
3. *Choosing the least-cost design for meeting demand or the most cost-effective way of attaining the project objectives*: a good appraisal will include an assessment of

different designs to meet the project demand or the comparative net benefit of different ways of attaining the project objectives.

4. *Determining whether economic benefits exceed economic costs sustainably through the life of the project*: a good appraisal will include an assessment of net benefit and other summary measures of project worth.
5. *Testing for risks associated with the project*: a good appraisal will test for the risk associated with the project by undertaking sensitivity analysis.
6. *Identifying the distributional effects of the project, particularly on the poor*: where relevant, a good appraisal will include an assessment of the effects of the project on different population groups.
7. *Enumerating the non-quantifiable effects of the project that may influence project design and the investment decision*: in the public sector, some projects may go ahead even if key measures are negative when non-quantifiable benefits are taken into account.

Drawing up a table of social costs and benefits

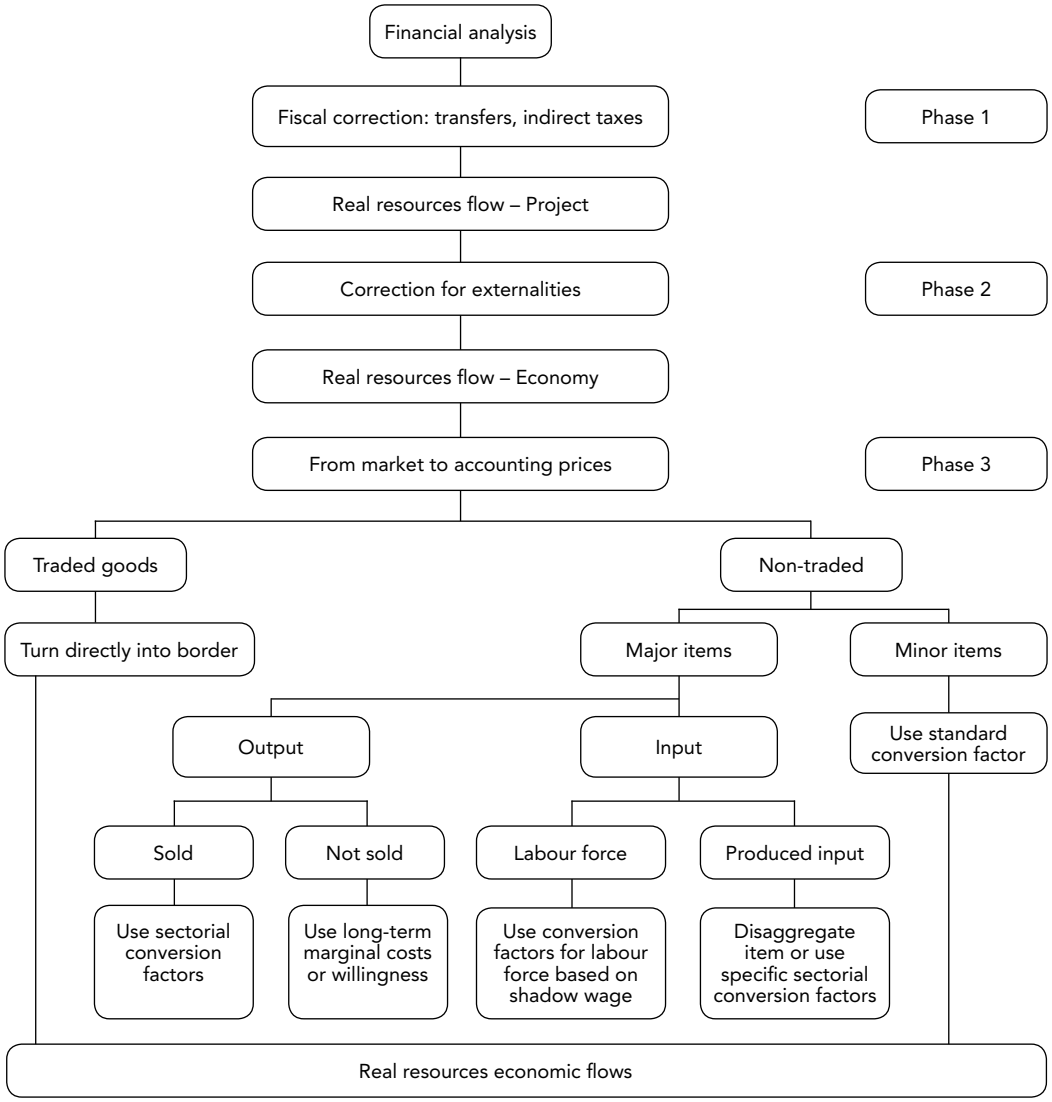
Using the project financial analysis (the performance of the investment regardless of its financial sources) as a base, economic analysis – by means of the definition of appropriate conversion factors for each of the inflow or outflow items – outlines a table that includes benefits and social costs not considered by the financial analysis. These conversions to allow the transfer from financial to economic analysis are summarised in Figure 2, and consist of the transformation of market prices used in the financial analysis into accounting prices (the amendment of prices distorted by market imperfections) and the consideration of externalities leading to benefits and social costs unconsidered by the financial analysis as they do not generate actual money expenditures or income (for example, environmental impacts or redistributive effects). This becomes possible by the attribution to each of the inflow or outflow items of an ad hoc conversion factor (see below) to change market prices into accounting prices.

International practice has assumed standardised factors for some input/output classes; others require specific factors to be defined case by case. Converting a financial analysis into an economic analysis, therefore, requires:

- *Phase 1*: taxes/subsidies and other transfers corrections;
- *Phase 2*: externalities corrections; and
- *Phase 3*: conversion of market prices into accounting prices to include social costs and benefits (determination of conversion factors).

Once the table for the economic analysis is ready, as in the financial analysis, the first step is the discounting made by the selection of a correct social discount rate and the calculation of the IRR of the investment.

Figure 2: Converting financial analysis into economic analysis



Examples of social external benefits:

- advantages in terms of reduction of risk of accidents in a congested area;
- savings in transport time in an interconnected network; and
- increase in life expectancy from better health facilities or from reduction of pollutants.

Examples of social external costs:

- loss of agricultural product because of different use of land;
- additional net costs for local authorities to connect a new plant to existing transport infrastructure; and
- increase in sewerage costs.

The advantages of measuring these social costs and benefits are further enhanced when it is possible to use distributional analysis. Benefits and costs can be separated into different population groups, such as age, gender and income, and be compared.

Phase 1: fiscal corrections

This phase leads to the determination of two new elements for the economic analysis – the value of the fiscal corrections and the value of the conversion factor for market prices affected by taxes, subsidies and, in some cases, transfer payments. These fiscal factors affect relative prices. While in some cases it would be difficult to estimate prices without the impact of these fiscal factors, the following rough, general rules can be laid down to correct distortions:

- prices of inputs and outputs to be considered for CBA should be net of VAT and of other indirect taxes;
- prices of inputs to be considered in the CBA should be gross of direct taxes; and
- pure transfer payments to individuals, such as social security payments, should be omitted.

In some instances, indirect taxes/subsidies are intended to correct externalities. Typical examples of this are taxes on energy prices to discourage negative environmental externalities. In this and similar cases, the inclusion of such taxes in project costs may be justified, but the appraisal should avoid double-counting (including both energy taxation and estimates of external environmental costs, for example).

Phase 2: externalities corrections

The objective of this phase is to determine external benefits or external costs not considered in the financial analysis, examples of which are costs and benefits arising from environmental impacts, the time saved by projects in the transport sector, human lives saved by projects in the health sector and so on.

Sometimes, valuing external costs and benefits is difficult, even though they may be identified easily. A project may cause ecological damage, the effects of which, combined with other factors, emerge only in the long run, and are difficult to quantify and value.

It is worthwhile to at least list the unquantifiable externalities, in order to give decision-makers more elements to use in arriving at a decision, by weighing up the quantifiable aspects, as expressed in the economic rate of return, against the unquantifiable ones.

As a general rule, any social cost or benefit that spills over from the project towards other subjects without compensation should be accounted for in the CBA in addition to the financial costs.

The project examiner should check that such costs have been identified, quantified and given a realistic monetary value, if possible. Should this be difficult or impossible, the costs and benefits should be quantified at least in physical terms for a qualitative appraisal.

Many large projects, particularly in infrastructure, may be beneficial to subjects beyond those directly appropriating the social income generated by the project. Externalities should be given a monetary value, if possible. If not, they should be quantified by non-monetary indicators.

These benefits may accrue not only to the direct users of the product but also to third parties for whom they were not intended. In this case, they must also be accounted for by appropriate evaluation. Examples of such positive externalities towards other consumers include a railway that may reduce traffic congestion on a highway, or a new university, the research of which will increase the future income of employers through providing a better-educated work force.

Environmental impacts

In the context of project analysis, the environmental impact should be described and appraised properly, possibly with recourse to state-of-the-art qualitative-quantitative methods. Multi-criteria analysis is often useful in this framework. A discussion of the assessment of environmental impact goes beyond the scope of this paper, but CBA and environmental-impact analysis raise similar issues. They should be considered in parallel and, whenever possible, should be integrated; this would imply attributing a conventional accounting value to environmental costs.

These may be very crude estimates. However, they should capture at least the most relevant environmental costs. The following are examples of environmental impacts:

- the environmental costs of a highway may be approximated by the potential loss of value of properties near it, because of increased noise and emissions, and a worsened landscape; and
- the environmental costs of a large, polluting plant (for example, an oil refinery) may be estimated by considering the potential increase in health expenditure among affected residents and workers.

Accounting value of public sector-owned capital assets

Many projects in the public sector use capital assets and land, which may be state-owned or purchased using the general government budget. Capital assets, including land, buildings, machinery and natural resources, should be valued at their opportunity cost and not at their historical or official accounting value. This has to be done whenever there are alternative options in the use of an asset, and even if it is already owned by the public sector.

Phase 3: from market to accounting prices

The objective of this phase is to determine conversion factors for the transformation of market prices into accounting prices. Project examiners should check if the project's proposer has considered the social costs and benefits of the project in addition to the financial costs and benefits. Besides the influence of fiscal factors or externalities, this can happen when the real prices of inputs and outputs are distorted because of an imperfect market, or when wages are not related to labour productivity.

Price distortion of inputs and outputs

Current prices of inputs and outputs cannot reflect their social value, because of market distortions, such as monopoly regimes, trade barriers and so on. Because they emerge from imperfect markets and from public sector pricing policies, current prices may fail to reflect the opportunity cost of inputs. In some cases, this may be important for the appraisal of projects, and financial data may be misleading as welfare indicators.

Sometimes, prices are regulated by the state, so as to compensate for perceived market failures, in ways that are consistent with the state's own policy objectives (for example, when indirect taxation is used to correct externalities). In other situations, actual prices are distorted by legal constraints, historical reasons, incomplete information, or other market imperfections (for example, tariffs for inputs such as energy and fuel).

Whenever inputs are affected by strong price distortions, the proposer should consider the issue in the project appraisal and use accounting prices that better reflect the social opportunity

costs of the resources. The project examiner needs to assess how the social costs are affected by departures from the following price structures: *marginal cost* for internationally non-tradable goods, such as local transport services; and *border price* for internationally tradable goods, such as agricultural or manufactured goods.

In fact, there are often good economic arguments for using border prices and/or marginal costs as accounting prices, when actual prices are deemed to diverge widely from social opportunity costs. However, this general rule may be checked under the circumstances of the specific project under examination.

The following are examples of price distortion:

- a land-intensive project (for example, an industrial site) where land is made available free of charge by a public body, while it may otherwise earn rental;
- an agricultural project that depends upon water supply at a very low tariff, heavily subsidised by the public sector;
- an energy-intensive project that depends upon the supply of electricity under a regime of regulated tariffs, when these tariffs are different from long-run marginal costs; and
- a power plant under a monopoly regime, which determines a substantial price divergence of electricity prices from long-term marginal costs (in this case, economic benefit could be less than financial benefit).

Wage distortion

Sometimes, labour is a crucial input of investment projects, particularly of infrastructure. Current wages may be a distorted social indicator of the opportunity cost of labour, because labour markets are imperfect. The proposer, in such cases, may resort to a correction of nominal wages and to the use of an accounting wage (shadow wages).

Although there is no recommended specific accounting wage formula, the proposer needs to be prudent and consistent in the appraisal of labour social costs.

Additional employment is, in the first instance, a social cost: when a project uses labour resources, these resources become unavailable for alternative social purposes. The relevant benefit is the additional income generated by job creation, and this is accounted for by the valuation of direct and indirect net output resulting from the project.

However, if an investment project already has a satisfactory internal rate of return before corrections for employment, it is not necessary to spend much time and effort on this kind of calculation. Nevertheless, it is important to consider that in some cases the employment impact of a project may need very careful consideration.[4]

The calculation of measures of project worth

After the table of social costs and benefits has been put together, the project appraiser applies a discount rate. The discount rate in the economic analysis of investment projects – the social discount rate – reflects the social view on how future benefits and cost should be valued against present ones. The social discount rate differs from the financial discount rate when the

4 One common approach to adjusting for the employment impact is the income-multiplier method, which uses shadow wages to account for the wage distortion.

capital market is imperfect. It is possible to calculate the ERR (Economic internal Rate of Return, see discussion of ERR in the basic concepts of project appraisal above) and – after the choice of an appropriate social discount rate – it is possible to calculate the economic net present value (ENPV) and the BCR.

As a rule of thumb, every project with an ERR of less than 5%, or a negative ENPV after the actualisation and with a discount rate of 5%, should be carefully appraised or even rejected. The same applies with a BCR of less than 1. In exceptional cases, a negative ENPV may be accepted if there are important non-monetised benefits, but these must be presented in detail because such a project would contribute only marginally to the country's growth objectives. In such cases, the appraisal report should specify in a convincing way, through a structured argument supported by adequate data, that social benefits exceed social costs.[5]

Least-cost and cost-effectiveness analysis

Once a project appraiser has successfully identified, quantified and valued the social costs and benefits associated with different project alternatives, the least-cost alternative for delivering on the project or the most cost-effective way for achieving project objectives can be determined. When undertaking least-cost analysis, it is important to ensure that the alternatives would result in the same output at the same quality. If there are differences, the project appraiser should adjust the assessment of benefits between the options to ensure that the cost-benefit analyses are comparable.

A least-cost project is identified by comparing the capital and operating costs of the different ways of delivering on project objectives, and assessing which alternative presents the lowest present value of costs or calculating an equalising discount rate for the difference in costs. A third option to assess which alternative is the cheapest is to estimate the average incremental economic cost for each additional output for each alternative.[6] This allows for the identification of the lowest per-unit cost.

When doing cost-benefit analysis, it should be noted that the most cost-effective method is not necessarily the most effective method overall. A more expensive project alternative might achieve higher benefits; cost-effectiveness ratios, which measure the cost per-unit increase in benefits, can be compared to see how the most effective method measures up against the most cost-effective method.

7. Risks and uncertainty

In the discussion above of the estimates of costs and benefits used in project analysis, the tacit assumption is that they are correct. However, in reality, future projections are uncertain, and estimates are subject to a margin of error.

Sources of uncertainty and risk

Key areas of uncertainty should be identified and explained in a discussion of project assumptions and risks in a project proposal. The major sources of uncertainty affecting a project can be categorised as technical, economic, socio-political and environmental.

5 For example, water supply and water sanitation projects where potential health benefits can be substantial.
6 The average incremental economic cost is the present value of incremental investment and operating costs, with and without the project alternative, divided by the present value of incremental output, with and without the project alternative.

Technical uncertainty

All infrastructure projects have a technical basis, which is subject to some uncertainty. Typical areas of uncertainty include the quality and availability of materials, the quality and availability of labour and managerial skills, and the type and reliability of the technology employed. Uncertainty increases if a project adopts a new approach, and is reduced if tried and tested approaches are replicated.

Economic uncertainty

The major areas of economic uncertainty affecting projects relate to prices, demand levels and market conditions. These, in turn, can be affected by macroeconomic policies, particularly in relation to exchange rates and interest rates. Projects in the social and infrastructure sectors often depend on assumptions about levels of demand, while projects in the directly competitive sectors are affected by competitive conditions surrounding inputs and outputs as well as international prices. Issues of economic uncertainty normally require assumptions about prices and quantities to be tested.

Socio-political uncertainty

Socio-political uncertainty relates to the acceptability of a project to affected groups and the potential for disruption either by affected groups or through outside political interventions, conflicts and bureaucratic delay. It can be difficult to devise tests for the effects of such delays.

Environmental uncertainty

Environmental uncertainty relates to climatic and ecological issues and the potential for natural disaster. Particularly important areas include: rainfall, and the availability and quality of water; soil conditions; the impact of pests and diseases; and the incidence of earthquakes, floods and volcanoes. Potential tests for environmental uncertainty include tests for production and yield variations and tests for disruption to project operations.

Approaches to uncertainty

While various approaches to the issue of uncertainty are commonly used, these can be described as unsystematic, and include the use of contingencies, the addition of a 'risk premium' to the discount rate, and varying the assumed project life by reducing the number of years or by using the payback criterion.

Frequently, several ad hoc approaches are used, such as adding a contingency factor or increasing the discount rate. However, such approaches to dealing with uncertainty are not reliable, nor are they very helpful in identifying measures that could increase the level of certainty and improve the chances of project success. Sensitivity analysis provides a more systematic approach to this issue.

Sensitivity analysis

Sensitivity analysis involves identifying important areas of uncertainty and testing key assumptions in a systematic way to determine the factors that are most likely to affect project success and to identify possible measures that could be taken to improve the chances of success.

A number of approaches can be applied to sensitivity analysis, including ranges of estimates, changing percentages and linear tests; these involve some advanced mathematical understanding and are not discussed here.

The primary point is that sensitivity analysis allows for the identification of critical areas that influence the success or failure of a project. This should provide those planning and managing projects with ideas about the areas that need to be studied in more depth or where action may be required to protect the project. Such action could include:

- adapting the project design to permit greater flexibility in response to changing circumstances;
- adopting a different scale of operation in the first instance, perhaps using a pilot-project approach;
- exploring alternative sources of material, energy or services;
- institutional adjustments to reduce the degree of uncertainty, particularly through the use of contracts; and
- ensuring that critical factors are monitored regularly during project implementation.

Sensitivity analysis also allows for the identification of the critical factors that might be included in a risk analysis of the project. In many cases, it is not possible to undertake risk analysis for a project because information is not available to establish the probability distribution for the variables under consideration. In such circumstances, it is only possible to undertake sensitivity analysis. However, where probability distributions can be determined, sensitivity analysis provides the first step by defining the critical parameters that should be tested in a risk analysis.

8. Conclusion

Project appraisal is a detailed and complex procedure with many issues to consider before a project is approved. Many criteria need to be satisfied, or else the negative effects of the proposed development could lead to budget shortfalls, environmental degradation, or unused or decaying public infrastructure.

There are many issues to resolve. For economic infrastructure, the financial appraisal frequently can show negligible rates of return and, yet, from an environmental perspective, the project is sound. Economic infrastructure initiatives, such as clean energy, solid-waste disposal, more efficient waste-water treatment and cleaner buses for urban transport, can have strong social and economic returns, but the low financial return can be a major disincentive for private developers and governments alike (the latter are especially reluctant to underwrite any potential revenue shortfalls for investors).

Nevertheless, even in the event of low financial returns, and affordability problems with infrastructure projects, there is always scope to look at other options. Too often, there is the analysis of 'option' versus 'no option', with little prospect of assessing an alternative.

A good example of a compromise option is the refurbishment and capital repair of existing infrastructure, which can provide an effective alternative. Undertaking new connections for water supply is an expensive procedure, but upgrading and refurbishing wells can increase the quality and quantity of fresh drinking water available to smaller communities. Purchasing a set of mini-vans for transport in congested cities can be a more efficient alternative to investing in a fleet of large and expensive diesel buses.

Very few projects can be expected to pass all stages of the appraisal analysis (technical, marketing, institutional, regulatory and legal, financial, economic and environmental factors), and that is why priorities and alternatives need to be part of the process. Thus, as each major infrastructure development has particularly strong criteria to justify it, the procedures for appraisal analysis need to be worked around the main priorities.

Although challenging, project appraisal provides a useful toolkit for decision-makers. The challenge for policy-makers is to use the appropriate tools at the right time and in the right place. In addition, the information from appraisal processes can be used by different interest groups for divergent purposes. Financial planning is essential for all projects to ensure both timely completion and long-term sustainability. The process of economic analysis is particularly relevant for medium- to large-scale projects, as the opportunity cost of time and effort involved in conducting economic analysis may make it too expensive for one-off, small projects.

A major reason for public sector intervention and involvement is the issue of externalities. These include environmental externalities as well as costs and benefits associated with the development of the infrastructure and social sectors. Some of these sectors provide services for which benefits may be based on consumer willingness to pay, while for others a cost-effectiveness approach to benefit assessment may be more realistic. Effective use of limited funds is especially important in ensuring that the poorest sections of the community have access to basic needs.

Appendix A: Stakeholder analysis as an input in project preparation

An important activity in project design is the identification of people, groups or institutions likely to be affected. These are the project stakeholders. Stakeholder analysis is particularly relevant for projects where a degree of participation is expected from beneficiaries in the design and/or operation of the project. It is used to gain a better understanding of the interests and needs of the various groups affected, and to assess their capacity to enhance or to threaten project implementation.

Stakeholder analysis differentiates between primary, secondary and external stakeholders. Primary stakeholders are those affected in a positive or negative way. Secondary stakeholders are those engaged in an intermediary role in the delivery of project benefits. External stakeholders are groups who are not directly involved either as beneficiaries or as implementers, but who may have an interest in the outcome of the project.

We can use tables to summarise the position of different stakeholders in relation to the project. Using the example of the building of a public hospital, Table A1 shows the various stakeholders by category and indicates their interests where these are relevant to the project.

Table A1: Statement of project costs and benefits

Stakeholders	Interests	Potential project impact	Importance relative to project priorities
Primary Beneficiaries of public hospital	Location of hospital, size of hospital, date of operation	– (if dissatisfied)	1
Secondary Finance institution	Probity in use of funds	–	2
External Members of Parliament	Project probity, effectiveness and customer satisfaction	–	1

These interests could include the expectations of stakeholders, the resources they are willing to commit, and any conflicts of interest. The potential impact on the project of those interests is given using positive (+), negative (–) and uncertain (?) indicators, and relative priority is indicated according to the nature of the project objectives. The indicator of relative priority is normally given on a scale of 1 (high priority) to 5 (low priority), and usually relates to the definition of primary, secondary and external stakeholders.

It can be useful to plot stakeholders on a graph against their level of power and influence and their importance for project objectives. This assists in the identification of stakeholders that must be included in project preparation.

For formal institutions, power and influence can be derived from legal status, leadership authority, control of resources, possession of knowledge and strength of position in negotiation. For informal groups, socio-economic status, levels of organisation and consensus, control of critical resources, informal influence and dependence levels are relevant.

If a participatory approach to project design is intended, a logical place to start is with an assessment of the degree of participation expected of each group at each stage of the project. Table A2 shows a participation matrix, which gives an indication of the roles of different stakeholders in the development of the project. At each project stage, stakeholders can be informed (provided with information), can be consulted for information or opinions, can

participate actively, can be delegated to a subsidiary role, or can be controlled (not involved in planning but involved in implementation). The appropriate role for each stakeholder group varies according to the stage reached in the project and according to the nature of the project.

Figure A1: Classification of stakeholders by relative importance for and influence on project objectives

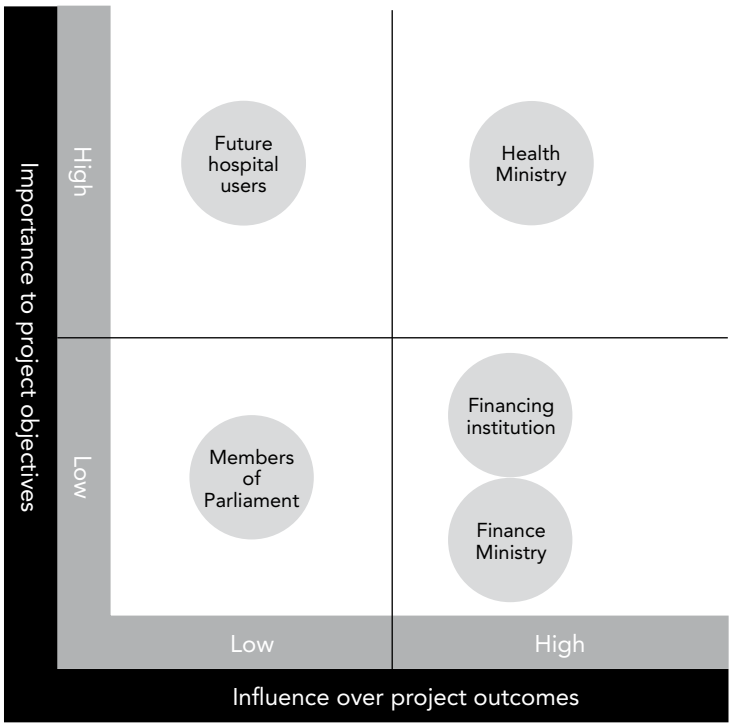


Table A2: Stakeholder participation matrix

	Inform	Consult	Partnership	Delegate	Control
Identification	Finance Ministry	Future users of hospital			
Planning	Members of Parliament	Future users of hospital	Finance institution Finance Ministry		
Implementation	Members of Parliament		Finance Ministry		Project contractor
Monitoring & evaluation	Members of Parliament		Finance Ministry		

The subsequent steps develop the project concepts into a coherent proposal. This involves techniques such as objective-oriented project planning and logical frameworks. Once a coherent project proposal is in place, project analysis and appraisal needs to be undertaken to ensure that the project is both feasible and desirable. This is discussed in the main paper.

Part 2

The Songo Songo Gas Development and Power Generation Project

Geraldine Baudienville[7]

7 The author wishes to express special gratitude to Mr Mwara A Shoo, PMU Co-ordinator at the Ministry of Energy and Minerals and Mr Pius M Mponzi, Assistant Commissioner Budget Analysis and Techniques at the Ministry of Finance and Economic Affairs, and their team, for making themselves available throughout the mission and for their invaluable support. Please note that the current case study heavily draws on the material provided by them, notably the World Bank Project Appraisal Document (Report No: 21316-TA), and would not have been possible without it.

The Songo Songo Gas Development and Power Generation Project includes two sub-components: the Songas gas-to-electricity facility, and the environmental and social management plan. Since July 2004, Songas has been a key provider of essential electricity to the people of Tanzania, particularly within the Dar es Salaam region. By utilising the country's own natural resources, the Songas facility provides an alternative source to hydroelectricity, which depends on regular rainfall to sustain the region's water supplies and heavy fuel generation, which is expensive.

Gas from the Songo Songo gas field, produced by PanAfrican Energy Tanzania (PAT), is processed at the Songo Songo Island facility and then transported through a 225km pipeline to Dar es Salaam, where it is used in Songas' Ubungo Power Plant, the largest gas-fired power station in East Africa (exhibit A). Songas also provides gas-transportation services to approximately 30 industrial customers.

The Ubungo power-generation facility, operated by Globeleq, generates about one-quarter of Tanzania's electricity (estimated at 700 MW). The electricity is supplied to the national electricity grid and distributed to end-users by the Tanzania Electricity Supply Company (TANESCO).

Natural gas was first discovered on Songo Songo Island in 1974. The first gas-utilisation study was completed in 1982. It concluded that the two most attractive uses of Songo Songo gas were for the generation of electric power for the domestic market and for the production of ammonia/urea fertiliser for export. In the mid-1980s, the government pursued a joint-venture arrangement with a private investor for the construction and operation of a fertiliser plant. However, the foreign investor withdrew from the project because of difficulty in raising local equity contributions and fertiliser price levels that did not justify the capital costs of the investment. Additional gas-utilisation studies conducted in 1989 and 1994 concluded that the main domestic market for gas was power, with the potential of gas use by some industries in the Dar es Salaam area. For this purpose, Songas was established in 1997, but the construction of the facilities started only early in 2002 after further studies had been conducted during the project-design phase.

Nature of the project

Songas is a limited-liability, majority privately owned and managed company (see exhibit B), which was established to develop, construct, own and operate the Songo Songo gas-to-electricity project. Songas is responsible for processing natural gas from the Songo Songo Island reservoir and transporting it to Dar es Salaam by pipeline. Some of the gas is delivered to the Ubungo Power Plant, which has been upgraded and converted to operate on gas, as well as extended from an initial capacity of 112 MW to 180 MW. Also, the Ubungo Power Plant has been privatised, and its debts transferred to Songas in exchange for the issue of shares. Power produced at the Ubungo Power Plant is sold to the Tanzania Electric Supply Company Limited (TANESCO), and the remaining gas is available for commercial use, including by the Twiga Cement Plant at Wazo Hill.

Under the project, a private sector joint-venture consortium between PanAfrican Energy Tanzania Limited (PAT) and the Tanzania Petroleum Development Corporation (TPDC) has been established. It is responsible for developing and marketing gas from the Songo Songo gas field to commercial and industrial users and for exploiting opportunities for export to neighbouring countries. In terms of the project's contractual arrangements, Songas is obliged to transport gas to end-users, applying a transparent transportation pricing mechanism.

Songas has prepared environmental and social assessments and a management plan report, which synthesises the environmental and social impacts of the project, and provides a detailed environmental and social management plan (ESMP) for eliminating or mitigating and monitoring these impacts. There are environmental impacts on forests and fauna, and on sea-grass beds along the marine part of the pipeline. The major impacts of this project, however, are due to resettlement and land acquisition. In total, about 2 945 households have been affected by the project. This includes the resettlement of 188 households along the pipeline corridor and of 155 households along the urban section of the pipeline around the outskirts of Dar es Salaam. In addition to these 155 households, another 155 households in these host communities were residing in areas designated for public use (roads, schools, churches, etc.) and had to be moved to the resettlement areas. Finally, the pipeline corridor affected another 2 602 households in some way, including through loss of crops and/or productive capacity, damage, disturbance and/or inconvenience that occurred during the construction period within the 30-metre way leave in the urban areas, and within the 60-metre way leave in the rural areas.

Project rationale and objectives

The total installed capacity in Tanzania in 2008 from both TANESCO and Independent Power Producers (IPPs) amounted to about 865 MW. The system is dependent on hydropower, which constitutes about 561 MW, or 65% of total installed capacity. Thermal generating capacity makes up the rest, and is provided mainly by IPPs.

Along with other sub-Saharan African countries, Tanzania experienced prolonged drought between 2003 and 2006, and this depleted the entire hydropower reservoir system. The situation was worst in 2006; at the end of February of that year, the country was threatened with complete closure of the Kidatu and Mtera hydropower plants, which contribute about 30% to the system's total installed capacity. However, the situation changed in 2007 and 2008, and the country received sufficient rainfall.

Only 10–15% of the population has access to electricity, with about half of all electricity consumption in the country occurring in the Dar es Salaam metropolitan area. Yet, electricity is an important input for sustaining economic growth and poverty reduction. A significant majority of the population, which depends upon wood and charcoal to meet its energy needs, is not within reach of the integrated electricity network and needs to be serviced by off-grid supply.

The main objective of the Songas project is to develop Tanzania's natural gas reserves to produce least-cost power generation for domestic and industrial use in an environmentally sustainable and efficient manner. The project promotes private sector ownership and management in the gas and power sectors. In addition, it encourages increased access to electricity supply by poorer groups, through developing financially and institutionally sustainable rural energy schemes in presently unserved areas along the pipeline corridor. Several analyses conducted before the implementation of the Songas project, including the June 1999 Power System Master Plan and its November 2000 update, concluded that the proposed project formed the first component of a least-cost power development programme to satisfy Tanzania's electricity requirements. In addition, these studies estimated that the project supports the most environmentally sustainable solution for the generation of power, because: it uses the cleanest available fuel source for energy production; it provides more affordable electricity and fuel for industrial use; and the gas infrastructure system and Ubungo Power Plant are owned and operated by the private sector.

The primary target population of the Songas project includes the existing and potential consumers of electricity on the interconnected power grid system, the villages along the gas

pipeline route, and businesses and industries that may switch to the use of gas for commercial purposes. The project benefits the public at large through increased fiscal revenues (gas fees and tax revenues), which make available additional funding to support health, education and social services. Also, it displaces imported fuel with indigenous gas, thereby freeing foreign exchange that can be used to import other important goods and services. More specifically, the project results in:

- the provision of electricity to homes and businesses, and of gas to industry, at the lowest cost (by using this local Tanzanian natural resource, it is estimated that the country has saved more than US$1.8 billion in fuel costs since commercial operations commenced in 2004);
- environmental benefits from the use of a cleaner fuel (natural gas), instead of diesel oil for energy generation and heavy fuel oil for industrial processing;
- improved plant availability, thereby enabling a more efficient dispatch of Tanzania's mixed hydro-thermal system to increase system reliability and service quality;
- the provision of a grid extension to five villages, and gas-based electricity access to five townships (Kilwa Masoko, Utete, lkwiriri, Kibiti and Bungo) along the pipeline route and to the inhabitants of Songo Songo Island (in addition, the Songo Songo Island population and many villages along the pipeline route will receive clean water supply); and
- fiscal revenues through gas sales, which amounted to around US$9 million in 2007/08 and US$11 million in 2008/09.

Implementation of the investment components of the project also directly benefits the population in the project areas by providing: employment opportunities during the construction and operational stages; and economic development opportunities, due to the availability of the gas infrastructure system as well as a need for local services and materials.

Appraisal and feasibility studies

Several studies have been conducted in relation to the Songas project, including overall electricity and gas sector analyses, which support the relevance and feasibility of the Songas project. Key general and project-specific studies include the following:

- The Power Sector Management Plan (1999 main report and 2000 update) (PSMP) assessed the short-, medium-, and long-term expansion options of the Tanzanian power system. It examined the most promising resource options and eliminated from consideration those generation options with energy costs significantly higher than other alternatives. The PSMP states that the best generation option for Tanzania under all major assumptions is the Songo Songo Gas Development and Power Generation Project. The generation expansion options assessed for the Tanzanian power system included the following alternatives:
    - an additional gas development and pipeline infrastructure system from the Songo Songo gas field;
    - electricity imports from Zambia high-voltage interconnection to Mbeya;
    - hydroelectric projects;
    - combustion turbines, combined-cycle, steam and diesel units, all dependent on imported fuel oil;
    - a medium-speed diesel plant, with its lower capital cost, smaller size and higher maintenance costs and heat rates, which appears very competitive with the low-speed diesel plant; and coal-fired steam generation, based on Mchuchuma coal development.

- The Songo Songo reservoir studies were carried out in 1982, 1990, 1992 and, most recently, 2000. The Gaffney Cline and Associates Reserve Certification Report (dated January 2001) certifies that there are 595 billion cubic feet of proven, probable and commercially recoverable reserves in the Songo Songo reservoir, which is more than sufficient to meet the gas requirements of the proposed project over the 20-year power-purchase agreement (PPA). In addition to Songo Songo Island, Mnazi Bay is considered to hold commercially attractive gas reserves; about 16 billion cubic feet have been established as being in contact with a single discovery well. Also, there are promising structural leads at Nyuni, Songo Songo West and Barakuni.
- The first gas-utilisation study, completed in 1982, concluded that the two most attractive uses of Songo Songo gas were for the generation of electric power for the domestic market and for the production of ammonia/urea fertiliser for export. Following the failure of the fertiliser-production project, a second gas utilisation study was conducted in 1989 to evaluate the use of gas for domestic power generation and industrial use in the Dar es Salaam area. The Songo Gas Development Evaluation Study (Economic Analysis of Gas Development Alternatives), dated January 1994, assessed the economics of various gas development alternatives, including the potential export of power/gas to Kenya. Both the 1989 and the 1994 studies concluded that the main domestic market for gas was power, with the potential use of gas by some industries. A market analysis estimated a potential gas demand from industry of around 15 million cubic feet per day in the Dar es Salaam area. This level of demand included about 5 million cubic feet per day for the Twiga Cement Plant, and covered a number of small industries (e.g. glass, paper and shoe factories, and breweries).
- The government carried out a study on the institutional and regulatory requirements for establishing a natural gas sub-sector. The study recommended regulation by contract to produce efficient transactions, until a regulatory framework was warranted. It recommended, in addition, a gas pricing policy that reflected the price of competing fuel alternatives. The government has adopted these recommendations under the proposed project by providing for a set of contracts within the Songas Contractual Agreements governing gas sub-sector operations.
- Twenty-seven environmental and social research studies, investigations and impact assessments have been conducted to identify possible negative impact associated with the natural gas processing plant on Songo Songo Island, the 25-km marine pipeline and the 217-km terrestrial pipeline for conveying gas to the Ubungo Power Plant located on the outskirts of Dar es Salaam and to Wazo Hill. The sponsor has prepared an environmental and social assessment and management plan report that synthesises the environmental and social impacts of the project, and provides a detailed environmental and social management plan for eliminating or mitigating and monitoring these impacts.

Institutional and regulatory environment

Executing agencies

Songas is registered as a majority privately owned company, in accordance with Tanzanian law, to produce and transport gas from the Songo Songo gas field to Dar es Salaam for electricity generation and industrial use, and to operate and sell power from the Ubungo Power Plant (180 MW) to the national grid. Songas has constructed, owns, manages and operates the gas processing plant on Songo Songo Island and the pipeline, as well as having refurbished and upgraded the Ubungo Power Plant. Also, Songas transports gas to the Twiga Cement Plant

(owned and operated by the Tanzania Portland Cement Company), and is responsible for processing and transporting gas for third-party industrial and commercial sales.

Songas is the executing agency for the Songas component and the resettlement infrastructure scheme under the ESMP. The Ministry of Energy and Minerals (MEM) is the executing agency for the ESMP. The MEM has delegated to TANESCO its responsibility for project-management oversight of the way-leave village electrification scheme.

Oversight agencies

Overall, the MEM is responsible for all energy-related matters, including electrical power, renewable energy, coal and petroleum. There is a project-monitoring unit specifically for the Songo Songo project. The energy division of the MEM has four sections: Energy Development; Petroleum and Gas; Electricity; and Renewable Energy. As one of its responsibilities, the energy division formulates energy policy, which includes licensing and legislation, and oversees implementation of energy policy. Additionally, the ministry facilitates resource mobilisation into areas where market forces have failed to ensure adequate energy services to the people. A further role of the energy division is to supervise the activities of various parastatal organisations, such as the TPDC and TANESCO.

The MEM is responsible also for establishing, staffing and overseeing the day-to-day operations of a project management unit (PMU) tasked with overseeing the implementation of the ESMP component of the project. The unit is headed by a project co-ordinator. Representatives of the MEM, TANESCO and the TPDC have been appointed to the PMU to work full time, in tandem with the environmental, social and contract monitoring and compliance consultants. The project co-ordinator of the PMU directs the various activities being undertaken by consultants, and co-operates with other government oversight bodies, such as the Ministries of Finance and Planning and the National Environmental Management Council. With assistance from consultants, the PMU has established and executes an appropriate monitoring and compliance programme linked to the ESMP, in addition to creating and managing a data base and filing system to monitor Songas contract compliance.

Project sponsor

Globeleq, the project sponsor, and PAT (through the PanAfrican Energy Corporation, PAE) have extensive experience in developing, building, operating and maintaining gas-to-electricity schemes.

In 1993, on the basis of a specified list of criteria, the government contacted 14 oil and gas companies and IPPs requesting the submission of investment proposals for the Songo Songo project. In 1994, following an evaluation of proposals, Ocelot Energy and TransCanada PipeLines were selected by the government to develop the project. An agreement of intent for the project was signed between the government and Ocelot Energy/TransCanada PipeLines in October 1995. Project negotiations were put on hold in mid-1997, however, awaiting policy decisions by the government concerning the construction of a 100 MW diesel plant at Tegeta.[8] Negotiations resumed in 1999. PAE's equity interests in the project were purchased by the private partner, leaving PAT (through PAE) to concentrate on its operational roles and

8 In 1995, agreements were signed with private investors for the construction of a 100 MW diesel plant at Tegeta in the Dar es Salaam suburbs, at a time when there was a perceived need for more thermal generation. The precise financial terms and conditions, however, remained to be negotiated in terms of verifiable costs. In April 1998, during the construction phase, TANESCO issued a notice of default to the private investors because, in its view, project costs were inflated. After several rounds of negotiations, the differences between the parties remained unresolved (a key issue was the cost of the plant and the calculation and value of monthly capacity and energy charges). In November 1998, in accordance with the dispute resolution clauses specified in the contracts, TANESCO submitted the matter to the International Centre for Settlement of Investment Disputes.

responsibilities in the optimum development of the Songo Songo gas field. In 2003, Globeleq acquired the private equity in the project and became the project's sponsor.

Contractual agreements

The government, the sponsor, PAE and two development finance institutions (DFIs) – the Commonwealth Development Corporation (CDC) and the Tanganyika Development Finance Company Limited (TDFL) (via the European Investment Bank, EIB) – have structured a set of contractual agreements with provisions for establishing mechanisms to achieve a steady and secure stream of revenues from the project. These agreements also prescribe the remedies for dealing with the full range of risks faced by the various parties, and allocate the commercial, technical and political risks to the parties best able to manage them.

The Songas component is structured as a build-own-operate arrangement, underpinned by a 20-year PPA between Songas and TANESCO on a take-or-pay basis. TANESCO makes monthly fixed (capacity) and variable (energy) payments to Songas that cover all operation and maintenance (O&M) costs, debt service, a target return on equity, the cost of fuel (gas) and any required build-up of reserves to finance anticipated gas-field development. An important feature of Songas' financial structure is that the return on equity is not guaranteed – it is a target rate of return based on Songas operating the project facilities in accordance with the agreed efficiency targets and O&M budgets.

The major risks borne by the sponsor include: capital cost overruns; delays due to either the contractors' or the sponsor's failure to properly design the project and adequately manage the construction or commissioning of the project facilities; gas plant, pipeline and power plant performance, including failure to maintain dependable capacity or to maintain the agreed heat rates, or gas quality changes; and operating cost increases exceeding the agreed O&M budget. Additional serious risks are payment defaults by TANESCO and currency inconvertibility.

Despite charging an average retail tariff that should be adequate (around US$0.093 per kWh), TANESCO has been unable to cover its O&M costs and debt service requirements. Revenue shortfalls have been due largely to weak operational performance and poor collection rates. As a consequence, maintenance has been deferred and system reliability has suffered (with losses of around 20%). While there has been improved regularity in monthly government payments for electricity consumption, and the pre-payment meter programme has increased cash collections, TANESCO's overall performance has been poor, and it has been unable to meet the growing demand for electricity or to significantly increase service coverage. Also, at the direction of the government, TANESCO has been obliged to invest in and operate rural schemes, which are socially important but not financially viable. Since 1999, TANESCO has made an effort, notably with the support of the World Bank, to upgrade its transmission and distribution networks; in addition, a cost-of-service study and a financial modelling study were conducted recently, with a view to requesting tariff adjustments from the Energy and Water Utilities Regulatory Authority (EWURA) that will eventually reach the level of full-cost recovery.

The Gas Agreement, the Production Sharing Agreement, and the Gas Processing and Transportation Agreement spell out the arrangements for: the use of 'reserve gas' set aside for the Songas project over the 20-year PPA (for the Ubungo Power Plant and the Twiga Cement Plant) at a preferred price; the setting aside by the government of 100 billion cubic feet of 'reserve gas' for electricity generation in the future; and the production and sale of 'additional gas' for power and industrial use by PAT/TPDC. Under the arrangements, PAT/TPCD is responsible for developing a commercial market for gas. Almost all revenue resulting from incremental sales of gas accrues to: TANESCO, in the form of lower gas transmission charges (and, thus, lower capacity charges to be paid to Songas); the government, in the form of

additional gas fees; and PAT/TPDC, for the production of gas in accordance with the Production Sharing Agreement.

Project costs and financing

Investment and financing plan

Initial cost estimates for the two components of the Songo Songo Gas Development and Power Generation Project were US$273.5 million (gas-to-electricity) and US$13.5 million (environmental and social management plan) (exhibit C).

These two components have been financed by credit extended by the IDA in the amount of SDR145.70 million (Special Drawing Rights equivalent to US$220 million), which became effective in November 2001. The IDA credit also covered a capacity-building element for the MEM.

However, the initial investment plan was revised (exhibit D), as savings were achieved (primarily because of favourable international market conditions in early 2002, which led to the bid prices for the engineering, procurement and construction contracts being significantly lower than the appraisal estimates). As a result, a first request for the utilisation of project savings was submitted by the government to the World Bank in September 2003, in which it proposed the restructuring of the project in order to employ the cost savings (US$78 million in 2003, including unallocated amounts) to: convert the 100 MW Independent Power Tanzania Limited (IPTL) Tegeta thermal power plant from heavy fuel oil to a gas-fired system; and add a new component for the rehabilitation and upgrading of TANESCO's distribution and transmission system. In June 2004, the World Bank approved the use of savings for the conversion of the ITPL plant to natural gas, but, since appraisal of the distribution and transmission component required further detailed studies (economic, technical, financial, environmental impact and social assessments), which were not ready at the time, it was decided to defer the decision in that regard.

Despite delays and cost increases (notably in the environmental and social management plan and the Tegeta Power Plant, due to foreign exchange movements) project savings by far outweighed the increases in project costs, giving rise to the second government request for the utilisation of project savings (US$42.9 million). However, it was expected that the MEM capacity-building component and the Tegeta project would require an additional disbursement of US$38 million to complete the outstanding activities.

Alternative financing structures

An IDA partial risk guarantee, IFC support and backing from the Multilateral Investment Guarantee Agency (MIGA) were considered initially, instead of an investment credit. In September 1995, the government and sponsors signed a letter of intent spelling out the principles pertaining to the scope, structure and commercial arrangements of the project. The effectiveness of a partial risk guarantee was reviewed then, even though this programme only became available for IDA countries in mid-1996. At the time, it was determined that: there was no interest from traditional providers of funds (e.g. export credit agencies) for a project in Tanzania, consequently requiring almost all of the debt to be covered by a partial risk guarantee; and there was little potential for mobilising such large amounts of commercial debt for the project on reasonable terms.

In early 2000, the possibility of an IDA partial risk guarantee was reassessed. The review concluded that since government-sponsor negotiations had been substantially completed, the introduction of a partial risk guarantee and commercial lenders would require significant renegotiation of all the project documents, which had already been concluded at considerable cost and effort. Renegotiations could take a substantial amount of time (one or two years, based on previous experience) and add further delays to realising the project. As this would involve time and development costs for the sponsor (in addition to the government's costs for legal and technical advisers), restructuring was not acceptable as it would lead to unravelling the project. It was found that long-term debt for the project, even if supported by a partial risk guarantee, would not lead to significantly better terms than those provided through IDA credit. Also, the IFC was involved in the development of the project, but decided not to participate because of the small size of its equity investment (US$6 million). The CDC was keen to pick up the IFC's equity position, and MIGA had been involved with the IDA earlier on in the project. Similarly, MIGA was not interested in providing currency-convertibility risk or breach-of-contract coverage at that time.

Exhibit A: Map of Songo Songo

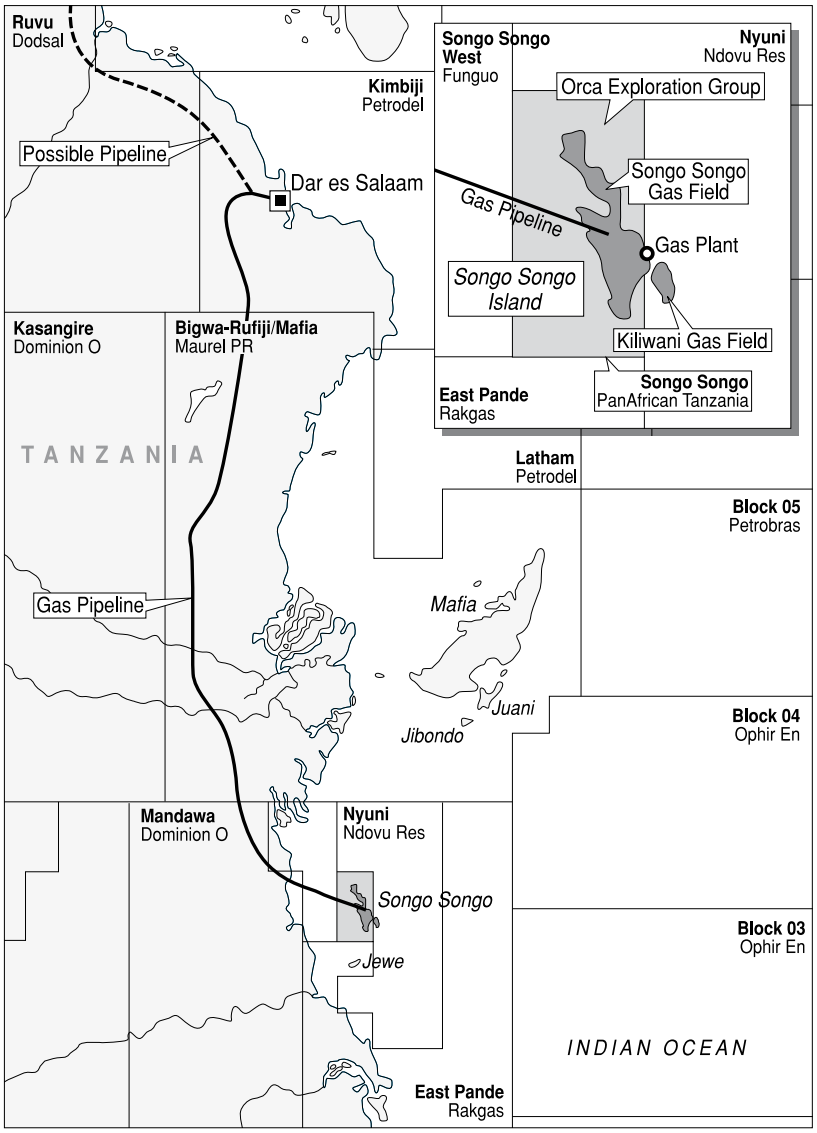


Exhibit B: Songas shareholding structure (31/12/2008)

Shareholders	Shares	Percentage of shares
Globeleq	56 570	54
TPDC	30 000	29
TANESCO	10 000	9
TDFL	8 000	8
Total	**104 570**	**100**

Source: Songas Audited Financial Statements for 2008

Exhibit C: Initial project costs and financing structure

Project costs (US$ million)		Percentage total	Financing (US$ million)		Percentage total
Songas	273.5	92	**Equity**	72	24
Environment & social	13.5	5	Private sponsor	50	17
MEM capacity-building	8.2	3	CDC	18	6
			EIB/TDFL	4	1
			Debt	223.2	76
			IDA	183	62
			EIB	40	14
			Government	0.2	0
Total	295.2	100		295.2	100

Exhibit D: Revised financing plan in US$ million (2007)

Government	2
IDA	220
CDC	22
EIB	41
Private sponsor	50
Total	335

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Example of case-study questions

You are an adviser to the Commissioner for Energy, located in the Ministry of Energy and Minerals of the United Republic of Tanzania. You are asked to develop a strategy for Tanzania's energy sector over the next ten years. Within that strategy development, you are to design and commission an appraisal study for the expansion of the project as against other options that could be designed to increase the country's generation capacity. You will have to pay particular attention to the following challenges that Tanzania faces today:

- *access to energy sources* – your strategy needs to take into account the nature and volume of energy resources available, as well as risks (technical and financial) associated with each source of energy in a context of rising concern about climate change and the long-term availability of fossil fuels;
- *access to financing sources* – your strategy needs to be based on realistic economic and financial assumptions, notably taking into account the impact of the financial crisis and ongoing recession on public finances in Tanzania and donor countries and on the private sector; and
- *change in the institutional and regulatory environment* – your strategy needs to address the new challenges arising from changes in Tanzania's institutional and regulatory environment, taking into account the role played by the newly established regulatory entity, as well as new and forthcoming regulations related to environmental impact adaptation and mitigation.

During your last meeting with the Commissioner, he asked you specific questions that are of particular concern to him in the light of important strategic meetings to take place in a few months time with the Ministry of Finance, TANESCO and EWURA (which regulates electricity tariffs), you have to undertake an appraisal of the possibility of extending the project.

- In your opinion, should Tanzania prioritise gas-fired electricity-generating projects, or should the country invest in alternative sources (hydro, wind, coal, regional integrated power grid, etc.) and use its gas resources for other purposes? How would you approach an appraisal of these options?
- If gas prices are to be regulated, what pricing strategy should be followed (how to regulate the price compared to market price)? What should the pricing strategy be for electricity? Develop the main arguments that could underpin a future request for tariff revision to EWURA.
- Should Tanzania continue to encourage private sector investment in new power-generating capacity, or should the government seek to have a majority share in new projects? What lessons can the government take from its experience with the Songo Songo Gas Development and Power Generation Project in this regard? On the basis of the proposed strategy, what support should be requested from the Ministry of Finance in terms of:
    - mobilisation of domestic public sources of funding;
    - attraction of local and/or private investors;
    - demand for support from donor agencies; and
    - attraction of commercial banks?

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