Guidelines for Calculating Financial and Economic Rates of Return for DFC Projects

J. Christian Duvigneau and Ranga N. Prasad
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Guidelines for Calculating
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for DFC Projects
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ABSTRACT

These Guidelines, prepared for Bank-assisted Development Finance Companies, explain how to calculate financial and economic rates of return. The approach concentrates on capital productivity and efficiency, and makes no allowance for income distribution effects. The financial rate of return indicates efficiency of resource use in the context of market prices. The economic rate of return indicates efficiency of resource use when prices are adjusted to reflect relative economic scarcities. Traded inputs and outputs are valued at the border, and domestic factors of production are shadow-priced and converted into border prices. The Guidelines offer a series of explanatory notes, standard tables, a note concerning the algebra of the net present value and domestic resource cost measures, illustrative case studies, a glossary of terms and a select bibliography.
Ces directives, rédigées à l'intention des Sociétés financières de développement bénéficiant d'un appui de la Banque, expliquent comment calculer les taux de rentabilité financière et économique. Elles portent essentiellement sur la productivité et l'efficacité du capital et il n'a pas été tenu compte des effets de répartition du revenu. Le taux de rentabilité financière exprime l'efficacité de l'utilisation des ressources d'après les prix du marché. Le taux de rentabilité économique exprime l'efficacité de l'utilisation des ressources lorsqu'on ajuste les prix pour tenir compte des raretés économiques relatives. Les intrants et les produits commercialisés sont évalués en prix frontière et les facteurs de production locaux sont évalués en prix virtuels et convertis en prix frontière. Ces directives comprennent une série de notes explicatives, des tableaux-types, une note concernant le calcul algébrique de la valeur actuelle nette et du coût en ressources intérieures, des monographies, un glossaire et une bibliographie selective.
En estas normas, preparadas para las instituciones financieras de desarrollo que reciben asistencia del Banco, se explica la forma de calcular las tasas de rentabilidad financiera y económica. El método se concentra en la productividad y eficiencia del capital y no se toman en cuenta los efectos sobre la distribución del ingreso. La tasa de rentabilidad financiera indica la eficiencia del uso de los recursos en el contexto de los precios de mercado. La tasa de rentabilidad económica indica la eficiencia del uso de los recursos cuando se ajustan los precios para que reflejen escaseces económicas relativas. Los insumos y productos comerciados se valoran en la frontera, y se aplican precios sombra a los factores internos de producción, convirtiéndolos a precios en frontera. Se da una serie de notas explicativas, cuadros estándar, una nota referente a los aspectos algebraicos del valor actual neto y el costo de los recursos internos, ejemplos de casos prácticos, un glosario de términos y una bibliografía seleccionada.
ACKNOWLEDGEMENT

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I. INTRODUCTION

A. Objectives of the Guidelines

1.01 As part of its assistance to Development Finance Companies (DFCs), the World Bank, in June 1974, released a short paper \( ^{1/} \) prepared to show how to compute an economic rate of return for a DFC project. The paper, which came to be known as the "Blue Book" because of the color of its cover, has been distributed widely to DFCs and other agencies. Over time, it became evident that many users within the Bank and in DFCs could benefit from more extensive guidelines than provided in the original brief document. These Guidelines were prepared to meet that need.

1.02 These Guidelines cover preparation of both financial and economic analysis for projects in industry and mining. They follow the same general method as the Blue Book but are more comprehensive in that they cover the analytical framework for both financial and economic analysis, provide an outline for data collection and organization, and include a fuller discussion of financial and economic concepts on which the recommended analysis is based. The Guidelines do not attempt to explain every aspect of financial analysis, but give emphasis to topics that are known to cause difficulties for many analysts in DFCs. Emphasis is on preparation of data, financial analysis of the project, and computation of its financial (internal) rate of return. Substantial coverage is also devoted to the economic analysis, which sometimes raises problems for many analysts who are otherwise proficient in financial analysis.

1.03 The methodology and techniques for calculating financial and economic rates of return suggested in the Guidelines are used by World Bank staff when appraising industrial and mining projects for direct financing, and are consistent with more sophisticated approaches that consider social as well as economic objectives. The cut-off rates used in the Guidelines are not meant to recommend minimum financial and economic rates of return including risk premia to be associated with individual projects and sectors (minimum rates normally used within the Bank range between 10-15%, but may be lower or higher depending on a country's opportunity cost of capital). They are offered simply as illustrations for discussing financial and economic appraisal techniques. The rates of return calculations should serve as a tool for achieving a more consistent and comprehensive analysis of a project. The proposed methodology and analytic techniques cannot substitute for a thorough project analysis based on the judgments of an

\( ^{1/} \) "Guidelines for Calculation of Economic Rates of Return on DFC Subprojects," Central Projects Staff, DFC Department, World Bank, June 7, 1974.
experienced analyst. Instead, they are aimed to provide a widely proven and accepted analytic framework for undertaking a systematic financial and economic appraisal of the project, and to allow the project analyst to undertake the data search, evaluation and analysis necessary to improve project concept and design to the extent feasible.

B. Scope of the Guidelines

1.04 Project appraisal should encompass at least six areas of analyses: (i) sectoral framework; (ii) market; (iii) process technology, project scope, size and design, implementation arrangements; (iv) management and personnel; (v) finance; and (vi) economics. The depth of coverage of these areas is discussed below.

1.05 The analysis of the sectoral framework should assess the mutual impact of (i) the economic sector in which the project is placed (structure, policies, constraints, strategies, linkages to the rest of the economy) on the project, and (ii) the project on the future development and prospects of the sector. In this context, it is particularly important to assess the impact of the incentive structures, policies with regard to foreign trade (tariffs, quotas), pricing policies, as well as other sectoral policies and resulting strategies on the project and, if necessary, to propose appropriate changes. Such analysis is largely outside the scope of these Guidelines. However, financial and economic analyses of the project may reveal shortcomings of sectoral policies such as pricing policies, import tariffs, investment incentives, and taxation policies, which should be dealt with in the appraisal of the project.

1.06 The market analysis of the project should normally (i) assess historic evolution of demand, supply, international trade and consumption of the project's outputs (and possibly also inputs, particularly when traded raw materials or intermediate goods are important); (ii) review domestic and international price regime, historic price evolution and price projections for the project's output and inputs; (iii) develop projections for future demand and supply and potential for international trade of project outputs and inputs, with and without the project; and (iv) analyze the efficiency of distribution and marketing systems. The analysis should be issue-oriented and aimed at developing recommendations for improvements necessary (or desirable) for the sector and/or the project to operate more efficiently. Again, the detailed discussion of such analysis is outside the scope of these Guidelines. However, adequate market analysis is crucial for an appropriate determination of the financial and economic viability of the project.

1.07 The technical or engineering analyses of a project typically deal with (i) process technology, scale of plant, design and layout of facilities, (ii) process flow of inputs and outputs, technical parameters of physical facilities, and process yields, (iii) standards and characteristics of inputs and their supply, of outputs and their storage and disposal, (iv) availability and use of utilities (water, energy), (v) environmental considerations, and (vi) project implementation arrangements, including procurement of goods and services, contractual arrangements and related issues. Again, a detailed discussion of such analyses is largely
outside the scope of these Guidelines. Yet, a thorough appraisal of the appropriateness of project capacities, technical parameters, input and output quantities and other technical data, as well as cost parameters for investment, operations, transport and distribution, form essential inputs for financial and economic analyses.

1.08 The management, manpower and organizational aspects analyzed in the context of project appraisal normally cover (i) the institutional framework of the sector, (ii) availability of, and need for, management with specific technical, financial and marketing know-how, (iii) availability of, and need for, skilled, semi-skilled and unskilled manpower, as a function of chosen technology, (iv) organization and staffing of the project institutions and facilities, (v) staffing costs, and (vi) need for, and cost of, training and technical assistance. The results of these analyses are again important inputs for the financial and economic analyses; however, the details of these analyses are outside the scope of these Guidelines.

1.09 The financial appraisal is one of the two main subjects of these Guidelines. It has four main objectives: (i) to evaluate alternative project configurations to determine the most attractive alternative and course of action; (ii) to develop a sound financing plan to cover expenditures during the implementation phase of the project; (iii) to ensure that financial resources will be available as needed during the operations to ensure timely availability of goods and services and to meet all financial obligations (e.g., service debt); and (iv) to verify that adequate levels of profits will be generated to reward investors for bearing risk and putting equity into the project rather than elsewhere.

1.10 The economic appraisal, the other main topic of these Guidelines, is undertaken to ascertain the overall impact of the project on a country's economy. In the financial analysis the viewpoint is that of a project sponsor. In the economic analysis it is that of a government decision maker concerned with broader economic development objectives of the country. It is here where the linkage of the project with the overall economy is of crucial importance.

1.11 These Guidelines concentrate essentially on the calculation of financial and economic internal rates of return. An internal rate of return (IRR) is defined as that discount rate which reduces the net present value of a series of different cost and benefit streams to zero. (Details in Explanatory Note No. 1 "Mechanics of Discounting"). The cost and benefit streams include cash costs only. Depreciation and interest charges are excluded (para 4.15). The IRR is an important test for assessing the quality of a project in financial and economic terms and is widely used by decision makers in governments, financial institutions and industry to determine whether a project is financially and economically viable. While the financial IRR measures whether a project is likely to be profitable enough to cover the average cost of capital of lenders and sponsors, the economic IRR indicates whether the project is efficiently using the country's resources, i.e., whether its economic IRR is higher than the opportunity cost of capital.
1.12 The Guidelines follow a deterministic approach, as compared to a probabilistic approach which often is desirable and necessary for complex and riskier projects even though it is more difficult to carry out. The deterministic approach means that a “most likely” set of numbers is chosen for the parameters which must be projected or estimated for the analysis. The resulting financial and economic projections and ratios, as well as financial and economic rates of return, represent one possible outcome of the project in the myriad of other potential outcomes. In such an approach sensitivity tests are essential to test alternative assumptions and determine the level of risk. This rigorous testing of assumptions and values is necessary for sound decision-making.

1.13 An important requirement for sound financial and economic analyses is the correct determination of prices of major inputs and outputs, because financial and economic rates of return of most industrial projects are very sensitive to these prices. Technical and qualitative distinctions among manufactured products and intermediate commodities make it difficult to obtain strict comparability of prices. To determine the correct long-term price of a product may require detailed analyses of the long-term global supply/demand structure of the product and its long-run marginal costs. Yet, such analytic work can be time-consuming and costly, and may not always be feasible for many DFC projects.

1.14 There is no obvious way to get around the difficulty of identifying strictly comparable inputs and outputs for use in project analysis. One must make a vigorous effort to specify the technical features and qualities of the products under consideration, determine their expected prices during the project life and then consider the possibility and level of higher or lower prices. The common approach is to project the appropriate prices after detailed analysis, and use these projections to calculate the expected rate of return; and it is desirable to undertake a sensitivity analysis to determine what would happen to the rate of return if the prices were higher or lower than those used in the base case.

1.15 The techniques recommended in these Guidelines require the analyst to be methodical and orderly. Many assumptions can affect the outcome; these should be explicitly stated for future reference. Without a careful analysis, incorrect conclusions are likely. Standard tables are provided in the Guidelines to help analysts undertake financial and economic analyses of typical industrial projects. When assumptions are clearly spelled out and standard tables are used, review by others is greatly facilitated.

1.16 Rate of return calculations cannot fully quantify and capture the likely development of important aspects such as technology transfer, effects from environmental pollution or degradation, and country risks. Such non-quantifiable costs and benefits must be considered by the decision-makers, in addition to the rates of return themselves.

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2/ This “most likely” set may be very subjective and depends on initial assumptions for the estimation of parameters. The analysts should therefore document all underlying assumptions.
1.17 A word of caution is in order about expansion projects, i.e., projects which build on existing facilities. Many projects involve modernization, rehabilitation or expansion of existing plants and often loan applications are based on a "before and after" analysis. In such cases, the correct procedure for the internal rate of return analysis is to measure the net benefit of a project by comparing two future scenarios: one "without" the project under study (i.e., assessing the future of only the existing facilities without the proposed expansion) and another "with" the project (i.e., assessing the future of the expanded facility). This is not the same as a "before-and-after" analysis. It is essential that the analysis be carried out in the "with/without" framework even if it involves some additional effort (for a more detailed discussion, see paras 4.08 and 5.10).

1.18 Finally, it must be emphasized that not all aspects and facets of methodologies, explained in these Guidelines are essential under all situations and for each project, whether small or large, simple or complex, "greenfield" or expansion. Judgement should be used to weigh the benefits of additional, maybe marginal information on a given project against the costs of obtaining it. For example, in situations where the economic benefits of the investment are quite obvious (e.g., investments for debottlenecking or for improvement of energy efficiency of otherwise efficient operations) simple demonstrations of economic merit could be used. Thus, shadow pricing of certain inputs maybe unnecessary given their relatively small weight in overall operating costs. The necessary judgement on what analyses are essential comes with the experience of carrying them out. Sensitivity analysis on a simplified rate of return calculation can help to identify areas where a project is weak or sensitive and therefore requires further probing. Chapter VIII provides some comments on the use of simplified approaches and "short cut methods". Of course, "short cut methods" must be used cautiously and with sound judgement based on experience.

C. Structure of the Guidelines

1.19 These Guidelines are structured into the Main Text, Explanatory Notes, Annexes, Illustrative Case Studies, a Glossary and a Bibliography. Since potential users have widely varying levels of training in finance, economics and experience in project appraisal work, an attempt has been made to make individual chapters, explanatory notes, illustrative case studies, and items defined in the Glossary as self-contained and independent as possible. This should permit quick and ready reference to particular aspects of methodology, concepts or issues.

1.20 Chapter II of the Main Text deals briefly with the objectives and analytical framework of financial and economic appraisal. Chapter III describes typical information requirements for project appraisal and suggests approaches to data collection and organization. Chapter IV discusses the basic concepts of financial analysis, and explains how to establish cash flows for calculating the financial rate of return (IRR). Chapter V deals with the mechanics of IRR calculation, covers different concepts of financial rates of return and describes most common sensitivity analyses. Chapter VI explains the basic concepts behind economic analysis,
and how to calculate economic costs and benefits as opposed to financial cash flows. Chapter VII illustrates how to calculate the economic rate of return and interpret results. Finally, as already mentioned above, Chapter VIII suggests some "short cut methods" to obtain initial, quick assessment of a project's viability.

1.21 Explanatory Notes, which cover in some detail certain concepts and analytical methods, are provided to give explanations and illustrations of key points. Finally, the Glossary at the end of the Guidelines gives brief definitions of the key terms used in the main text.

II. OBJECTIVES AND FRAMEWORK OF FINANCIAL AND ECONOMIC APPRAISAL

A. The Sponsor's Point of View: Increasing Sponsor's Net Income

2.01 The typical DFC project is a profit-oriented venture that manufactures, processes, assembles and/or sells goods and services for sale in a marketplace. The basic objective of financial appraisal is to provide decision makers with the information needed by them to judge the financial viability of a specific project they may wish to sponsor. Thus, for a project sponsor willing to invest his risk capital into the proposed project, the basic objective of the financial analysis is to determine whether the proposed investment would generate a stream of future income sufficient to meet the minimum financial return requirements of the sponsor in a time frame acceptable to him. Since alternative investment opportunities normally are available to most investors, the rational sponsor will place his funds in an activity which promises to generate a future stream of income that meets or exceeds the opportunity cost of capital in alternative investments.

2.02 Many projects supported by DFCs involve the purchase of machinery, equipment and other items to modernize and balance a production line to reduce primarily the future operating costs. The appraisal techniques for such projects are the same as for output-expanding ventures, except that project benefits are now cost reductions rather than revenue increases.

2.03 Investors can use a variety of methods, tests and techniques to measure the potential rewards of placing investment funds into one activity instead of another. The financial objective of investing the funds in any activity is usually the same, viz., to maximize the resulting flow of income while remaining within the level of risk acceptable at that return. A systematic analysis helps to bring out the nature and extent of risk as well as the likely return on investment to be expected.

2.04 The essential question raised by a project sponsor is this: "If I spend $x of my own and other persons' money to build and equip a factory (or other facility), what kind of return can be expected within a reasonable period of time if things go as expected?" The intelligent investor will want to explore alternatives to find those that promise the highest return at the lowest risk. The most important measure of return from the
specific viewpoint of the sponsor who places equity in a project is the after-tax financial rate of return on investment and on equity and not the before-tax financial IRR. The methodology for calculating these measures is explained in paras 5.03 and 5.08.

B. The DFC's Point of View: The Development Banker's Position

2.05 A project sponsor should have performed analyses necessary to have a reasonable assurance of a satisfactory post-tax return on equity, prior to approaching the DFC for a loan. These analyses should indicate to the DFC the project's financial soundness and the sponsor's solvency and creditworthiness. Liquidity during the difficult start-up period of a project and the ability to service debt throughout its life, after having met tax obligations, are among the important tests of a sound project. In that sense the DFC should be concerned about the financial viability of the project and about the financial strengths of the sponsor like any commercial bank. If the DFC is asked to invest equity money as well, this type of analysis is equally important for the DFC.

2.06 However, from the DFC's viewpoint as a development institution, an after-tax financial rate of return on investment may not yet convey enough information on the project's financial viability. Staff analysts may want to look also into a project's fundamental strengths, without regard to specific financing considerations. The financial rate of return on all resources before taxation can be an interesting measure of a project's fundamental soundness since it is not affected by special financial and tax features which may change with time. A DFC therefore should be interested in both the project's financial rate of return before taxes as well as in the return to the investor (i.e., after taxes) and the expected evolution of his financial position during the life of the project. Comparing the two returns can help to distinguish fundamental project strengths and tax breaks.

C. The Country's Point of View: Using the Economy's Resources Efficiently

2.07 Useful as the financial rate of return is, it usually does not give an accurate indication of a project's net impact on a country's economy. To obtain such an indication, one turns to the economic rate of return. This measure determines the economic merit of the project from the country's viewpoint. It therefore treats import duties, sales taxes, profit taxes, and other government levies (or subsidies) as internal transfers within the country and disregards them, since they do not affect the overall wealth of that economy. It also uses "shadow prices" (see para 6.03 below) instead of domestic input and output prices, in case they do not adequately reflect the opportunity costs to the economy. For traded goods shadow prices (or economic prices) are international (or world) prices at the border of the country (border prices), i.e., cif prices (before tariffs and duties) for imports, and fob prices for exports. For nontraded goods (for example, land), the economic cost is defined as the value of net output foregone (when using that good in the best alternative use) as a result of using that good in the project. Use of shadow prices enables one to see beyond the effects of tariffs, exchange rates, interest rates, and wage rates, as well as administered prices, subsidies and sur-
charges that distort a product's true scarcity value. It enables one to measure an investment's efficiency of using the resources of an economy, priced at border prices.

D. Income Distribution

2.08 A few remarks are in order about the measure of economic merit, i.e., the economic internal rate of return. The stream of future income generated by a proposed investment may be spent entirely to purchase items of final consumption; or, alternatively, some of it may be saved. The occupational and income status of the recipients, together with other phenomena, will condition their spending and saving propensities. A poor person is likely to spend marginal income rather quickly for food, clothing, and other necessities of life, whereas a wealthy person may save a considerable proportion because immediate needs are satisfied.

2.09 An investment project can have important distributive effects of the benefits generated. These income effects are of two types: interpersonal (i.e., between different groups) and intertemporal (i.e., between different times). Other things equal, a venture that creates future income for poor people may be considered superior to a venture that does not. Other things equal, a venture that distributes income to people with a high marginal propensity to save may be considered superior to one that does not. The problem is that the two considerations may be mutually exclusive. The poor person who wants to meet his basic needs is likely to consume most of the marginal income. On the other hand, this reduces the amount of savings available to finance future investment, and reduces future income growth potential.

2.10 These interpersonal and intertemporal distributive effects can be important, and in some investment projects it may be important to consider them in detail. For the typical DFC project, however, the "efficiency" appraisal criteria set forth in these Guidelines should suffice. It is a special case of the more general "social" analysis described in other sources, rather than in contradiction to it. A unit of future income in the hands of one recipient is assumed to be of equal welfare value to that received by any other recipient—rich or poor, private or public. This admittedly simplifying assumption is considered acceptable while analyzing a typical DFC subproject.

E. Analytical Framework

2.11 These Guidelines deal mainly with the calculation of financial and economic rates of return which, by definition, are those discount rates

3/ A detailed discussion of distributional considerations is contained in a separate World Bank Publication (Economic Analysis of Projects, by L., Squire and H., van der Tak—Reference 2 in the Bibliography). The appraisal process may generate some of the data needed to perform a supplemental test of distributive effects, and a skilled analyst will be able to present the information when it is likely to be of material importance.
which achieve a net present value of zero, when discounting sets of financial and economic cost and benefit streams for a given project. The task of the analyst is to use the cost information for a proposed project from the engineer (capital cost estimates, operating cost estimates, transport and distribution cost estimates) and put them into a systematic and consistent framework to permit projections of cost streams which will be used in the IRR Analyses. Similarly, pricing and sales estimates result from the market analysis of the project and are used to develop projections of likely revenues for the project (benefit streams). The systematic annual projections of the cost and benefit streams are needed to compute a net benefit stream, which, in turn is discounted to calculate the financial internal rate of return (financial IRR). Through elimination of transfer payments and application of appropriate shadow prices to the financial cost and benefit streams with the help of the economist, the financial cash flows are transformed into economic cost and benefit streams, to calculate the economic internal rate of return (economic IRR).

2.12 The analytical framework normally used in the above process is a set of financial tables which is based on the standard projected balance sheet, income statement and cash flow statements for the project. These statements are projected for the life of the project. Cost and benefit streams are extracted from these projections as explained in Chapter IV. The economic IRR is similar in concept to the financial IRR in that it is a measure of the return on the funds invested in the project. However, for the economic IRR all costs and benefits are measured from the viewpoint of the economy of the country as a whole.

III. DATA NEEDS AND DATA ORGANIZATION

A. Feasibility Study

3.01 Projects to be supported by a DFC must be demonstrated to be sound from the market, technical, management, financial and economic points of view. A feasibility study of the project prepared by the sponsors should include data needed to demonstrate the project's soundness. The feasibility report submitted to the DFC for its review should therefore deal with all aspects briefly summarized in paras 1.04 to 1.10. An outline of such feasibility study is given in Annex 3-1. Of course, the costs of preparing the feasibility study must be weighed against the overall costs and benefits of the project. The depth and degree of detail of the feasibility study depend to a large extent on the proposed project's scope, size, complexity and risks. Nevertheless, the feasibility study should include adequate analyses of market, technical, management, implementation, financial and economic aspects to assess the project's expected costs and benefits, and risks.

3.02 The typical feasibility study also contains an executive summary, highlighting main features of the project, major issues, problems and to risks, and an outline of actions proposed to deal with the issues, and minimize risk. For large and complex projects, the main text will have sections on the (i) economic environment in the country and its implications for the project; (ii) industrial sector; (iii) market for the inputs
and outputs of the proposed project; (iv) company and/or sponsor; (v) objectives, scope, process, and technology of the proposed project; (vi) implementation, start-up schedules, procurement and contractual arrangements; (vii) organization, management, staffing, training and technical assistance arrangements; (viii) capital cost and financing plan; (ix) financial analysis; (x) economic analysis; and (xi) recommendations as to special actions required, conditions to be met, etc. The main text of the feasibility study will be supported by appropriate annexes providing detailed backup data, tables, assumptions used and analyses as well as other relevant background material. For smaller projects some of the above sections could be covered within a short paragraph or only a few sentences. However, an adequate coverage of the above points should be included for all projects.

3.03 Under normal circumstances, the DFC should insist that a reasonably comprehensive feasibility study be submitted by the project sponsor along with his formal application for project financing (equity and/or loan). While this study may not contain a detailed economic analysis, it should cover relevant market aspects, project details, personnel-related and technical, as well as financial, information and analyses to enable the DFC to assess the project's strengths and weaknesses, its financial and economic implications, its risks and potential for rewards. The DFC can then itself prepare the economic analysis along the lines suggested in Chapters VI to VIII.

3.04 Often the project sponsors may not be able to prepare by themselves a project, analyze alternatives, and design an appropriate project configuration. In that case the DFC may consider providing guidance for the establishment of the feasibility study by the sponsors, or may finance consultant services to help the sponsors to organize their project ideas, to collect necessary technical and financial information and to set that information into an analytical framework which will permit the systematic project analysis and design of an optimal project scope, configuration, layout and design. Again, the costs for establishing an adequate feasibility study should be in a reasonable relation to the project's investment volume (typically less than 1-2%) and should be justified through a large initial probability that the project is sound.

3.05 The subsequent paragraphs focus on the data necessary for the establishment of a financial and economic analysis. They deal with details of project timing and related schedules, with costs and revenues, necessary to establish financial statements and cost and benefit streams for rate of return calculations. These data should be contained in sufficient detail in the feasibility study provided by the project sponsors, and should be reviewed carefully by the DFC staff as to their reliability.

B. Project Timing and Schedules

3.06 Project schedules are important elements in project analysis and IRR calculations, since the IRR analysis deals with "timed" streams of costs and benefits. Typically the financial analyst needs to distinguish between the (i) schedule of project preparation and implementation up to testing of equipment and start-up of facilities; (ii) the schedule of early
operation and increasing capacity utilization, as the company's staff becomes increasingly familiar with the new facilities and technical "teething" problems are corrected; this period until achievement of "steady state operations" is often referred to as the "learning curve"; (iii) the project life, referring to the expected duration during which the new facilities will be able to produce economically the output for which they were designed; and (iv) schedules of financial nature, such as equity and debt draw down schedules, debt servicing schedules, dividend and tax payout timing, etc. Other schedules, such as staffing and training calendars as well as timing of technical assistance contracts, will also affect cost and benefit streams, but to a lesser degree.

3.07 Project preparation and implementation schedules determine the disbursement pattern of investment expenditures and therefore need careful evaluation. These schedules should be based on realistic assessments of foreign as well as local factors influencing them and normally require experienced engineering input. Realistic procurement schedules up to signature of contracts and timed to carry out the optimal sequencing of project implementation are the first important step. Execution schedules for civil works, manufacture and delivery of equipment, as well as erection, installation and testing of equipment need to be closely coordinated to minimize costly project implementation delays. Typically a network plan with identification of the critical path is established for the preparation, implementation, testing and starting of complex projects to assure optimal execution. The timing of different contracts which is governed by physical execution schedules, dictates the schedules of down payments, progress payments and retention payments which, in the aggregate, represent the first years of the capital cost stream of the IRR calculations. A typical project implementation schedule is shown in Annex 3-2. Examples of contractual progress payments, i.e., expenditure schedules, are contained in the Illustrative Case Studies (after the Annexes).

3.08 The learning curve for the start-up and operational phase of a project is influenced by factors such as the experience of personnel with the new technology, experience of starting up a new facility, size and complexity of the new project, quality of equipment and of erection and installation, availability of technical assistance during start-up as well as organization of timely availability of required inputs from outside the plant. Results of this analysis are usually expressed as percentages of capacity utilization over time and will therefore determine the (i) estimated production schedules and resulting revenue projections as well as (ii) input quantity estimates over time and resulting operating cost projections. Typical learning curves for various industries are shown in Annex 3-3. Given the strong impact of initial operational results on cash flow and financial situation of a company, the curves should be estimated reasonably conservatively.

3.09 The economic life of a project is a rather abstract concept for the purpose of IRR calculations, albeit a necessary one. In practice, different components of investment packages are likely to have different physical life expectancies. Thus, the mobile equipment of a venture may have a physical life of only 5 to 7 years and require replacement thereafter, whereas a stationary piece of heavy machinery may last 20 years and
civil works 30 years or more without major rehabilitation or replacement work. However, in economic terms, some components or even the whole project may become obsolete before the end of the physical life of the overall plant due to development of more efficient technologies and increasing competition from newer, more efficient facilities. The IRR analysis requires a common time frame for cost and benefit streams. Therefore, a careful judgment must be made about the overall project life in terms of likely physical and economic life expectancy, taking account of considerations of likely technological evolution, sectoral developments, replacement costs and economies of scale. This judgment should be made by the sectoral specialist. The discounting factors decline over the years so that the impact of cash flows in later years on the project's rate of return becomes less important. Thus errors in judgments of the useful life of projects beyond about 15 years are unlikely to be critical.

3.10 Project implementation period plus project life define the overall time frame for IRR calculations. Cost and benefit streams are established within this time frame (para 3.12).

3.11 Schedules of a financial nature are important for the establishment of pro forma financial statements (income statement, balance sheet, cash flow statement) and are crucial in determining the financial solvency and creditworthiness of the project sponsors. However, in the financial and economic rate-of-return calculation, the method of financing, of debt servicing (interest and principal repayment), depreciation and dividends are unimportant.

C. Cost and Benefits

3.12 The IRR analysis calls for the consistent establishment of all cash cost and benefit streams under the same estimated time frame (project implementation and project life). Typically the analyst must distinguish between (i) capital cost streams, (ii) operating cost streams and (iii) revenue streams (benefit streams). The sum total of costs and benefits for each year results in the "net benefit" for each year. Depending on the absolute size of all costs and benefits for a given year the net benefit can be positive or negative. The stream of annual net benefits is simply referred to as the net benefit stream. One can think of the analytical framework of the IRR calculation as a matrix consisting of the annual cost and benefit streams (para 4.14 illustrates such table matrix). Desirable standard tables for the required data are shown in Annex 3-4, Tables 1 to 5 and explained in the text below.

3.13 Capital cost estimates should be established for each project configuration and should be grouped into local and foreign costs. They should also distinguish between capital costs for (i) fixed assets, including costs for land, civil works and buildings, equipment and machinery, but also engineering, services and in-plant infrastructure, (ii) outside plant infrastructure, (iii) start-up costs, and (iv) working capital. Total financing required for the project also needs to consider interest during construction which has to be covered by the overall financing plan and will enter projected balance sheets and fund flow statements. If major project components are estimated to require replacement, within the time frame of
the IRR analysis, appropriate "replacement costs" must be accounted for in the capital cost stream (see example on Cement Plant Project: Replacement of Mobile Plant). Annex 3-4, Table 1 shows a typical project capital costs table, resulting in a base cost within the plant. It also lists typical capital cost items for infrastructure facilities often required outside the plant (e.g., links to electricity, transport, and water network). Working capital requirements, for the purpose of the IRR calculation, involve the net incremental working capital, that is, the gradual buildup, over time, of current assets minus the buildup of current liabilities. For this purpose, a working capital schedule should be prepared (example in Annex 3-4, Table 3).

3.14 The base cost estimate of a project is the best judgment of the estimated costs, as of a specified date, and assuming that the quantities of land, works, goods and services as well as prices relevant to the project are accurately known and will not change during implementation and that the project is implemented as planned. The base cost estimates do not reflect changes in quantities and prices that may be expected during implementation. Contingency allowances are an integral part of the expected total costs of the project. Normally, such allowances are necessary for all project items involving significant expenditures. The allowances should reflect physical and price changes that can reasonably be expected to increase a base cost estimate, after it has been prepared to a degree of thoroughness and professional standard appropriate to the type of project under consideration. The allowances are, however, not intended to provide assurance against the effects of all possible adverse events and conditions. Contingency allowances may vary with the nature and components of a project and may need to be calculated separately for each main item included in the project. The estimate of total project cost including contingency allowances represents the best estimate of expected final costs at the time of project completion.

3.15 Physical contingency allowances reflect expected increases in the base cost estimates of a project due to changes in quantities and methods of implementation. Physical contingency percentages may vary for different project components depending on the degree of certainty on which the estimate is based. For example, for items where contracts have already been signed and the likelihood of errors and omissions is small, a 5% contingency may be generous; whereas for a civil works' cost estimate, even a 15% physical contingency might be low, if the estimate is based on a crude design without soil investigation and estimate of required bills of quantities. When suitable physical contingencies would have to be relatively large, say more than 15% to 20% on overall base costs, consideration should be given to further refinement of site investigations and of basic designs in order to reduce uncertainties. Price contingency allowances reflect expected increases in project costs due to changes in unit prices for the various project components beyond the date of the base cost estimates. The overall price contingency allowance is built up by applying expected annual price increases to the base cost estimates of the various project components, expressed in annual amounts of expenditures and including prorated physical contingencies, starting with the date of the base cost estimate. Price contingencies are discussed in more detail in paras 3.22 to 3.24.
3.16 Capital cost estimates should be of a high quality to permit a realistic project assessment and establishment of an adequate financing plan. Comparisons with similar projects elsewhere may be useful but should take account of differences in time, layout, size, local economic and physical conditions, etc.

3.17 The financing plan, while not an essential ingredient for basic IRR calculations, is a vital element in project appraisal. That plan needs to assure that at all times during project implementation, startup and early years of operation, sufficient funds are available to cover capital cost expenditures and incremental working capital needs. That forecast should also take account of conservative estimates of internal cash generation, particularly in the case of expansion projects. Given its importance these Guidelines contain a typical format for a financing plan in Annex 3-4, Table 4. For many DFC projects that simple format will suffice.

3.18 For elaborate and detailed calculations of after-tax IRRs and returns on equity (para 5.08), knowledge of the financing plan and of conditions of financing is necessary. In this context, questions arise frequently concerning the proper treatment of foreign investment and loans (see also para 5.09). In any case, the analyst should try to obtain as much information about the terms and conditions of foreign financing as possible.

3.19 Operating Cost Estimates: Based on input requirements, process flows and resulting input/output coefficients within the proposed plant, and based on estimated production buildup, operating costs can be estimated for the project. It is useful for subsequent financial and economic analyses to distinguish right from the start between (i) local and foreign operating costs, (ii) variable and fixed operating costs. The latter distinction will permit break even analyses (paras 4.11 and 4.12) whereas the former is necessary for an economic analysis involving shadow prices.

3.20 Typically, operating costs are estimated for the "steady state" of plant operation, i.e., at a production level near a realistic level of capacity utilization, once the learning curve has reached a plateau (the steady state). However, due to lower production levels in early years of operation, the total level of annual operating costs is typically lower during earlier years of operations. On the other hand, given a lower efficiency in early operations and the impact of fixed costs on a lower capacity utilization, the average unit cost of operation during early years can be significantly higher than during the steady state situation. In order to take account of these effects, it is useful to establish systematically the annual operating costs on the basis of detailed cost estimates for the steady state situation, grouped by major operating cost components (Annex 3-4, Table 2).

3.21 The benefit streams rely on a calculation of annual revenues for different products. The annual revenue for a given output is calculated by multiplication of the estimated net product price with the projected production quantity. Also financial and economic IRR calculation need to distinguish between financial and economic price. A financial product
price may not be available and will have to be estimated if the product is not yet traded domestically. The market analysis should provide estimates of the financial price at which the projects output would be sold. For a discussion of economic prices see Chapter VI.

D. Price Changes

3.22 Price changes are an important factor affecting projects throughout their implementation and economic life, with respect to capital and operating costs as well as revenues. If all prices increased at the same rate at home or abroad, their relative levels would not change. If, in that case all prices were deflated in order to correct for the general increase in nominal (or current) prices, "real" prices, i.e., prices expressed in constant value terms, would result. In that case, the comparison of costs and benefits of a project for the purpose of calculating its economic and financial IRR should not be affected by changes in the general price level resulting from inflation.

3.23 However, relative price changes do occur in the world. Typically, different cost categories (e.g., energy, labor, raw materials) incur differing rates of change over time. If differences are significant, they should be projected for the period under consideration and be taken into account. For the purpose of IRR calculations, it is important to distinguish whether changes in prices, anticipated during the life of a project, are estimated in real or in nominal terms (para 3.24).

3.24 Up to now, cost and revenue categories described above were estimated in constant prices, as of a specific date (base cost as, for example, for capital costs). Applying different estimated rates of inflation will convert these data into nominal terms. For capital costs, this consideration is particularly important, since the financing plan will have to cover total capital costs expressed in nominal terms. Similarly, financial cash flows should be in nominal prices to determine the financial performance of the project and the creditworthiness of the borrower. For purposes of IRR calculations, however, real terms are preferred since they incorporate relative price changes but disregard inflation. Real term projections are obtained by deflating nominal term projections by the estimated level of general inflation. The financial IRR can be calculated in nominal or in real terms. (As a first approximation, the real financial IRR equals the nominal IRR less the average annual inflation rate expected during the projected period). If general inflation is unimportant the financial IRR is quite acceptable in nominal terms. The economic IRR is always estimated in real terms.

E. Exchange Rate Considerations

3.25 The base cost estimate (para 3.14) as well as operating cost projections have distinguished between local and foreign costs. To express all costs in the domestic currency, normally the prevailing exchange rates are being used for the purpose of financial analysis. However, we have to project costs and benefit streams over a considerable period of time into the future. Thus, applying the present exchange rate to the future cost and benefit streams may be misleading.
3.26 The assumption of a constant exchange rate over time normally implies among other things, that domestic price inflation moves in parallel with that of the country's main trading partners. If this assumption can readily be made, use of the constant exchange rate over time may be justified provided there are no other factors (e.g., balance of payments problems) that would affect relative exchange rates over time. However, in some countries domestic inflation surpasses significantly that of their main trading partners. Then the country can either follow a crawling-peg policy, whereby the exchange rate is adjusted continually according to the amount of inflation differential or it might attempt to postpone devaluation. Postponement of devaluation leads to overvalued exchange rates, distortion of price signals and eventual misallocation of resources in the economy. At some point, a major devaluation will be required to remove those distortions.

3.27 The analyst has to make a judgment with regard to the likely development of inflation domestically and for main trading partners. If the projected inflation differentials are small and one therefore can assume constant exchange rates over time, the task is simple. If, however, the domestic inflation rate is high and inflation rate differentials with major trading partners significant, the exchange rate development matters and must be considered. In the case of a crawling-peg policy environment, the analyst may want to do financial projections in a foreign currency at the projected international rates of inflation and assume that the exchange rate will be adjusted regularly. In this manner, he will be able to make all projections applying the foreign inflation rate to domestic and foreign costs (expressed in foreign currency and converted at the presently prevailing exchange rate). Alternatively, he could apply the foreign inflation rate to foreign currency and the (high) domestic inflation rate to domestic currency. In that case, he would have to estimate an annual projected exchange rate, which is a function of the inflation rate differential. On the other hand, if domestic inflation is high and the government does not have a clear exchange rate policy, further analysis is required. One possibility would be to assume a crawling-peg policy and then to test for sensitivity (see Explanatory Note No. 2 on "Currency Devaluations").

IV. FINANCIAL PROJECTIONS, FINANCIAL COST AND BENEFIT STREAMS

A. Methodology of Financial Projections

4.01 For the purpose of a consistent and comprehensive financial analysis, it is important to use a consistent framework for (i) developing financial projections, (ii) analyzing these projections, and (iii) establishing cost and benefit streams for the IRR calculations. This chapter suggests such a framework. Illustrative Case Studies Nos. 1 to 4 provide examples for different methodologies as explained below.

4.02 The previous chapters discussed the estimation of capital costs, operating costs and revenues on an annual basis. These estimates are then used to develop annual projected income statements, balance sheets and funds flow statements. As a first step these estimates are typically in